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Project Management Development – Practice and Perspectives

Fourth International Scientific Conference on Project Management in the Baltic Countries

Project Management Development – Practice and Perspectives

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CONFERENCE PROCEEDINGS

April 16-17, 2015, Riga, University of Latvia

Conference is organized by the Faculty of Economics and Management, University of Latvia, in cooperation with the Professional Association of Project Managers and Baltic Controlling Institute supported by the "Latvijas Mobilais Telefons"

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PVPA Professional Association of Project Managers

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EVF Ekonomikas un vadības fakultāte

LBA LATVIJAS BŪVNIEKU ASOCIĀCIJA

BCI Baltic Controlling Institute

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PREFACE

The International Scientific Project Management Conference organized by the Professional Association of Project Managers of Latvia in co-operation with the Faculty of Economics and Management, University of Latvia has now become a proven value. Its international recognition has considerably grown and similarly has the quality of the submitted articles. The proceedings hereby are the fourth in turn and present articles of both scientific and practical significance. We are particularly pleased to announce that the articles published in the proceedings are now available internationally via EBSCOhost research database.

The articles in the proceedings are aimed at both theory and practice. They present extensive depiction of the contemporary situation in project management by covering the internationally applied methods and tools, the standards project management methodology is currently based on and developments expected in the field in the nearest future.

In the articles professionals set forecasts for the future project practice. The forecasts underline the importance of project managers' social competences. The project manager's role as a project work organizer, leader and competent implementer cannot be overestimated. Several articles of the proceedings deal with such project management competences as leadership, ability to communicate within a group as well as conflict management skills.

Emotions are an important tool in all projects. Without emotions there is no innovation and no successful team collaboration. For this reason the research dedicated to this topic might be interesting to all project implementers.

Project implementation is successful if projects have been well-prepared and the critical path has been identified. In this context it is interesting to study the use of the PERT method for determining the project time-span and deadlines for individual activities of the project network.

Project management is closely connected with the risks influencing the project time-span, costs and quality. The issue of coping with project risks, implementation of risk planning and supervision of the subsequent process is discussed based on the experience of constructing a football field.

There are articles devoted to the project manager's personality and opportunities to acquire education and pursue a career. Several articles concern the experience of project management education in higher education institutions of various countries and can be worth the interest of project management professionals.

Finally, we would like to thank the all supporters of the conference, especially "Latvijas Mobilais telefons"Ltd for the support extended to the conference organization and issuing of the proceedings hereby.

Let the papers and presented research results provide all participants with innovative ideas for project implementation!

Prof. Dr. oec. Žaneta Ilmete

Chairman of the board of the Professional
Association of Project Managers

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Project Management Development – Practice and Perspectives
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THE IMPACT OF SOFT TOTAL QUALITY MANAGEMENT PRACTICES ON EMPLOYEES' JOB SATISFACTION: EVIDENCE FROM PROJECT BASED ORGANIZATIONS IN PAKISTAN

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Abstract

In Pakistan number of manufacturing, information technology and construction sectors are adopting hard Total Quality Management (TQM) tools. Despite extensive research on TQM, rare papers highlighted the role of soft TQM practices in project oriented organization. Study intends to find the impact of soft TQM practices on employees' job, growth and work satisfaction in project based organization with the moderating role of demographic variables (Gender, Age, Education, Employment Status, and Professional Experience). The paper proposes and tests 26 hypotheses on the relation of soft TQM practices and job satisfaction with the moderation effect of demographic variables. Some of the project oriented organizations are facing challenges regarding human resource and quality issues. TQM practices are the ultimate way that enables them to overcome those challenges. Research findings of the study will be pragmatic for the project based organizations as they can enhance quality related financial and non-financial performance by practicing/adopting soft TQM practices. Five main and common soft TQM dimensions are selected from literature (Top Management Commitment, Involvement, Reward, Training, and Empowerment). The questionnaire comprises of 54 items and the study sample is 220 individuals working in project based organizations in Pakistan. The data are collected from three project activity sectors (Construction, Development, and Information Technology) and the response rate is 63%. Data is analyzed through SPSS. The results are very coherent they verify and empirically validate many of the hypotheses. Results demonstrate that soft TQM practices have significant positive impact on job satisfaction and demographic variable moderates the relation between soft TQM practices and job satisfaction.

Key words: *Soft TQM Practices; Job, Work; Growth; Satisfaction; Demographic Attributes*

JEL codes: H43, O22, J28

Introduction

During the last couple of decades numbers of studies have explored the role of total quality management in organizational culture and it has promoted positive changes in organization by enhancing financial and operational organizational performance. According to literature little work has been contributed regarding the role of soft TQM in job satisfaction, specifically in Pakistan's project based organizations. The Quality gurus Crosby, Deming, Juran, and Ishikawa have worked for quality management foundations and guiding principles to achieve organizational effectiveness and ultimately to improve internal customer's satisfactions. TQM

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scope is not bound to enhance only financial position effectiveness but it also leads to improve internal customer's satisfaction (Ahire et al., 1996) Some HR related practices like compensation, teamwork, empowerment, performance appraisal, and training in Baldrige National Quality Program (2005). Ahire et al. (1996) revealed that validation of key attributes of people related soft items and more important human resource factors like empowerment, training, involvement, and employee empowerment were categorized as HR related soft practices.

Empowerment is defined in dual context, initially it provides the project team a chance to participate in quality issues like assessing challenges and resolving them, secondly keeps the employee's independent by giving them freedom to make decision at their own (Hill and Huq, 2004). Empowerment is grounded on the idea to enhance performance of employees (Seibert et al., 2004). Reward is a general concept to be given to employees in return of their contribution and it tends to give value to employees (Chiang and Birtch, 2008). Leader's actions and plans can bring positive changes in organization. Changes can be engineered in the attitude of employees and teamwork by receiving support and resources provided by leaders (Yeung et al., 2005). Literature is enriched with studies related to TQM practices but limited research is conducted on HR related soft TQM practices. Prajogo and Cooper (2010) examined the association between job satisfaction and people related TQM practices and further recommended that exploration of soft TQM practices related factors like reward, recognition and recruitment. Hosie et al. (2013) studied on the association between age and salary on job satisfaction and they further outlined that exploration would be valuable into the links between employment status and age on job satisfaction. Rayton (2006) outlined that to date not any research yet has been done to use demographic variables as moderators. The study objective is to investigate the impact of soft TQM practices on job satisfaction in project oriented organizations of Pakistan and to analyzing to what extent demographic variables moderates the relation of soft TQM practices and job satisfaction.

The below research questions were suggested for exploring the study:

What is the impact of soft/HR related TQM practices on job satisfaction?

What is the moderation effect of demographic attributes (age, education, employment status, employment experience, and gender) on relation of soft TQM practices and job satisfaction?

1. Literature Review

1.1. Soft TQM Practices

Major part of the previous research work contribution shows that soft TQM practices comprise of people related factors which are specifically directed toward employees enhancement for example reward and recognition, teamwork and empowerment (Guimaraes, 1996, Guimaraes, 1997, Karia and Ahmad, 2000). There has been general consensus that Total Quality Management comprise of soft and hard dimensions, hard TQM involves tools and techniques, whereas soft TQM comprise of HR related factors like commitment, empowerment, team and involvement (Kochan et al., 1995, Kekäle and Kekäle, 1995). Majority of TQM gurus agree that soft facets of TQM practices are substantial for successful implementation of TQM

(Deming, 1986). Soft TQM is about the social and people based issues related to management of quality (Rahman and Bullock, 2005). Butler (1996) finds that, organizations which adopt TQM practices, progress better in organizational issues like attendance, turnover, safety, employee satisfaction, and health. Forsyth (1995) mentions that factors like Supportive working conditions, equitable rewards and helping colleagues lead to job satisfaction. The soft nature of TQM is supposed to contribute in promoting organizational culture that stress on continuous improvement and is most related to motivating human resource related factors (Samson and Terziovski, 1999). Organization's success and growth is determined by the extent to which employees are satisfied with their organization's system and culture where the level of commitment is the key indicator of success and growth (Loscocco and Roschelle, 1991, Harrison et al., 2006). Lam (1995) concludes that adaptation of TQM practices does not necessary enhances all the aspects of employees satisfaction. They perceive it as sort of controlling environment after introducing TQM practices. Employees feel less freedom while it has not any effect on pay, job security, and promotion activities; moreover it has not any significant role in personal effectiveness.

1.2. Soft TQM Practices and Job Satisfaction

Jun et al. (2006) suggest that loyal employees are valuable asset to organization. Karia and Hasmi Abu Hassan Asaari (2006) conduct a study in private and public organizations working in Malaysia find that empowerment and training have strong correlation with job satisfaction. Ugboro and Obeng (2000) find that management commitment and employee empowerments are the most adopted practices in the literature for promoting job satisfaction. Organization's success and growth is determined by the extent to which employees are satisfied with their organization system and culture (Harter et al., 2002, Harrison et al., 2006). Baran (1986) explores that Job satisfaction is not static state, it varies from situation to situations, influenced by external factors and forces which comprise of individuals, their personal traits and organization's working environment. Savery (1996) finds causes of job dissatisfaction of workers with minor job responsibility interest, little credit or accomplishments are more willing to quit in short period of time. Hendrie (2004) mentions that most of the organizations with inefficient work environment, lack of career development opportunities and poor employee relations lead to increase job dissatisfaction.

1.3. Soft TQM Dimensions

Prajogo and Cooper (2010) find that top management commitment is significantly related to job satisfaction, most of the quality gurus recognize that, for the successful implementation of total quality management, the leadership plays a vital role (Deming, 1986). Top management act as driver's role in TQM implementation as they define goal, objective and values to satisfy employees. According to Dwyer (2002), reasons of TQM failure are poor management efforts by people, like, lack of teamwork, low level of employee involvement and poor motivation. Top management can successfully implement TQM in organizations through the trust of employees, fostering internal communication and participating in problem solving (Ooi et al., 2013). Honda-Howard and Homma (2001) mention that lack of development opportunities and insufficient training lead significantly to turnover. Employees who avail training are more committed as compared to those who don't avail training in

organization (Royalty, 1996, Bartel, 1992). Training opportunity intends to give multiple ways to broaden individuals thinking level though which they can enhance their existing knowledge. Jun et al. (2006) highlight the critical role of employees' training as basic pillars for enhancing teamwork and employees' empowerment. Empowerment activities in organizations lead to positive job experience (Seibert et al., 2004). Ripley and Ripley (1992) define empowerment as the key ingredient to organization growth where employees can utilize, promote and enhance their talent and knowledge for the improvement of themselves and organization's welfare as well (Seibert et al., 2004).

The past studies in the field of HRM and TQM show that employees' empowerment is positively associated with job satisfaction supported by many authors (Blackburn and Rosen, 1993, Ugboro and Obeng, 2000). He et al. (2010) find positive relationship among job satisfaction, job quality and empowerment. Freeman (1978) says that keeping employees involved in organizational activities will lead to commitment. Employees' involvement in quality development activities is foremost accomplishment of total quality management (Mohanty and Lakhe, 1998). The participation of lower level employees in decision making has a positive relation with work satisfaction which ultimately increases commitment, loyalty and performance (Kim, 2002). Lee and Bruvold (2003) draw from social exchange theory that when organization keeps investing on human resource besides increasing the employment opportunity, it makes employees feel that they are valued and their contribution is significant to organization. Reward system is key management tool often implemented within organization (Lawler and Cohen, 1992). The paradigms of organization is shifted to financial reward because the non-monitory reward is not much appreciated by employers and employees as well, most of the labor intensive firms use non-monitory reward to control costs which do not benefit employees in monetary sense where it is used to motivate employee and to increase employee satisfaction (Chiang and Birtch, 2008). Job satisfaction is affected by both financial and non-monitory rewards (Kalleberg, 1977). Pratheepkanth (2011) show significant association between reward and job satisfaction. In TQM environment the recognition of reward is very necessary for motivating employees.

The above literature leads to following hypothesis.

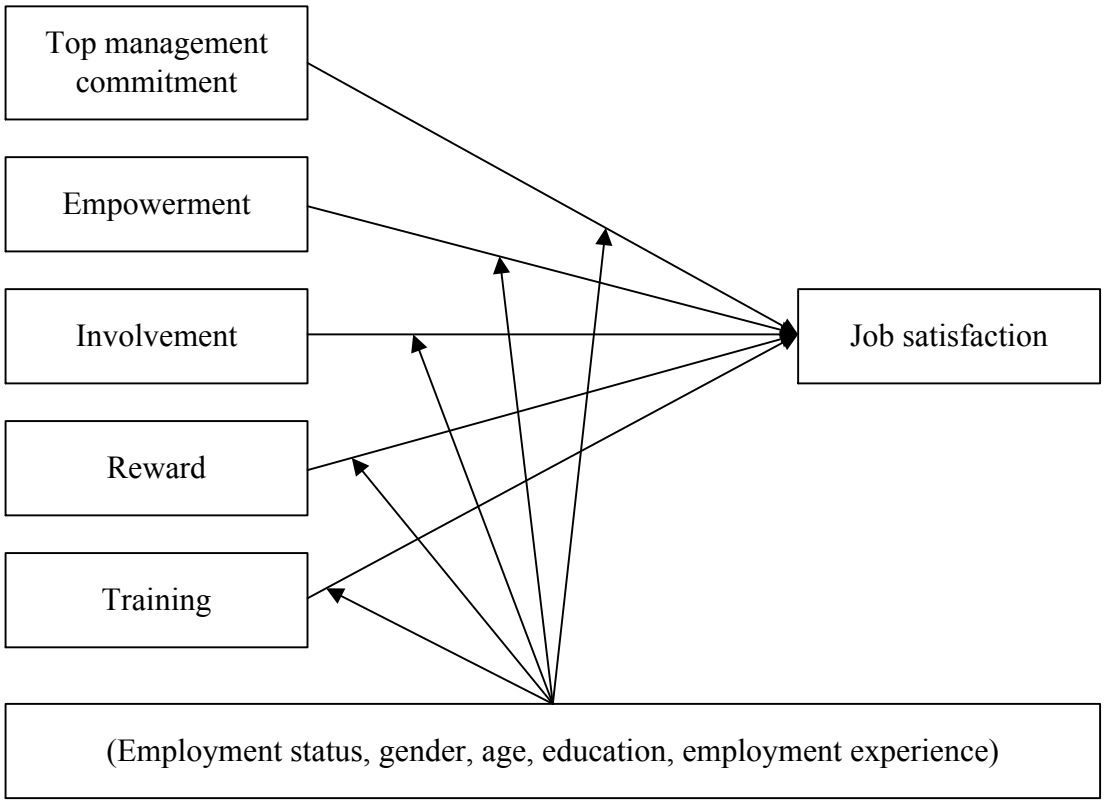
H1: There exist a significant relation between soft TQM dimensions (empowerment, top management commitment, reward, involvement, and training) and job satisfaction.

1.4. Moderating Role of Demographic Variables

Rhodes (1983) mentions that job satisfaction depends upon age level, the relation between them is positive up to 60. Herzberg et al. (2011) mention that job satisfaction is U-shaped in nature with respect to age, with higher level of confidence among fresh workers but it starts decreasing after some period of time, satisfaction again increases when employees get familiar of job. Clark et al. (1996) mention that employment experience and employment status play a vital role in the prediction of job satisfaction where in some other context employees with high experience are more satisfied as compared to low experienced because they stopped searching for new opportunities as existing job meets their expectations. Oshagbemi (2000) elaborates that employment status has a significant role in the measurement of job satisfaction where satisfied workers prefer to stay in organization and dissatisfied workers try to quit the organization. Oshagbemi (2000) find that job satisfaction level varies with respect to age. Groot

and van den Brink (1999) study job satisfaction among different age brackets and examined that there is not any significant impact of on/off job training and development on job satisfaction for aged employees. Georgellis and Lange (2007) examined an opposite result regarding different age groups, employees who avail recent training opportunity, they are least interested in future trainings. Employees who avail training are more committed to organization and ultimately turnover ratio decreases gradually as compared to those who don't avail training in organization (Bartel, 1992, Royalty, 1996). High educated workers are more satisfied than low educated workers because highly educated workers have better quality job (Verhofstadt et al., 2007).

1.5. Theoretical framework



1.6. Hypotheses

The above literature leads to following hypotheses, 25 subsidiary hypothesis and six major hypotheses were proposed as based on theoretical framework.

H2: Employment status has moderating impact on the relation between Soft TQM practices and job satisfaction.

$H2_1$: Employment status has moderating impact on the relation between top management commitment and job satisfaction.

$H2_2$: Employment status has moderating impact on the relation between empowerment and job satisfaction.

$H2_3$: Employment status has moderating impact on the relation between involvement and job satisfaction.

$H2_4$: Employment status has moderating impact on the relation between training and Job satisfaction.

$H2_5$: Employment status has moderating impact on the relation between reward and Job satisfaction.

H3: Employment experience has moderating impact on the relation between soft TQM practices and Job satisfaction.

$H3_1$: Employment experience has moderating impact on the relation between top management commitment and Job satisfaction.

$H3_2$: Employment experience has moderating impact on the relation between empowerment and Job satisfaction.

$H3_3$: Employment experience has moderating impact on the relation involvement and Job satisfaction.

$H3_4$: Employment experience has moderating impact on the relation between training and Job satisfaction.

$H3_5$: Employment has moderating impact on the relation between reward and Job satisfaction

H4: Education has moderating impact on the relation between top management commitment and Job satisfaction.

$H4_1$: Education has moderating impact on the relation between top management commitment and Job satisfaction.

$H4_2$: Education has moderating impact on the relation between empowerment and Job satisfaction.

$H4_3$: Education has moderating impact on the relation between involvement and Job satisfaction.

$H4_4$: Education has moderating impact on the relation between training and Job satisfaction.

$H4_5$: Education has moderating impact on the relation between reward and Job satisfaction

H5: Gender has moderating impact on the relation between soft TQM practices and job satisfaction.

$H5_1$: Gender has moderating impact on the relation between top management commitment and job satisfaction

$H5_2$: Gender has moderating impact on the relation between empowerment and job satisfaction.

$H5_3$: Gender has moderating impact on the relation between involvement and job satisfaction.

$H5_6$: Gender has moderating impact on the relation between training and job satisfactions.

$H5_1$: Gender has moderating impact on the relation between reward and job satisfaction.

H6: Age has moderating impact on the relation between soft TQM practices and job satisfaction.

$H6_1$: Age has moderating impact on the relation between top management commitment and job satisfaction.

$H6_2$: Age has moderating impact on the relation between empowerment and job satisfaction.

$H6_3$: Age has moderating impact on the relation between involvement and job satisfaction.

$H6_4$: Age has moderating impact on the relation between training and job satisfaction.

$H6_5$: Age has moderating impact on the relation between reward and job satisfaction.

2. Research methodology

Our study is empirical in nature and population of the study covers all project oriented organizations like construction sector, development sector, and information technology sector. The unit of analysis was project managers and project team members. The questionnaire on soft Total Quality Management dimensions were gauged by five item scale adopted from (Ugboro and Obeng, 2000, Jun et al., 2006, Prajogo and Cooper, 2010). Dependent variable: job satisfaction was measured by ten items adapted from (Güngör, 2011). The response of respondents were anchored on five point Likert scale (1 = strongly agree, 2 = agree, 3 = neutral, 4 = strongly disagree, 5 = disagree). The adopted scale showed highly reliable as the Cronbach's Alpha values range from (0.83 and 0.90) which shows the high reliability of scale.

2.1. Sampling Techniques and results

Convenient sampling strategy was used to collect sample. The sample sizes 350 were taken for collecting the data through self-administered and web based methods. Only 215 responses were received back and the overall response rate was 61%. The self-administered response was appreciating where web based response was not good, as the web based response was 50%.

2.2. Demographics

Percentage of female respondents is 45% while the percentage of male respondents is 34%. Employment status reflects that 65% respondents have contractual status and 35% have permanent status. Education level is distributed as bachelor 20%, sixteen years of education

65%, and MS/MPhil 15%. Age groups contribute as "below 25" – 30%, "26-35" – 66%, and "36-45" – 4%. Experience is grouped as "1-5" – 50%, "6-10" 32%, and "10 and above" 18%.

3. Results and Findings

3.1. General Linear Model Analysis (GLM)

Table 1

GLM summary: Soft TQM practices and job satisfaction with moderation results of employment status

Employment status						
Independent variables	**Contractual**		**Permanent**		**R^2**	*** After Mode Sig**
	**** Before Mode B**	*** After Mod B**	**** Before Mode B**	*** After Mod B**		
Training	1.087	-0.331	0	0	0.3	0.001
Involvement	1.708	-0.479	0	0	0.3	0.000
Reward	-1.094	0.304	0	0	0.16	0.022
Top management commitment	0.908	0	-0.214	0	0.31	0.113
Empowerment	0.796	-1.96	0	0	0.29	0.113

** After mod B = after moderation value of beta. ** Before mode B = before moderation beta value. Dependent variable: Job satisfaction. * After mode sig = after moderation significance value.*

Source: authors' calculations

Table 2

GLM analysis with moderation of gender with soft TQM items and job satisfaction

Gender						
Independent variables	**Male**		**Female**		**R^2**	*** After Mode Sig**
	**** Before Mode B**	*** After Mod B**	**** Before Mode B**	*** After Mod B**		
Top management commitment	-1.794	0	0	0.462	0.37	0.000

** After mod B = after moderation value of beta. ** Before mode B = before moderation beta value. Dependent variable: Job satisfaction. * After mode sig = after moderation significance value.*

Source: authors' calculations

Top management commitment has high significant relation with job satisfaction when interacts with gender. The beta value 0.46 after moderation shows that female are more satisfied than male when top management is committed with the organization.

Table 3

GLM summary of Soft TQM practices & job satisfaction with age moderation

Age								
Interaction variables	**Below 25 years**		**26-35 years**		**36-45 years**		**R^2**	*** After Mode Sig**
	**** Before Mode B**	*** After Mod B**	**** Before Mode B**	*** After Mod B**	**** Before Mode B**	*** After Mod B**		
Training	-1.317	0.219	-2.337	0.52	0	0	0.3	0.03

** After mod B = after moderation value of beta. ** Before mode B = before moderation beta value. Dependent variable: Job satisfaction. * After mode sig = after moderation significance value.*

Source: authors' calculations

Age only moderates the relation between training and job satisfaction. The beta values change significantly in opposite direction after moderation. Employee's falling in age brackets 26-35 year old are most satisfied after training while in highest age bracket 36-45 are least satisfied after training.

Table 4

GLM summary Soft TQM practices and job satisfaction with education moderation

Education								
Independent variables	**BA/BSc**		**Masters**		**MS/M.Phil.**		**R^2**	*** After Mode Sig**
	**** Before Mode B**	*** After Mod B**	**** Before Mode B**	*** After Mod B**	**** Before Mode B**	*** After Mod B**		
Empowerment	-2.068	0.611	-2.905	0.82	0	0	0.36	0.000
Top management commitment	-1.943	0.527	-2.952	0.807	0	0	0.35	0.001
Involvement	-1.673	0.531	-1.915	0.565	0	0	0.3	0.002
Reward	-4.466	1.237	-4.498	0.237	0	0	0.25	0.000

** After mod B = after moderation value of beta. ** Before mode B = before moderation beta value. Dependent variable: Job satisfaction. * After mode sig = after moderation significance.*

Source: authors' calculations

Education moderates the relation between job satisfaction and soft TQM practices (empowerment, top management commitment, involvement, and reward). The employees with

master degree (sixteen years of education) are most satisfied and employees with MS/MPhil education level are least satisfied among all the four soft TQM practices. The relation almost reverses with respect to education levels after moderation.

Table 5

Soft TQM practices and job satisfaction with moderation of experience

Employment Experience								
Independent variables	**1_5 Years**		**6_10 Years**		**Above 10 years**		**R^2**	*** After Mode Sig**
	**** Before Mode B**	*** After Mod B**	**** Before Mode B**	*** After Mod B**	**** Before Mode B**	*** After Mod B**		
Reward	2.374	-57.4	1.068	-0.146	0	0	0.28	0.000
Top management commitment	1.808	-0.442	1.566	-0.361	0	0	0.34	0.019
Training	1.654	-0.399	1.477	-0.293	0	0	0.36	0.003
Involvement	1.959	-0.54	1.224	-0.262	0	0	0.37	0.000
Empowerment	2.094	-0.574	1.306	-0.3	0	0	0.37	0.001

** After mod B = after moderation value of beta. ** Before mode B = before moderation beta value. Dependent variable: Job satisfaction. * After mode sig = after moderation significance value.*

Source: author calculations

The employment experience moderates the relation between job satisfaction and soft TQM practices (reward, top management commitment, training, involvement, and empowerment). The job satisfaction is gradually increasing with increase in experience in case of top management commitment, training, involvement, and empowerment; however, highest change occurs in case of reward after five years of experience.

3.2. Relation between soft TQM dimensions and job satisfaction without moderation

All the soft TQM practices have strong and positive relation with job satisfaction with regression coefficients given in brackets along with each soft TQM dimension as follows empowerment (0.54) top management commitment (0.55) training (0.50) involvement (0.49) and reward (0.37). Linear regression model is used to estimate all the above regression coefficients.

3.3. Discussion of Results

Our first hypothesis of study was supported which shows that there exists positive relation between soft TQM practices (top management commitment, empowerment and involvement, training and reward) and job satisfaction result are also supported by (Karia and Hasmi Abu Hassan Asaari, 2006, Guimaraes, 1996). Employees with permanent job status are comparatively more satisfied than employees with contractual status as permanent employees

are relatively better empowered as compared to contractual employees, the results are supported and aligned with (Asaari, 2006, Chang et al., 2010). This result is also in line with past studies which mentioned that empowerment is good predictor of job satisfaction as compared to salary (Voisard, 2008). Formal and informal opportunities for training have a significant impact on the factors of intrinsic and extrinsic job satisfaction factors (Origo and Pagani, 2008). Results also conclude that there exist positive relation between reward and job satisfaction as the previous research also supports our results there is significant relationship between reward and job satisfaction and it has insignificant contribution towards employee's job satisfaction (Ooi et al., 2007, Prajogo and Cooper, 2010). Groot and van den Brink (1999) find that there is no any significant impact of on/off job training and development on job satisfaction for aged employees whereas there is positive impact of training below 43 age employees which perfectly supports our study. Results are also in line with literature that education has positive effect on TQM practices and job satisfaction (Asaari, 2006). Professional experience shows high moderation impact in the relation of soft TQM dimension and job satisfaction in line with (Ahire et al., 1996.

Conclusion

The present study was conducted on project based organizations working across Pakistan with the objective to find the impact of soft TQM practices on job satisfaction along with moderation effect of demographic variables. The study is unique in the sense of moderation of demographic variables. Future research can be conducted by adding more mediating variables. The study can be extended by including more human related factors which are not mentioned in this research. Such practices must be reviewed and examined to increase the level of employees' satisfaction and organizational performance. The results showed positive relation between job satisfaction and soft TQM practices. The relation is completely changed after moderation which shows a significant role of demographic variables. People related soft TQM practices are the best management approach for achieving organizational success and work related attitude such job satisfaction. The results also conclude that reward has a significant relation with job satisfaction and reflect that employees are more motivated by monitory benefits.

Bibliography

Ahire, S. L., Golhar, D. Y. & Waller, M. A., 1996. Development and validation of TQM implementation constructs. *Decision sciences,* 27, pp. 23-56.

Asaari, N. K. M. H. A. H., 2006. The effects of total quality management practices on employees' work related attitudes. *The TQM Magazine*, pp. 30-43.

Baran, R., 1986. Understanding Behaviour in Organizations. Allyn & Bacon, Boston, MA.

Bartel, A. P., 1992. Training, wage growth and job performance: evidence from a company database. National Bureau of Economic Research.

Blackburn, R. & Rosen, B., 1993. Total quality and human resources management: lessons learned from Baldrige award-winning companies. *The Academy of Management Executive,* 7, pp. 49-66.

Butler, D., 1996. A comprehensive survey on how companies improve performance through quality efforts. *David Butler Associates, Inc., CA*.

Chang, C., Chiu, C. & Chen, C., 2010. The effect of TQM practices on employee satisfaction and loyalty in government. *Total Quality Management,* 21, pp. 1299-1314.

Chiang, F. F. & Birtch, T. A., 2008. Achieving task and extra-task-related behaviors: A case of gender and position differences in the perceived role of rewards in the hotel industry. *International Journal of Hospitality Management,* 27, pp. 491-503.

Clark, A., Oswald, A. & Warr, P., 1996. Is job satisfaction U-shaped in age? *Journal of occupational and organizational psychology,* 69, pp. 57-81.

Deming, W., 1986. Out of the crisis. Cambridge, MA, itd: Massachusetts Institute of Technology Press. MIT Press.

Dwyer, G., 2002. Quality management initiatives and people management strategies: the need for integration in the new millennium in an Irish context. *International Journal of Quality & Reliability Management,* 19, pp. 524-539.

Forsyth, P., 1995. 101 Ways to be a Better Manager. Heinemann Asia, Singapore.

Freeman, R. B., 1978. Job satisfaction as an economic variable. National Bureau of Economic Research Cambridge, Mass., USA.

Georgellis, Y. & Lange, T., 2007. Participation in continuous, on-the-job training and the impact on job satisfaction: longitudinal evidence from the German labour market. *The International Journal of Human Resource Management,* 18, pp. 969-985.

Groot, W. & Van Den Brink, H. M., 1999. Job satisfaction of older workers. *International Journal of Manpower,* 20, pp. 343-360.

Guimaraes, T., 1996. TQM's impact on employee attitudes. *The TQM magazine,* 8, pp. 20-25.

Guimaraes, T., 1997. Assessing employee turnover intentions before/after TQM. *International Journal of Quality & Reliability Management,* 14, pp. 46-63.

Güngör, P., 2011. The relationship between reward management system and employee performance with the mediating role of motivation: A quantitative study on global banks. *Procedia-Social and Behavioral Sciences,* 24, pp. 1510-1520.

Harrison, D. A., Newman, D. A. & Roth, P. L., 2006. How important are job attitudes? Meta-analytic comparisons of integrative behavioral outcomes and time sequences. *Academy of management Journal,* 49, pp. 305-325.

Harter, J. K., Schmidt, F. L. & Hayes, T. L., 2002. Business-unit-level relationship between employee satisfaction, employee engagement, and business outcomes: a meta-analysis. *Journal of applied psychology,* 87, 268 p.

He, P., Murrmann, S. K. & Perdue, R. R., 2010. An investigation of the relationships among employee empowerment, employee perceived service quality, and employee job satisfaction in a US hospitality organization. *Journal of Foodservice Business Research,* 13, pp. 36-50.

Hendrie, J., 2004. A review of a multiple retailer's labour turnover. *International Journal of Retail & Distribution Management,* 32, pp. 434-441.

Hendrie, J., 2004. A review of a multiple retailer's labour turnover. *International Journal of Retail & Distribution Management,* 32, pp. 434-441.

Herzberg, F., Mausner, B. & Snyderman, B. B., 2011. *The motivation to work*, Transaction Publishers.

Hill, F. & Huq, R., 2004. Employee empowerment: conceptualizations, aims and outcomes. *Total Quality Management and Business Excellence,* 15, pp. 1025-1041.

Honda-Howard, M. & Homma, M., 2001. Job satisfaction of Japanese career women and its influence on turnover intention. *Asian Journal of Social Psychology,* 4, pp. 23-38.

Hosie, P., Jayashree, P., Tchantchane, A. & Lee, B. S., 2013. The effect of autonomy, training opportunities, age and salaries on job satisfaction in the South East Asian retail petroleum industry. *The International Journal of Human Resource Management,* 24, pp. 3980-4007.

Jun, M., Cai, S. & Shin, H., 2006. TQM practice in maquiladora: Antecedents of employee satisfaction and loyalty. *Journal of operations management,* 24, pp. 791-812.

Kalleberg, A. L., 1977. Work values and job rewards: A theory of job satisfaction. *American sociological review*, pp. 124-143.

Karia, N. & Ahmad, Z., 2000. Quality practices that pay: empowerment and teamwork. *Malaysian Management Review,* 35, pp. 66-76.

Karia, N. & Hasmi Abu Hassan Asaari, M., 2006. The effects of total quality management practices on employees' work-related attitudes. *The TQM magazine,* 18, pp. 30-43.

Karia, N. & Hasmi Abu Hassan Asaari, M., 2006. The effects of total quality management practices on employees' work-related attitudes. *The TQM magazine,* 18, pp. 30-43.

Kekäle, T. & Kekäle, J., 1995. A mismatch of cultures: a pitfall of implementing a total quality approach. *International Journal of Quality & Reliability Management,* 12, pp. 210-220.

Kim, S., 2002. Participative management and job satisfaction: Lessons for management leadership. *Public administration review,* 62, pp. 231-241.

Kochan, T. A., Gittell, J. H. & Lautsch, B. A., 1995. Total quality management and human resource systems: an international comparison. *International Journal of Human Resource Management,* 6, pp. 201-222.

Lam, S. S., 1995. Quality management and job satisfaction: an empirical study. *International Journal of Quality & Reliability Management,* 12, pp. 72-78.

Lawler, E. E. & Cohen, S. G., 1992. Designing pay systems for teams. *ACA journal,* 1, pp. 6-19.

Lee, C. H. & Bruvold, N. T., 2003. Creating value for employees: investment in employee development. *The International Journal of Human Resource Management,* 14, pp. 981-1000.

Loscocco, K. A. & Roschelle, A. R., 1991. Influences on the quality of work and nonwork life: Two decades in review. *Journal of Vocational Behavior,* 39, pp. 182-225.

Mohanty, R. & Lakhe, R., 1998. Factors affecting TQM implementation: empirical study in Indian industry. *Production Planning & Control,* 9, pp. 511-520.

Ooi, K.-B., Lee, V.-H., Chong, A. Y.-L. & Lin, B., 2013. Does TQM improve employees' quality of work life? Empirical evidence from Malaysia's manufacturing firms. *Production Planning & Control,* 24, pp. 72-89.

Ooi, K. B., Bakar, N. A., Arumugam, V., Vellapan, L. & Loke, A. K. Y., 2007. Does TQM influence employees' job satisfaction? An empirical case analysis. *International Journal of Quality & Reliability Management,* 24, pp. 62-77.

Origo, F. & Pagani, L., 2008. Workplace flexibility and job satisfaction: some evidence from Europe. *International Journal of Manpower,* 29, pp. 539-566.

Oshagbemi, T., 2000. Is length of service related to the level of job satisfaction? *International Journal of Social Economics,* 27, pp. 213-226.

Prajogo, D. I. & Cooper, B. K., 2010. The effect of people-related TQM practices on job satisfaction: a hierarchical model. *Production Planning and Control,* 21, pp. 26-35.

Pratheepkanth, P., 2011. Reward system and its impact on employee motivation in commercial bank of sri lanka plc, in jaffna district. *Global Journal of Management and Business Research,* 11 p.

Rahman, S.-U. & Bullock, P., 2005. Soft TQM, hard TQM, and organisational performance relationships: an empirical investigation. *Omega,* 33, pp. 73-83.

Rayton, B. A., 2006. Examining the interconnection of job satisfaction and organizational commitment: an application of the bivariate probit model. *The International Journal of Human Resource Management,* 17, pp. 139-154.

Rhodes, S. R., 1983. Age-related differences in work attitudes and behavior: A review and conceptual analysis. *Psychological bulletin,* 93, 328 p.

Ripley, R. E. & Ripley, M. J., 1992. Empowerment, the cornerstone of quality: empowering management in innovative organizations in the 1990s. *Management Decision,* 30 p.

Royalty, A. B., 1996. The effects of job turnover on the training of men and women. *Industrial and Labor Relations Review*, pp. 506-521.

Samson, D. & Terziovski, M., 1999. The relationship between total quality management practices and operational performance. *Journal of operations management,* 17, pp. 393-409.

Savery, L. K., 1996. The congruence between the importance of job satisfaction and the perceived level of achievement. *Journal of Management Development,* 15, pp. 18-27.

Seibert, S. E., Silver, S. R. & Randolph, W. A., 2004. Taking empowerment to the next level: A multiple-level model of empowerment, performance, and satisfaction. *Academy of management Journal,* 47, pp. 332-349.

Ugboro, I. O. & Obeng, K., 2000. Top management leadership, employee empowerment, job satisfaction, and customer satisfaction in TQM organizations: an empirical study. *Journal of Quality Management,* 5, pp. 247-272.

Verhofstadt, E., De Witte, H. & Omey, E., 2007. Higher educated workers: better jobs but less satisfied? *International Journal of Manpower,* 28, pp. 135-151.

Voisard, F., 2008. Employee Empowerment and employee satisfaction in workplace. *California Sociology Journal*, pp. 1-17.

Yeung, A. C., Cheng, T. & Lai, K. H., 2005. An empirical model for managing quality in the electronics industry. *Production and Operations Management,* 14, pp. 189-204.

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STAKEHOLDER NETWORK PERSPECTIVE: COLLABORATION BETWEEN BUSINESS AND EDUCATION

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Abstract

According to the Project Management Institute (2013), 15.7 million new project management roles will be created globally across project-intensive industries by 2020. The next five years should be an opportunity for project managers to build valuable project management skills and enter the prosperous market. However, currently, demand for project management professionals is greater than the supply of human resources with relevant project management skills. The paper aims to explore how different stakeholders such as business and education, collaborate on purpose to educate future project managers and to promote their integration into the labor market. The paper presents a concept of business and education collaboration in Kaunas University of Technology (KTU) School of Economics and Business, Lithuania.

Key words: *stakeholder network, project management, collaboration, project managers*

JEL codes: J2, J240, J440

Introduction

According to PMI (2013), through 2020, 1.57 million project management jobs will be created each year globally. The jobs will be available in project-intensive industries such as manufacturing, business services, finance and insurance, oil and gas, information services, construction, and utilities. It shows that demand for project managers remains strong. However, many organizations are challenged to find enough talent with required, essential skills. PMI's (2013) report confirms that 4 in 5 organizations notify difficulty in finding qualified talent to fill open project management positions. Successful project managers require a lot of various skills, not only technical but also soft skills. Business nowadays often lack of professionals who possess expansive project management experience. The paper is based on PMI's, as the world's leading not-for-profit professional organization for project management, research. PMI (2014) states that technical skills are not enough in today's global market, because companies are seeking additional skills in leadership and business intelligence. For this reason PMI created the ideal skill set (the Talent Triangle) which combines technical, leadership and strategic and business management competences. It focuses on developing additional skills that project managers need to meet the expanding demand on profession. There are different stakeholder groups involved in the project manager's talent development: future project managers-students, business and educational institutions. Collaboration between business and education has always been relevant topic. This paper aims to explore how business and education can collaborate in developing project managers' skills and competences corresponding future demands. This paper

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is structured as follows: first, the concept of stakeholder network is presented. Second, importance of collaboration between business and education is examined and emphasis on the developing skills and competences of the future project managers is highlighted. Third, considering different implementation phases, the concept of collaboration between business and education is developed. Finally, conclusions of the paper, recommendations and ideas for further researches are presented.

Stakeholder network

This section provides an overview of stakeholder network concept as approach to deeper understand importance of collaboration between business and education. The purpose of stakeholder – business and education – network is to prepare project managers for future market by developing their project management skills ant competences. The complexity of project managers' education problem is such that one person or organization cannot solve it. The problem affect various groups in different levels such as individuals – students (future project managers), educational institutions (offering project management program), business representatives and recognized project management organizations (employers) and community. For this reason, effective collaboration between all groups with different interests is essential.

Notoriety of stakeholder management increased when Freeman in 1984 published stakeholder theory. According to author, stakeholder definition covers "any group or individual who can affect or is affected by the achievement of the firm's objectives". Stakeholder theory developed from the theory of the firm to study complex stakeholder relationships, partnerships and collaborations which can include public and private organizations (Jung et al., 2015). Sciarelli and Tani (2013) observed that in literature there are two approaches to stakeholder management: first, focuses on identifying which stakeholders are relevant and on defining the right strategies to manage them, whereas second urges managers to analyze the whole structure of the relationships network the enterprise is embedded into. This paper focuses on stakeholder network oriented approach.

Best (2007) notes that despite similar intentions, resources and motivation, success in getting things done often depends on having an effective social network. There is no single network definition accepted widely and not always term 'network' is used for the same purpose. Usually it may refer to common themes and be mentioned as a synonymous of words as social interaction, partnerships, relationships, coalitions, collaboration, etc. Also many authors focus only on dyads – relationships between two persons or organizations. Network members can be linked by different types of connections such as information, economic resources, social support, etc. (Best, 2007). Definition of network has several meaning, however in this paper term 'network' is considered as a group of people who exchange information and contacts for professional or social purposes (Oxford dictionary, 2015), specifically, as a group of different stakeholders (business and educations) that collaborates to reach a common goal (educate future project managers, develop their skills and competences).

Best (2007) distinguishes two perspectives of network theory: from the individual level and from the network level. Individual level approach is most popular and is considered to explain how involvement of different groups in a network affects its actions and outcomes. In contrast, network lever approach focuses on explaining properties and characteristics of the network as a whole and considers on the network level outcomes. Roloff (2007) also make a

distinction on multi-stakeholder networks that are known since mid-nineties. In these networks different parties from business, civil society and governmental institutions meet to find the solutions for issues and problems that may affect them all and cannot be solved without collaboration. Roloff (2007) additionally points out that companies apply two approaches of stakeholder management: organization focused or issue focused. First approach focuses on company's welfare whereas second – on an issue that affects company's relationship with other societal groups and organizations. Author further notes that issue focused stakeholder management approach prevail in multi stakeholder networks, because it enables companies to solve problems and challenges in collaboration with other stakeholders.

To sum up, approach to stakeholder network is not a new topic, however not widely applicable. Stakeholder management can be understood as management of individuals or groups with interests to particular object or management of stakeholder network, where different interested parties collaborate to achieve a common goal.

Importance of collaboration between business and education

Bergman and Gunnarson (2014) states that project management as a subject in universities has been introduced about half a century ago, but mainly in engineering curricula. However the attitude to project management changed over the years and today projects are not viewed as singular and isolated undertakings, but rather as ways in structuring and simplifying complex tasks in a larger organizational setting. In today's project management professionals are talking not only about single projects but also about programs and project portfolios. This increases the importance not only of project manager profession, but also of new roles and responsibilities such as program or portfolio manager.

1. Project management talent gap

PMI's (2014) research confirmed that there is a shortage of skilled talent: four out of five organizations from the research have difficulties to find qualified candidates to fill open positions. Moreover, PMI forecasts that situation will go worse and no one will be available to fill 15.7 million new globally created project management roles, projected between 2010 and 2020. PMI (2013) states that the rapid growth of demand for project management roles and the exceptional salary levels in the profession make the project management profession highly desirable to job seekers. However, currently, demand for project management professionals is greater than the supply of human resources with relevant project management skills. For this reason young project management professionals have to develop their valuable skills.

Moreover, there is a gap between what educational institutions offer and what business representatives require for successful project management in today's rapidly changing global market. Ramazani and Jergeas (2015) note that the main reason that graduates of university project management programs are in high demand in all types of industries is that while project management became more central in executing projects, effective education and talent management for those in charge of managing projects is vital for organizational competitiveness. Starkweather and Stevenson (2010) argued that there is lack of empirical evidences that certified project managers with the popular methods of project education are any more successful than non-certified project managers.

Ramazani and Jergeas (2015) state that project managers' education and development of their competencies should be viewed as a multidimensional and complex process. Authors further emphasized that there are three areas that should be considered in educating and training project managers: developing critical thinking for dealing with complexity, creating softer parameters of managing projects, and preparing project managers to be engaged within the context of real life projects. Because the complexity of projects is increasing as well as pace of change, organizations recognize that for project managers it is no longer enough to have technical project management skills, but also the strategic and business management skills, and leadership skills (PMI, 2014). For this reason PMI created the ideal skill set (the Talent Triangle) which combines technical, leadership, and strategic and business management competences.

However, it is obvious, that the development of skills and competences starts before project manager enters the labor market. And it is even better if young professionals have a possibility to develop them while studying, because then it is easier to apply theoretical knowledge to practice directly. For this reason, the collaboration between business and education is essential to achieve a common goal – build a talent together. Effective talent management comprises the right combination of theoretical education (knowledge) and practical experience.

2. Collaboration between business and education

Collaboration between business and education has always been a relevant topic from both sides, however there is no one model, method or tool that would be widely used for effective collaboration. Proper education in project management is essential first step for sustained career success in the labor market. However qualification does not guarantee job position, therefore, next step is to gain an experience working as a project manager or in a project team. It is important to note that there are many examples of collaboration between business and education when common goals are new products, innovations, however when talking about collaboration for development of skills and competences of young professionals information is limited.

There can be many types of collaboration between business and education. Links between university and industry have different objectives, scopes and institutional arrangements. Collaboration can be intense and focus on training or research activities, also exist formal or informal collaboration (Hagedoorn, Link and Vonortas, 2000). Furthermore, collaborations can be divided into short-term (usually for on-demand problem solving with in advance established results) and long-term (associated with joint projects and public-private partnerships) (Koschatzky and Stahlecker, 2010). Obviously, long-term collaborations are more strategic and can ensure development of talent management in the long run.

Exists a general attitude that education provided by universities is more theoretical with a strong general training than practical training that could be applicable into labor market. Moreover, education focuses more on technical competences but less on behavioral and contextual competences; therefore recently graduated students require additional training to comply with industry requirements (Afonso, Ramírez and Díaz-Puente, 2012). Education through experience regularly engaging with business or project management organizations is essential to keep up and advance a promising career in this field. Project based companies; recognized project management organizations are competitive, innovative, and technology-driven. They need skilled professionals who would have knowledge in project management and

other disciplines, combined with soft skills and practical experience. On the contrary, educational institutions are complex organizations and mainly focus on serving society through different study areas. There is no longer enough for students to offer internships, but also private participation in graduate programs is needed, for example, joint supervision with business representatives. In this case students will be able to have consultation bot from practical and theoretical perspective. According to Afonso, Ramírez and Díaz-Puente (2012), participation of business professionals in university teaching has a positive impact in employment creation, because it improves courses contents contributing with more practical, labor market demanded knowledge and complementing theoretical knowledge.

Successful collaboration between business and education needs to support the missions and motivations of each partner. Educational institutions are motivated by possible improvement of teaching, access to funding, access to empirical data from industry and general image, reputation of institution, whereas business is motivated by access to technological knowledge, access to skilled future employees, access to public funding, etc. (World Bank, 2013). For effective collaboration between business and education there is a need to think about the value that a university has for business, for example, research and educational services, qualified, competent and skilled people.

To sum up, there is no doubt that collaboration between business and education is beneficial for both sides and in the long run. To ensure effective transition between educational institutions and business environments there is a need to enhance possibilities for students to gain essential work experience during and/or right after their studies.

Approach to collaboration between business and education for KTU School of Economics and Business

Usually education institutions are structured to provide academic disciplines rather than think about the needs and requirements of business. Moreover, business engagements with universities sometimes are only written on the paper, but do not show up in practice. To improve the situation, the structure, management and governance of universities have to be analyzed and evaluation of needed capacity to create systematic and institutionalized collaboration with business has to be made (Yazdani, 2014).

With increasing popularity of project management many universities involve project management in different programs. There is a possibility to find public project management, international project management, IT project management and many other courses incorporated in different study programs, however not every university offers single Project Management program. In Lithuania several universities offer a possibility to study bachelor or master in Project Management. Kaunas University of Technology (KTU), School of Economics and Business was the first in Lithuania that offered master studies of Project Management.

Taking into account that every temporary activity focused on the achievement of the unique goal can be called project, in this case concept for collaboration between business and education will be interpreted as a project for university. According to PMBOK (2013), there are five different project phases:

1. Initiating – defining a new project or a new phase of an existing project by obtaining authorization to start the project or phase;

2. Planning – establishing the total scope of the effort, define and refine the objectives, and develop the course of action required to attain those objectives;
3. Executing – completing the work defined in the project management plan to satisfy the project specifications;
4. Monitoring and controlling – tracking, reviewing, and orchestrating the progress and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes;
5. Closing – concluding all activities across all project management process groups to formally complete the project, phase, or contractual obligations.

Obviously, there is no single ideal structure that could apply to all projects and may have significant variations (PMBOK, 2013). In comparison, Dechange and Lau (2008), defined 4 phases for implementing a PMO that is similar to phases that suggests PMBOK:

1. Analysis and buy-in – analysis of current situation, determination of requirements, stakeholder analysis;
2. Design – definition of target, strategy and functions, assigning resources, designing final concept;
3. Implementing – implementing final system with processes, resources, IT, etc.;
4. Controlling and improving – evaluating, setting up a controlling system.

Those phases also can be interpreted for other types of implementation, for example, change management system, learning programs, motivation system in companies, etc. Combining both before mentioned approaches was designed a concept for collaboration between business and education for KTU School of Economics and Business with 4 phases (Fig. 1):

1. Analysis of current situation;
2. Design of collaboration process;
3. Collaboration process;
4. Closing and controlling.

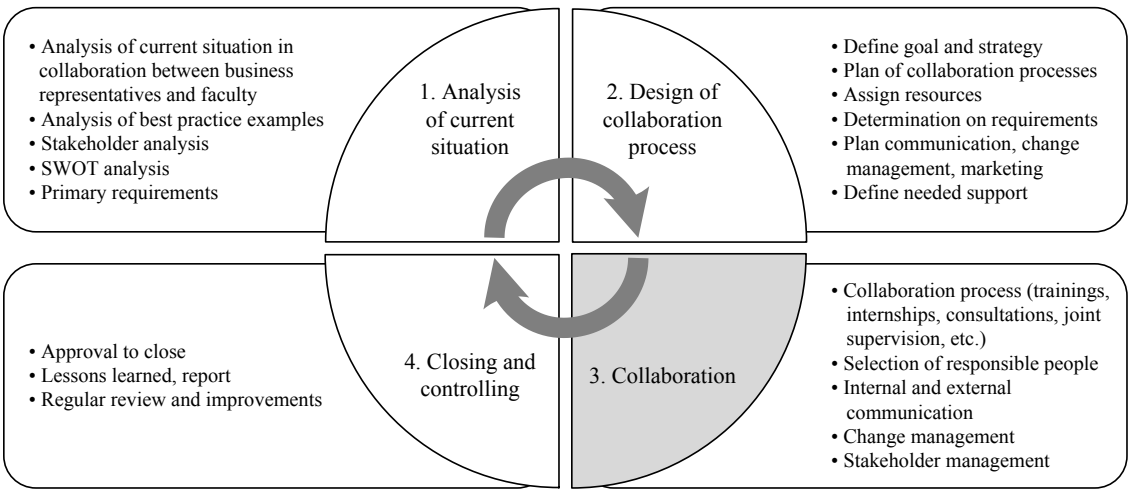


Fig. 1. **Approach to process of collaboration between business and education**

Because collaboration is the most important part of this approach, it is necessary to identify possible ways of collaboration between university and business.

First, not every teacher during his or her career in the university may have had a direct experience of working in the area of studies, e.g. project management organization. For this reason, they need to develop their skills and competences to better understand the real situation in market and be able to work with organizations (with project based companies and recognized project management organizations) in this rapidly changing world. On the contrary, an increasing number of appointed teachers in university are experienced from the practical field, however they lack of academic skills. The collaboration in this case can be exchange programs for both sides – theorists and practitioners – for ones to gain practical knowledge, for other – academic skills.

Second, both interested parties have to ensure the support for each other and help to navigate through uncertainty and confusion. For this reason, special teams to introduce business needs and requirements for university and vice versa should be formed from both stakeholders. Moreover, common language is important for education and business to understand each other, because practical side from business and academic issues from education may cause confusion between both parties. To solve this problem the simple communication structure should be created.

Third, in literature also can be find practical examples how university can collaborate with business. One of those examples can be real case of company or organization with real problems, numbers and other information. Cobo-Benita et al. (2010) in their research presented "learning by doing" approach, which includes practical work focused on managing real project, competition among teams of students, transformation of theoretical knowledge into practical presentation, combination of different roles and responsibilities.

Furthermore, the solution for collaboration may be placement for students. Internships are well known suggestion for students, but also there could be a possibility for students to join the single projects or programs for a short or long term. Students do not necessarily need to be project managers right after their studies, they can be project managers' assistants or team members in the project during or after their studies. This will give an opportunity to develop and gain new skills, increase knowledge in project management. In this case, collaboration between education and business is inevitable.

Because the importance of soft skills is increasing it would be beneficial to incorporate lectures that are based on development of soft skills and include subjects as leadership, communication, negotiation, public speaking, etc. or promote students to attend seminars where they could develop soft skills.

Finally, it is important always to consider what are the examples of collaboration in other universities, countries and not only to learn from them but also share own experience. This will lead to improvement of collaboration system and may help to expand network.

Conclusions

Investment in a professional development of project managers may ensure the long-term success for business and education. Education can achieve more if it takes time to communicate directly with business to understand their needs and requirements and manage them. This would help to establish stakeholder engagement network to enable students, university and business

representatives to collaborate by communicating and sharing ideas, offers, suggestions for situation improvement, etc. It is important continuously improve collaboration between business and education and share best practices to enhance quality and raise awareness of the current situation in project management.

This paper presented an approach of stakeholder networking through collaboration between business and education. The concept of collaboration was designed for KTU School of Economic and Business and possible collaboration strategies were suggested. Business and education can collaborate in many different forms as follows: teachers exchange programs, student internships, joint supervision, topic suggestions for final thesis, submission of real cases from companies, etc. All suggested forms of collaboration could help in developing future project managers' skills and competences, and promote their integrations into labor market.

This study confirmed the importance of collaboration between business and education on purpose to develop skills and competences of young project management professionals, however there are some questions for further researches. It would be useful to investigate situation in all country and explore different business-education collaboration practices and their results. Future findings could contribute to improving the collaboration processes between university and business.

Bibliography

Afonso, A., Ramírez, J. and Díaz-Puente, J., 2012. University-Industry Cooperation in the Education Domain to Foster Competitiveness and Employment. *Procedia – Social and Behavioral Sciences,* 46, pp. 3947-3953.

Bergman, I. and Gunnarson, S., 2014. Teaching Organizational Project Management at Postgraduate Level. *Procedia – Social and Behavioral Sciences*, 119, pp. 446-455.

Best, A., 2007. *Greater than the sum*. Bethesda, MD: National Cancer Institute, U.S. Dept. of Health and Human Services, National Institutes of Health.

Cobo-Benita, J., Ordieres-Mere, J., Ortiz-Marcos, I. and Pacios-Alvarez, A., 2010. Learning by doing in project management: Acquiring skills through a collaborative model. *IEEE EDUCON 2010 Conference.*

Hagedoorn, J., Link, A. and Vonortas, N., 2000. Research partnerships. *Research Policy*, 29, pp. 567-586.

Jung, T., Lee, J., Yap, M. and Ineson, E., 2015. The role of stakeholder collaboration in culture-led urban regeneration: A case study of the Gwangju project, Korea. *Cities*, 44, pp. 29-39.

Koschatzky, K. and Stahlecker, T., 2010. New forms of strategic research collaboration between firms and universities in the German research system. *IJTTC*, 9(1/2), 94 p.

Lau C. and Dechange A., 2008. Effiziente und erfolgreiche Implementierung von Projekt Management Offices. Steinle C., Eßeling, V. and Eichenberg, T. (Hrsg.), *Handbuch Multiprojektmanagement und – controlling*. Berlin: Erich Schmidt Verlag.

Project Management Institute, 2013. *Project Management Body of Knowledge (PMBOK® guide) – Fifth edition.* Pennsylvania: Project Management Institute.

Project Management Institute, 2013. *Project Management Talent Gap Report*. PMI's Industry Growth Forecast. Project Management between. [Online] Available at: http://www.pmi.org/~/media/PDF/Business-Solutions/PMIProjectManagementSkillsGapReport.ashx [Accessed 9 Jan. 2015].

Project Management Institute, 2014. *Talent Management – Powering Strategic Initiatives in the PMO*. PMI Thought Leadership Series. [Online] Available at: http://www.pmi.org/~/media/PDF/Publications/Talent-Management-Powering-Strategic-Initiatives.ashx [Accessed 9 Jan. 2015].

Ramazani, J. and Jergeas, G., 2015. Project managers and the journey from good to great: The benefits of investment in project management training and education. *International Journal of Project Management,* 33(1), pp. 41-52.

Roloff, J., 2007. Learning from Multi-Stakeholder Networks: Issue-Focused Stakeholder Management. *Journal of Business Ethics*, 82(1), pp. 233-250.

Sciarelli, M. and Tani, M., 2013. Network Approach and Stakeholder Management. *Business Systems Review*, 2(2), pp. 175-190.

Starkweather, J. and Stevenson, D., 2010. PMP® certification as a core competency: Necessary but not sufficient. *Project Management Journal,* 42(1), pp. 31-41.

Yazdani, B., 2014. Academia should place collaboration with industry at its heart. *The Financial Times*. [Online] Available at: http://www.ft.com/intl/cms/s/2/68eab2dc-7490-11e4-b30b-00144feabdc0.html#axzz3RfGVaNJy [Accessed 7 Jan. 2015].

World Bank, 2013. *Promoting University-Industry Collaboration in Developing Countries.* The Innovation Policy Platform. [Online] Available at: https://www.innovationpolicyplatform.org/sites/default/files/rdf_imported_documents/PromotingUniversityIndustryCollaborationInDevelopingCountries.pdf [Accessed 15 Jan. 2015].

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EMOTIONAL INTELLIGENCE AND PROJECT MANAGEMENT IN ICT INDUSTRY IN LATVIA

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Abstract

Although emotional intelligence (EI) is recognized as a significant soft skill, among others, in project management, it still remains essentially underexplored in information and communications technologies (ICT) project management in Latvia. Hence, the aim of this paper is to examine the relevance of project manager's EI to improve project performance in the Latvian ICT industry.

To achieve the abovementioned goal, a questionnaire-based survey among top ICT project managers is employed to establish a link between project managers' EI and the performance of their ICT projects in order to determine the level of importance of EI skills for successful project execution in the ICT industry.

Research results show a significant relevance of EI factors in project performance in ICT projects; as well as, recognize that such soft skills as EI competencies are not only equally important to hard skills (management experience, leadership and technical skills) required for project management, but also if relevance of EI skills is overlooked, it could undermine the potential for fulfilling the criteria set for ICT project success under time and resource constraints.

Managerial implications of the results are twofold. Firstly, findings help formulating recommendations on selection of project managers for ICT project management based on EI competencies; secondly, it is of significant importance for project managers in recognizing the relevant EI competencies that are required for successful execution of ICT projects.

Key words: *Emotional intelligence, ICT industry, Project manager, Project performance*

JEL codes: M10, O32

Introduction

Manifestations of increasing globalization (investment flows, labour force movement, increased consumption of good and services, changes in the structures of economies) and the changing entrepreneurship environment have substantially changed the requirements as to the skills of managers (leaders), resulting of growing importance of leadership in the 21st century across the globe, including in project management. It is suggested that project managers must have specific skills in project leadership and management (Galbreath & Rogers, 1999).

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Leadership that focuses on the project is a systematic application of management awareness and skills in each stage of the project life cycle (Kloppenborg et.al., 2003) and this concept in theory describes good practice management referable to project environment (Toth, 2011). Today's organizations are faced with particularly complex circumstances, where versatility thrives forcing to give up stereotypes and truly comprehend individual differences, ways of thinking and learning (Maccoby, 2004; Mersino, 2007) and with a business environment of increasing complexity where such elements as changing technologies and globalization trends makes project performance an ever more challenging task (Smith, 2014). Therefore, in today's project management, it is topical to develop such project management competencies and skills, which would combine the classic management skills with project leaders' social skills.

Project management as an independent sector of management sciences has been brought to the forefront in the ICT sector in Latvia, which has been experiencing a stable development already for the second decade running. Currently, Latvian ICT companies play a significant role in the development of the economy of Latvia, by greatly contributing to the GDP of Latvia: according to the data of the Central Statistical Bureau of Latvia, the proportion of the value added of the ICT sector in the Latvian gross domestic product in 2013 amounted to 3.7% in absolute prices, and the sector also offers vast employment opportunities. Provisional data of 2013 suggest that more than 5000 people were employed in the ICT sector on the whole. One of significant obstacles to a more rapid development of the ICT sector of Latvia and to engagement in global projects is the relatively low number of employed specialists and their insufficient knowledge in other sectors of the economy (Andersone, 2014). In a study of future strategically necessary skills in Latvia, it was found that over the period leading up to the year 2030, the demand will increase for highly qualified labour force having the skills to solve a complex range of problematic issues, along with fine managerial and social skills. Already in the nearest future, the demand will increase for such employee competencies as creativity, communication skills, ability to adapt to changes, self-organisation, self-training, systematic thinking (Kasalis et.al., 2013).

All of the aforementioned competencies are significant not only in the view of the future perspective, but also at this time. The need for well-developed social skills is increasing, as the level of complexity and scale of ICT projects is rising. Studies show that a considerable part of IT projects are not completed or the project outcome is delayed, by significantly exceeding the resources during the implementation (Flyvbjerg & Budzier, 2013) and human factors are recognised as the biggest obstacles to a successful project implementation (Jørgensen et.al., 2008; Smith, 2014). Likewise, it is concluded that only 20% of project success depends on the management methods employed in project management, whereas the project manager's social skills account for 80% of project success (Reiter, 2003). Therefore studies suggest that the focus of project management should shift away from scheduling and management of resources only (Ahlemann, 2009). Achievements of a successful project manager are largely rooted in the emotional faculties, empathy, understanding people and in the developed team leadership skills (Stevenson & Starkweathe, 2010). The performed studies confirm that social skills and emotional intelligence promote leadership skills (Palmer et.al., 2001), efficiency of activity and professional growth (Higgs & Aitken, 2003), enhance co-operation and relationships within a team (Schutte et.al., 2001) and are an important success factor of a project (Mersino, 2007).

The notion and concept of emotional intelligence

In academic writings, emotional intelligence (EI) as a significant aspect of a manager's social skills has been described relatively recently. For a long time, researches believed that there is little connection between emotions and logical thinking, and that successful people rely more on logical judgments instead of feelings. Therefore, in the assessment of managers' success and in forecasting activity, the general intellect category – analytical intelligence (IQ) – was employed. The first studies attempting to grasp the essence of EI and its relation to other concepts of psychology were published in early 1990-ties. Salovey and Mayer were among the first to publish the definition of emotional intelligence and theoretically justify this concept, by claiming that emotional intelligence is the ability to adequately sense, perceive, understand, voice, and manage emotions (Salovey & Mayer, 1990).

Significant development of the EI theory was started along with the publication of the book by the American psychologist in 1995 (Goleman, 2005). Goleman claimed that EI includes self-awareness and impulse control, perseverance, diligence and ability to motivate oneself, empathy, and social resourcefulness, moreover, EI is manifested in the character of an individual (Goleman, 2005).

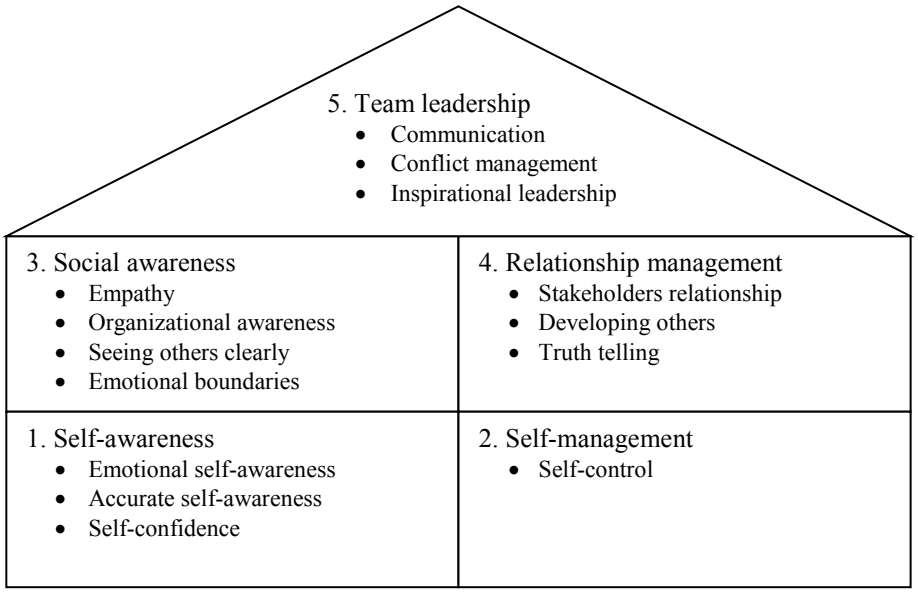
In the development of the EI concept, the researchers recognised that IQ does not always guarantee work success (Goleman, 1996; Gardner, 2011) and claimed that individuals having the same IQ can react very differently to external circumstances (Mayer et.al., 2001). EI studies in a work environment confirmed that the importance of EI components can differ in various occupational sectors (Zeidner et.al., 2004).

Several theoretical EI models have been described in writings. The following are among the most important:

- Mayer and Salovey's model of ability, proposing an assumption that EI encompasses various abilities of an individual engaged in the adaptive processing of emotional information, and it is related to four types of abilities: (1) expressing emotions and the accuracy of assessing emotions both with respect to self and to other people; (2) cognitive assimilation of emotional experience; (3) recognising, understanding, and grasping emotions; (4) adaptive regulation of emotions of an individual and of other people (Salovey & Mayer, 1990).
- The emotionally social intelligence Bar-On mixed model is an EI model encompassing specific competencies, skills and stimuli with regard to the social and emotional aspect; it consists of five different but mutually interacting areas: (1) introspective or intrapersonal, (2) interactional or interpersonal, (3) ability to adapt, (4) ability to cope with stress, and (5) the overall sentiments or general mood. This model suggests that emotionally social intelligence is intrinsically linking stimuli, competencies and skills in the social and emotional respect (Bar-On, 2006).
- The mixed model as suggested by Goleman describes people who are generally successful in action. In the model, the author initially proposes five areas: self-awareness, self-management, self-motivation, social awareness and social skills (Goleman, 2005), however later on, he revised the EI concept several times, by both expanding and narrowing it. Several years later, Goleman suggested that EI includes two types of competencies: (1) personal competencies, such as Self-awareness and

Self-management; (2) social competencies, such as Social awareness and Relationship management (Goleman et.al., 2002).

Mersino was first to theorise that EI is positively affecting the project management process (Mersino, 2007). He believed that a project manager, who is better at understanding the emotions and needs of parties involved in a project, can better perform his/her role of a project leader. Mersino modified the Goleman model (see Fig. 1), by adapting it to the project management processes and defining the most important EI competencies for a project manager and proposing a framework of fourteen competencies categorized in five areas: (1) self-awareness; (2) self-management; (3) social awareness; (4) relationship management and (5) team leadership (Mersino, 2007). The importance of emotions within the context of project management has been studied also later on, because participation in project involves continuous involvement with a plethora of social situations (Clarke, 2010).



Source: Mersino, 2007

Fig. 1. **EI framework for project managers**

It is believed that EI is crucially important for project managers due to a number of reasons:

- No two projects are the same. Project managers must constantly adapt to different teams, stakeholders, sponsors as they finish one project and move on to the next;
- Projects are not a permanent venture, but instead they take place within a set time period, which means that the manager is hard-pressed to progress quickly, which hinders the formation of close ties;
- Usually project managers' power and authority are limited in terms of exercising it over the team members of the project. In order to achieve the necessary results, project managers must employ finer approaches (Mersino, 2007);

- Project managers using the right "tone" with others, and helping others taking on challenging tasks, together with good control over their own feelings, are the attributes of successful leadership in these projects (Müller & Turner, 2010).

Emotional intelligence in ICT project management

Traditionally, ICT projects are regarded as technologically inclined projects, therefore the matters of project managers' efficiency are more considered from the viewpoint of managing resources (labour force, time, money). In the ever changing environment of today's world, an increasing number of scientists (Lent & Pinkowska, 2012; Stevenson & Starkweathe, 2010; Fisher, 2011) admit that an efficient ICT project manager must have:

- Technical skills ("hard" skills) – they must focus on mastering technical skills, predominantly in the areas of engineering, hardware and software and this includes technical proficiency and competency in methodologies and processes of development, as well as approaches used in IT system development (Keil et.al., 2013);
- Project management skills – proficiency in choosing the optimum tools and methods to lead and complete a project with a successful outcome (Brewer, Dittman, 2013), such as project planning and management of changes, time, budget, and quality management, management of risks and causal relationships, defining work tasks and control of work performance, setting the critical paths, managing non-conformities, information analysis, using project management software, among other things (Richman, 2012);
- Skills in interpersonal communication ("soft" skills) – less tangible and manifested as social and communicative skills – self-management, leadership, human resources, team, conflict and communication management process skills (Lent, & Pinkowska, 2012).

The more complex and bigger the projects to manage, the more of what are known as "soft" skills are needed to achieve a better result. Studies have unveiled that project managers having a high EI and fine communication skills have bigger advantages — they can easily sort out their priorities in terms of thoughts, adapt them to the changing emotions in the working environment (Bande, et al., 2015), they stand out among other project managers and will achieve more given the same team (Mersino, 2007).

Even though it is clear that project managers' EI is directly affecting the success of projects in the ICT sector, the development of this competency is still not postulated as a primary competency to achieve growth and development of project managers. As suggested by recent studies (van Blerk, 2013), managers of companies in the ICT sector assess EI as one of the most important project managers' skills, all the while the actual EI performance of project managers cannot be assessed as fully satisfactory. It is not surprising that several competence models, including the guidelines European e-Competence Framework 2.0, mainly address technical skills that are necessary for ICT specialists, failing to clearly acknowledge that EI is of importance. EI is not mentioned no evidence is provided suggesting that these guidelines define EI as an integral element contributing to the performance of ICT specialists.

The only global guideline that makes a reference to EI is the PMBOK® Guide (PMBOK, 2013). It perceives EI as a competency of behavioural nature forming a part of interpersonal skills. However, PMBOK® Guide (2013) does not elaborate on the components of EI that are necessary in order to achieve effective project management (van Blerk, 2013). The authors admit that ICT organisations do not consider that certification is an essential element for success. The main recruitment criteria do not include such elements as certification or training qualifications, hence they do not influence the selection and subsequent performance. The aforementioned considerations clearly demonstrate that there is a global gap between the desirable and actual importance of EI for project managers in the ICT sector. In the face of the said gap, it is crucial to assess whether EI as a highly valued competence, which, nevertheless, is poorly implemented in the day-to-day practice, affects the success of project implementation.

Even though a positive correlation between EI and the work performance has been proven in studies, in most studies the forecasting validity of EI is different (Rozcenkova, 2011). There are few studies, where a sound manager (as a leader) is actually using the EI competency in the management process, and a gap still remains between the theory and practice in terms of emotional leadership (Bolden et.al., 2011). Goleman in his studies has found a direct link between EI and a measurable business outcome (Goleman, 1998).

In order to assess the EI role of ICT project managers in satisfying the project success criteria, a study was performed by surveying professional project managers working in the ICT sector in Latvia.

The study method

In January 2015, an expert survey of the sector was performed, by employing a self-selection method. The sample size was 60 respondents representing project management in the ICT sector. The survey includes 10 questions, with the help of which the importance of project success criteria is evaluated, self-assessment of project performance and of EI skills is performed. To assess the project managers' EI, the questionnaire developed by Mersino (Mersino, 2007) was used; it contains 20 questions. The results are divided into 3 EI index groups, where the lowest group (LG) comprises respondents, whose EI skills performance is 12 points out of 20 or lower, the medium group (MG) with 13 to 16 points, and the highest group (HG) with over 17 out of 20 points, according to the guidelines proposed by Mersino (Mersino, 2007). A questionnaire developed by the authors is used for assessing project results; the questionnaire consists of 7 criteria, evaluating the performance on a scale of 1 to 10, where 10 is the highest assessment and 1 is the lowest.

To determine the relation between the project managers' EI parameters and the fulfilment of project success criteria, a comparative analysis of project results is performed according to the obtained EI results (LG, MG, and HG). To assess the consistency of correlations between EI and project performance results, a correlation analysis is performed (using the Pearson correlation coefficient) between the project managers' EI index and seven project success criteria, thereby allowing to determine the project manager's personal qualities that play the most important role in achieving the criteria of successful project fulfilment and to which most attention should be paid when defining the guidelines for successful long-term project management.

Study results

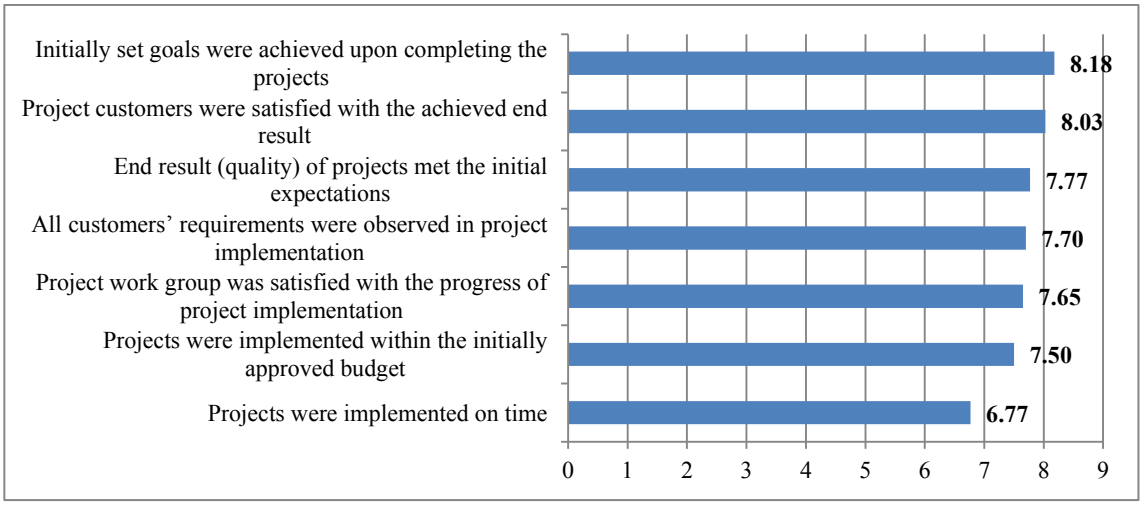
Within the study, 60 professional project managers (experts) representing the ICT sector were surveyed: 45% women and 55% men. 26% of the respondents are younger than 30 y., 61% of experts fall in the age group of 31 to 40 year olds, whereas 10% of respondents are 41 to 50 y. o.; the remaining 3% are in the age group of 51 to 65 y. 32% of respondents are certified project managers.

According to the self-assessment results (Fig. 2), most experts assessed the results of projects performed in 2014 as corresponding to the initially set objectives (on average 8.18 points), and the wishes of clients commissioning the projects were met upon completing the projects (on average 8.03 points).

78% of respondent experts believe that it is not difficult to communicate with people and it is not difficult to work together with people, whose experience is different or not equally extensive. 88% of respondents claim that in difficult situations, they manage to preserve self-restraint. 50% of respondents said that they tend to joke often, and 82% of experts build relationships with the project group not only within the context of problems to be resolved.

According to the experts, one of the most crucial factors affecting the project outcome is the engaged human resources, namely, the team. 40% of respondents mentioned the importance of a team as one of significant project success factors. Furthermore, expert responses point to that the project success depends also on:

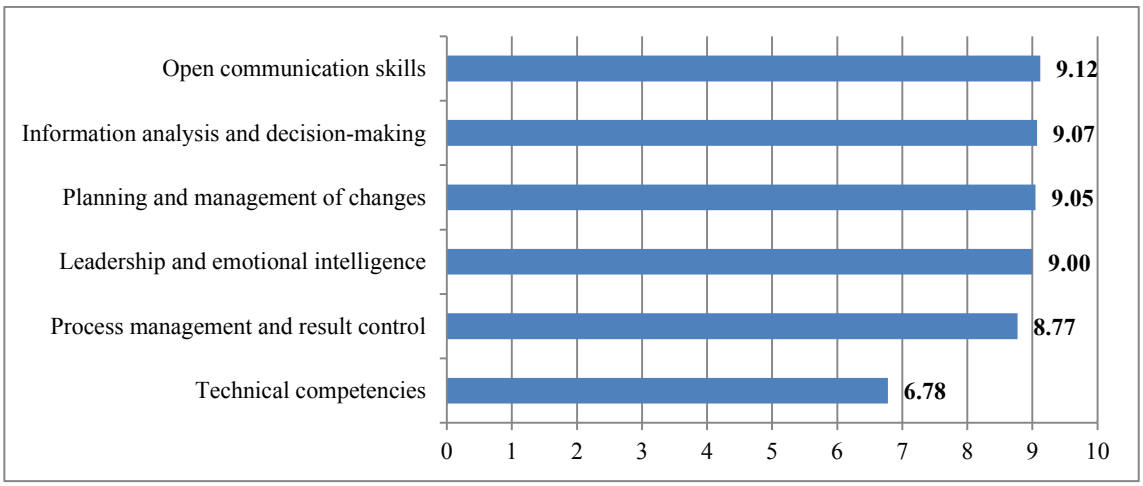
- the project manager's experience and qualification;
- understanding the project (objectives, tasks);
- mutual communication and involvement;
- understanding between the customer and contractors;
- planning and control of deadlines and tasks, as well as other factors.



Source: author's calculations based on survey data

Fig. 2. **Bearing in mind your performance in 2014, please, assess the success of projects you have managed**

When asked to assess the skills that are necessary for a project manager in order to successfully implement projects, experts identify communication skills, information analysis and decision-making skills (Fig. 3) as the most important, alongside planning and change management, leadership and emotional intelligence.



Source: author's calculations based on survey data

Fig. 3. **In your opinion, how significantly the listed project manager's skills influence a successful result of the project?**

The importance of technical competences, however, is not regarded as decisive – respondents have assessed these skills on average with 6.78 points.

The results of the experts' self-assessment survey also elucidate the problem situations that project managers face:

- 18% of the surveyed project managers admitted that they have often been surprised at how different the performance of others has been to what was expected;
- 18% of the surveyed experts have been reprimanded for being rough and insensitive;
- 22% of the surveyed project managers remarked that they had been surprised about the failure of the project team members to grasp the project objectives;
- 52% of experts claim that they have experienced a situation when they have not been able to find common grounds with a project team member for a long time;
- during project implementation, 18% of experts have been faced with conflicts that they have not been able to resolve.

Firstly, project success largely depends on the project manager's leadership – 57% of project managers believe that it is necessary to consolidate their leader position, furthermore, 67% say that sometimes more passion is necessary in resolving complicated matters.

Secondly, upon assessing the impact of emotional intelligence on the quality of project performance, the most significant differences are outlined in the self-assessment of project success (see Table 1), according to the emotional intelligence index of the project manager, by dividing it into three groups (standard error shown in brackets)

Table 1

Comparison of self-assessment of project success criteria depending on the emotional intelligence parameter performance

EI index group	LG	MG	HG
Projects were implemented within the initially approved budget	6.33 (0.7)*	6.48 (0.4)	7.59 (0.3)
Projects were implemented on time	6.75 (0.7)	7.48 (0.3)	8.06 (0.3)
Project work group was satisfied with the project implementation progress	7.08 (0.5)	7.39 (0.2)	8.53 (0.2)
End result (quality) of projects met the initial expectations	6.92 (0.5)	7.71 (0.3)	8.47 (0.3)
Initially set goals were achieved upon completing the projects	7.75 (0.4)	8.00 (0.3)	8.82 (0.2)
Project customers were satisfied with the achieved end result	7.58 (0.5)	7.77 (0.3)	8.82 (0.2)
All customer's requirements were observed in project implementation	7.33 (0.6)	7.32 (0.4)	8.65 (0.2)
Average indicator	**7.11** (0.5)	**7.45** (0.2)	**8.42** (0.2)

* Standard errors are reported in parentheses

Source: author's calculations based on survey data

The results show that there are significant changes in the project success criteria performance, depending on the project manager's EI parameters. The highest group achieves a result that is on average by 1.3 points higher than the lower group, which suggests that the project manager's EI is one of the factors fostering better achievement of project goals. Project managers, who have assessed their EI index with 17 or more points (the highest group), during the project implementation, have been able to achieve the initially defined goals, to deliver the expected end result to the customer and to meet the customer's requirements significantly better than others. The parameter that received the lowest assessment in all three groups was keeping with the initially approved budget, nevertheless, even though significant differences are observed between the performance of the lowest and highest EI group, there are no grounds to claim that the comparatively low assessment should be directly attributable to the project manager's personal qualities.

Thirdly, to assess the correlation between the EI parameters and the performance of specific project success criteria, a correlation analysis is performed to assess the consistency of correlations between the project manager's "soft skills" and the project performance parameters, as shown in Table 2.

Table 2

Correlation of self-assessment of project success criteria with the project manager's emotional intelligence index

Emotional intelligence index	Correlation coefficient
Projects were implemented within the initially approved budget	0.390
Projects were implemented on time	0.415
Project work group was satisfied with the project implementation progress	0.515
End result (quality) of projects met the initial expectations	0.451
Initially set goals were achieved upon completing the projects	0.371
Project customers were satisfied with the achieved end result	0.344
All customer's requirements were observed in project implementation	0.355

Source: author's calculations based on survey data

The correlation analysis results show a moderately consistent positive correlation between the project manager's emotional intelligence index and the performance of project success criteria (the consistency of correlations from $r=0.344$ to $r=0.515$, $p<0.01$), which implies that the project manager's personal traits are important in fostering the achievement of project goals on the whole.

Upon considering project success criteria individually, the highest consistency of correlations is observed between the project manager's emotional intelligence and the level of satisfaction of the work group with the progress of the project ($r=0.515$, $p<0.01$), which plays an important role in achieving project goals in a long term, because, as it has been mentioned before, project managers have stated that the project team is the most important factor in facilitating project success, and that, for its part, means that project managers with higher emotional intelligence are able to motivate the team – the important success factor – to co-operate productively in a long-term.

A medium consistent correlation is observed also between the "soft skills" of the project manager and the correspondence of the end result of the project to what was planned ($r=0.451$, $p<0.01$) and meeting the deadlines ($r=0.415$, $p<0.01$), which also points to the project manager's personal traits as a factor facilitating a successful team work and achievement of project goals.

Conclusions

Based on academic writings and the performed empirical assessment of project management in the ICT sector in Latvia, the authors conclude that:

1. There is a growing tendency of diminishing the role of technical skills in the project management process, instead focusing on the project manager's social skills, which ensure a more effective way of overcoming challenges, complicated situations and to handle the impact of external factors, which arise in an uncertain business environment.

2. Emotional intelligence is a vitally important competency for project managers due to several reasons: each project is unique and the project manager's ability to adapt to new circumstances is important, projects are subject to time constraints, and the project manager is granted a limited time for establishing co-operation with the team, moreover, project managers usually have only a limited power and authority with regard to the members of the project team; therefore, it is important to employ more complex methods and strategies to achieve the result.
3. Overall, research results in the ICT sector of Latvia show that:
   3.1. Project managers in the ICT sector of Latvia consider emotional intelligence of project managers as one of the important components in achieving a successful project outcome.
   3.2. Significant differences are noted in the achievement of assessed project success criteria according to the self-assessment of the project manager's emotional intelligence parameters.
   3.3. There is a moderately strong positive correlation between the self-assessment of a project manager's personal traits and the performance of project success criteria, especially the degree of satisfaction of the project work group with the project implementation, which, for its part, in the assessment of project managers is one of the critical factors for successful project implementation and as a result serves as a pre-condition for a successful long-term co-operation among the project work group.
4. Implications of the results indicate that, firstly, the findings help defining recommendations on the selection of project managers for ICT project management based on EI competencies; secondly, it is crucial for project managers to recognize the relevant EI competencies that are required for successful execution of ICT projects.
5. As the study results confirm the correlation between project managers' social skills and successful achievement of project performance criteria, in future studies, it is necessary to determine the role of emotional intelligence in the implementation of various projects depending on their level of complexity, by setting forth a hypothesis that complicated projects require better social skills of the project manager, as well as to conduct in-depth studies of the co-operation dynamics within the framework of a project work group in order to accurately define the instruments for motivating the work group in a long-term, fostering the achievement of project goals and ensuring added value to businesses.

Bibliography

Ahlemann, F., 2009. Towards a conceptual reference model for Project management information systems. *Int. J. Project Manage*. Vol. 2, pp. 19-30.

Andersone, I., (2014), Ekonomiskās analīzes pētījums par Informācijas tehnoloģiju nozari, Gateway Baltics. [Online] Available at: http://www.viaa.gov.lv/files/news/24112/it_presentation_gateway_baltic.pdf [Accessed 26 January 2015].

Bande, B., Fernández-Ferrín, P., Varela, J.A., Jaramillo, F., 2015. Emotions and salesperson propensity to leave: The effects of emotional intelligence and resilience. *Industrial Marketing Management* Vol. 44, pp. 142-153.

van Blerk, W.E., 2013. Dissertation "The role of emotional intelligence in implementing information technology strategies".

Bar-On, R., 2006. The Bar-On model of emotional-social intelligence (ESI), *Psicothema*, Vol. 18, pp. 13-25.

Bolden, R., Hawkins, B., Gosling, J., Taylor, S., 2011. Exploring Leadership: Individual, Organizational, and Societal Perspectives, Oxford University Press, UK, 64 p.

Brewer, J.L., Dittman, K.C., 2013. Methods of IT Project Management, Purdue University Press, West Lafayette, Indiana.

Central Statistical Bureau data, Indicators of services. [Online] Available at: http://data.csb.gov.lv/pxweb/lv/zin/zin__datoriz__ikt_sektors/?tablelist=true&rxid=cdcb978c-22b0-416a-aacc-aa650d3e2ce0 [Accessed 30 December 2014].

Clarke, N., 2010. Projects are emotional. How project managers' emotional awareness can influence decisions and behaviours in projects. *International Journal of Managing Projects in Business*, Vol. 3, No. 4, pp. 604-624.

European Commission, European e-Competence Framework 2.0, 2010. [Online] Available at: http://www.ecompetences.eu/site/objects/download/5999_EUeCF2.0userguide.pdf [Accessed 21 January 2015].

Fisher, E., 2011. What practitioners consider to be the skills and behaviours of an effective people project manager. *International Journal of Project Management*, Vol. 29, pp. 994-1002.

Flyvbjerg, B., Budzier, A., 2011. Why Your IT Project May Be Riskier Than You Think, *Harvard Business Review*.

Galbreath, J., Rogers, T., 1999. Customer relationship leadership. *TQM Mag.,* Vol. 11, No. 3, pp. 161-171.

Gardner, H., 2011. Frames of Mind: The Theory of Multiple Intelligences, Basic Books, 3rd ed., p. 528.

Goleman, D., 2005. Emotional intelligence: Why It Can Matter More than IQ, Bantam Books, 10th ed., 384 p.

Goleman, D., 1996. Emotional Intelligence. Why It Can Matter More than IQ. *Education Resources Information Center*, Vol. 24, No. 6, pp. 49-50.

Goleman, D., 1998. Emotional intelligence. What Makes a Leader? *Harvard Business Review*, Vol. 76, No. 6, pp. 93-102.

Goleman, D., Boyatzis, R., McKee, A., 2002. Primal Leadership: Realizing the power of Emotional Intelligence, Boston: The Harvard Business Review Press, 352 p.

Higgs, M., Aitken, P., 2003. An exploration of the relationship Between emotional intelligence and leadership potential. *Journal of Managerial Psychology*, Vol. 18, pp. 814-823.

Jørgensen, H.H., Owen, L., Neus, A., 2008. Making change work, IBM Global services, USA, pp. 10-15.

Kasalis, E., Brekis, E., Jekabsone, S., Purmalis, K., 2013. Strategically most demanded skills in future Latvia. [Online] Available at: https://www.em.gov.lv/files/tautsaimniecibas_attistiba/1st_research_skills_eng.pdf [Accessed 12 November 2014].

Keil, M., Lee, H.K., Deng, T., 2013. Understanding the most critical skills for managing IT projects: A Delphi study of IT project managers. *Information & Management*, Vol. 50, pp. 398-414.

Kloppenborg, J.T., Shriberg, A., Venkataraman, J., 2003. Project Leadership, Management Concepts Inc., 137 p.

Lent, B., Pinkowska, M., 2012. Soft skills needed in the ICT project management – classification and maturity level assessment. *Int. J. Applied Systemic Studies*, Vol. 4, No. 3, pp. 168-185.

Maccoby, M., 2004. Why People Follow the Leader: The Power of Transference, *Harvard Business Review*, 10 p.

Mayer, J.D., Salovey, P., Caruso, D.R., Sitarenios, G., 2001. Emotional intelligence as a standard intelligence. *Emotion*, Vol. 1, No. 3, pp. 232-242.

Mersino, A.C., 2007. Emotional Intelligence for Project Managers: The People Skills You Need to Achieve Outstanding Results, Amacom, New York, 264 p.

Müller, R., Turner, J.R., 2010. Project-oriented Leadership, Gower Publishing Limited, England, 98 p.

Palmer, B., Walls, M., Burgess, Z., Stough, C., 2001. Emotional intelligence and effective leadership. *Leadership & Organization Development Journal,* Vol. 22, No. 1, pp. 5-10.

Project Management Institute, 2013. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th ed., 589 p.

Reiter, W., 2003. Die nackte Wahrheit über Projektmanagement, Orell Fussli Verlag AG, Zürich, 196 p.

Richman, L.L., 2012. Improving Your Project Management Skills, 2nd ed., Amacom, New York, 212 p.

Rozcenkova, A., Dimdins, G., 2011. Emotional Intelligence as a mediator between commanders' transformational leadership and soldiers' social identification with their unit in the military, *Baltic Journal of Psychology*, Vol. 12, No. 1, pp. 59-72.

Salovey, P., Mayer, J. D., 1990. Emotional intelligence. *Imagination, Cognition, and Personality*, Vol. 9, pp. 185-211.

Schutte, N.A., Malouff, J.M., Bobik, C., Coston, T.D., Greeson, C., Jedlicka, C., Rhodes, E., Wendorf, G., 2001. Emotional Intelligence and Interpersonal Relations, *The Journal of Social Psychology*, Vol. 141, No. 4, pp. 523-536.

Smith, A., 2014, PMI's Pulse of the Profession® In-Depth Report: Requirements Management – A Core Competency for Project and Program Success, Project Management Institute, Inc. PMI.org/Pulse. [Online] Available at: http://www.pmi.org/~/media/PDF/Knowledge%20Center/PMI-Pulse-Requirements-Management-In-Depth-Report.ashx [Accessed 13 January 2015].

Stevenson, D.H., Starkweathe, J.A., 2010. PM critical competency index: IT execs prefer soft skills. *International Journal of Project Management,* Vol. 28, pp. 663-671.

Toth, P.A., 2011. Dissertation "Project Leadership and the PMBOK® Guide".

Zeidner, M., Matthews, G., Roberts, R.D., 2004. Emotional intelligence in the workplace: A Critical review. *Applied Psychology: An International Review*, Vol. 53, No. 3, pp. 371-399.

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DO YOU WANT TO FINISH YOUR PROJECT ON TIME AND WITHIN THE BUDGET?

Dr. István Fekete, Corvinus University of Budapest, Hungary[1]

Abstract

In risk management literature a great number of methods can be found that are suitable for risk assessment. Most of them can only be used if there are historical data available as they rely on statistical analysis to assess risks. However, many times there is no daily database to use for assessing most risks. Of course, the probability of occurrence and impact of these risks should always be assessed/ estimated in a reliable manner. The question is: exactly how? To answer it a method has been developed by the author that has been used in more than 50 different applications up to now. The aim of this paper is to demonstrate the way how can be assessed the risks affecting the target values of building a new football stadium by using of the developed method.

Main steps of risk assessment according to the developed method:

- creating project schedule suitable for risk assessment,
- identification of different risk sources/events for particular project activity,
- risk analysis with the help of scenario analysis,
- risk evaluation for selecting critical risks,
- formulating risk treatment actions for all critical risks,
- running Monte-Carlo simulation by using the outputs of scenario-analysis.

Results

Building of new football stadium has finished on time and has met the quality expectations thanks to the execution of suggested risk response actions.

Key words: *risk assessment, building a new football stadium, project schedule, scenario analysis, Monte-Carlo Simulation*

JEL code: H43

Introduction of the project

Ferencváros is one of the most famous football clubs of Hungary. This football team has won 28 Hungarian championships and has remarkable number of fans. Unfortunately their former Stadium was far from date and it was not suitable for arranging international matches.

So thus, the need has occurred for an up-to-date Stadium, which passes all UEFA regulations.

The new Groupama Arena is capable of hosting 22.122 attendances in case of international and 23.704 attendances in case of national championship and cup matches. The pitch was made by the help of the latest technologies and the hayseeds were evolved in consideration of specialties of the Hungarian climate. The subsoil was selected considering

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the special needs, so the grass could grow faster, became more persistent and the drainage capacity has increased. The most advanced system of cameras and entry control were installed.

According to the original project schedule the duration of the construction work was 18 months, which is fairly short time. To meet this considerably strict deadline and quality expectations, it was necessary to use a tool, which could help to analyze the risks of construction works in a structured way.

Assessing risks affecting the execution time

The author has developed a risk assessment method, which is suitable to assess the risk if historical data are not available or insufficient. This method was published in the First International Conference on Project Management in the Baltic Countries in 2012. (Fekete, 2012).

According to this method the risk assessment affecting the execution time requires the following steps:

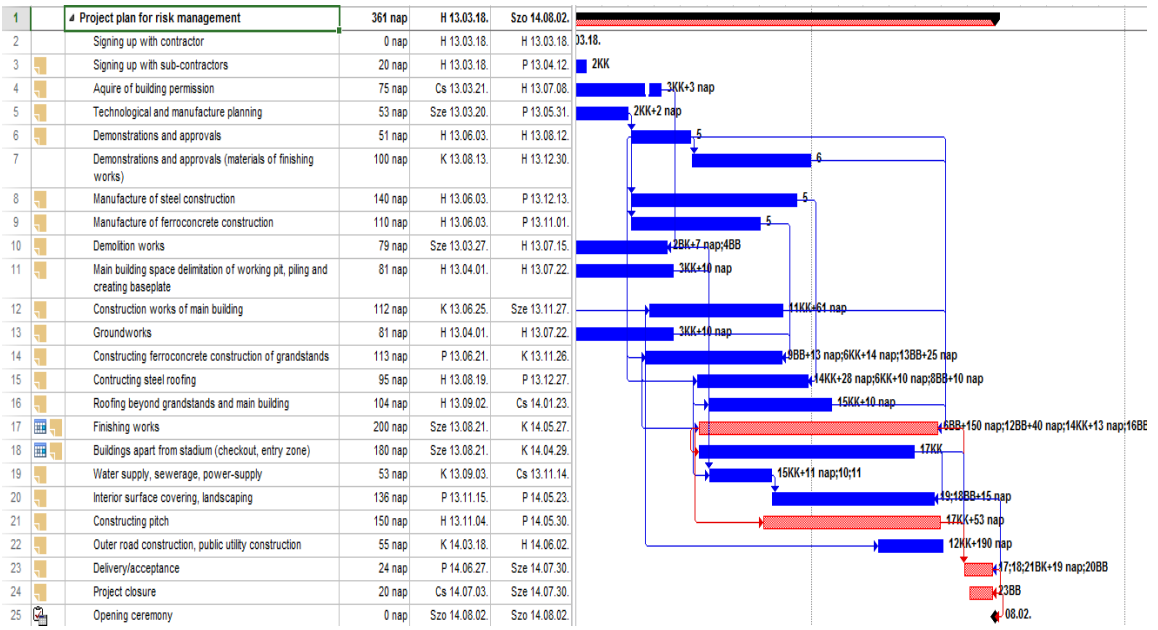
- Making a simplified project schedule suitable for risk management.
- Identification of risk events/sources affecting the execution time of each project activity.
- Analysis of risk events/sources by the help of scenario analysis.
- Running Monte-Carlo simulation using the results of scenario analysis.
- Selecting critical risk events/sources which should be treated in any way.

The risk management activity was performed in a series of workshops, where all concerned experts (electric engineering, mechanical engineering for example) were attended.

The first step was to create a simplified project schedule, which can help to complete the risk management efficiently. A simplified project schedule like this usually contains 20-25 project activities only. It is important to note however, that the extent of this simplified project schedule has to be corresponding to the original project schedule, which can contains thousands of project activities. Because risks should be assigned to each project activity, the risk assessment of the original project schedule would be time consuming. It's important that the simplified project schedule has to fulfill the requirements of project management as well (Görög, 2008), so it was possible to calculate the length of critical path which is referred as target value.

The first project schedule was created in spring 2013. According to this schedule, the duration of construction work was the above-mentioned 18 months. However in spring 2014 the duration of the construction work was shortened by a month based on project owner's decision. Therefore a new project schedule was created which was used during the actualization of risk assessment.

The Figure 1 provides an example for the project schedule suitable for risk assessment.



		Project plan for risk management	361 nap	H 13.03.18.	Szo 14.08.02.
2		Signing up with contractor	0 nap	H 13.03.18.	H 13.03.18.
3		Signing up with sub-contractors	20 nap	H 13.03.18.	P 13.04.12.
4		Aquire of building permission	75 nap	Cs 13.03.21.	H 13.07.08.
5		Technological and manufacture planning	53 nap	Sze 13.03.20.	P 13.05.31.
6		Demonstrations and approvals	51 nap	H 13.06.03.	H 13.08.12.
7		Demonstrations and approvals (materials of finishing works)	100 nap	K 13.08.13.	H 13.12.30.
8		Manufacture of steel construction	140 nap	H 13.06.03.	P 13.12.13.
9		Manufacture of ferroconcrete construction	110 nap	H 13.06.03.	P 13.11.01.
10		Demolition works	79 nap	Sze 13.03.27.	H 13.07.15.
11		Main building space delimitation of working pit, piling and creating baseplate	81 nap	H 13.04.01.	H 13.07.22.
12		Construction works of main building	112 nap	K 13.06.25.	Sze 13.11.27.
13		Groundworks	81 nap	H 13.04.01.	H 13.07.22.
14		Constructing ferroconcrete construction of grandstands	113 nap	P 13.06.21.	K 13.11.26.
15		Contructing steel roofing	95 nap	H 13.08.19.	P 13.12.27.
16		Roofing beyond grandstands and main building	104 nap	H 13.09.02.	Cs 14.01.23.
17		Finishing works	200 nap	Sze 13.08.21.	K 14.05.27.
18		Buildings apart from stadium (checkout, entry zone)	180 nap	Sze 13.08.21.	K 14.04.29.
19		Water supply, sewerage, power-supply	53 nap	K 13.09.03.	Cs 13.11.14.
20		Interior surface covering, landscaping	136 nap	P 13.11.15.	P 14.05.23.
21		Constructing pitch	150 nap	H 13.11.04.	P 14.05.30.
22		Outer road construction, public utility construction	55 nap	K 14.03.18.	H 14.06.02.
23		Delivery/acceptance	24 nap	P 14.06.27.	Sze 14.07.30.
24		Project closure	20 nap	Cs 14.07.03.	Sze 14.07.30.
25		Opening ceremony	0 nap	Szo 14.08.02.	Szo 14.08.02.

Source: author's construction

Fig. 1. **Project schedule suitable for risk assessment**

The next step was to identify the relevant risk events/sources for each project activities and to evaluate them by the help of scenario analysis. Experts in risk management and in construction works identified and evaluated positive (towards shortening the duration of project activities) and negative (towards elongating the duration of project activities) risk events/sources based on their recent experiences.

The experts assigned maximum four different scenarios to each risk event/source (Watchorn, 2007). It is important to note that generally the aggregated probability of scenarios has to be 100%, since the scenarios are mutually exclusive. At the same time the impact of the scenarios can measure the positive and negative deviation from the original (target) value, if the risk occurs. The experts gave utmost attention to the explanation of evaluations. One of the reasons is to encourage them to enhance the reliability and reality of evaluation. The other reason is to preserve the explanations for the next updates of risk assessment; this can help the experts to decide where the evaluations have to be modified in the light of the newly revealed information.

Using the experts' belief the expected value and standard deviation of the duration of each project activity can be calculated, assuming that the risk events are independent of each other. However, the independency is not true by all means. The evaluation of correlations, in absence of historical data, would make the assessment process more complicate and inaccurate, so the experts decided that the aside from correlations is less remarkable error.

Towards selecting critical risks, threshold values have to be defined for the divergence of the expected value compared to target value and relative deviation values (standard

deviation/expected value) came from the results of scenario analysis. If risks are exceeding one or both threshold value they have to be treated any way. The experts considered risks as critical if the divergence from the expected value exceeded 10% of the target duration, and/or exceeded 100% of the relative deviation. The experts defined risk response actions with designated deadline and persons in charge for each critical risk. The above mentioned steps need to be executed for all project activities. For this reason it can be imagined that the experts assigned the same risk event/source for more than one project activity, or if the same risk source/event considered as critical more than once, the same risk response action were formulated by them. In order to increase the efficiency of the execution of risk response, the consolidation (aggregation by content) of risk response actions was necessary.

Table 1 gives an example for risk assessment by scenario analysis.

Table 1

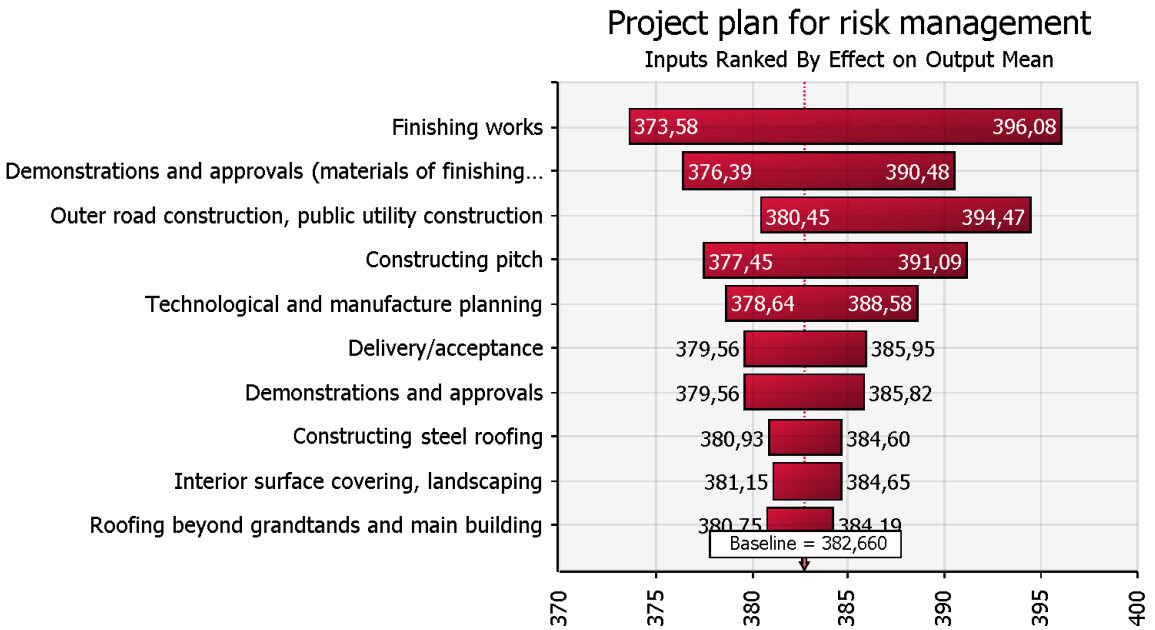
Example for risk assessment by scenario analysis

<table>
<tr><th rowspan="2">Project task</th><th rowspan="2">Name of risk source</th><th rowspan="2">Description of risk event</th><th colspan="4">1. scenario</th><th colspan="4">2. scenario</th></tr>
<tr><th>Description</th><th>Likelihood (%)</th><th>Impact (days)</th><th>Explanation</th><th>Description</th><th>Likelihood (%)</th><th>Impact (days)</th><th>Explanation</th></tr>
<tr><td rowspan="3">Main building space delimitation of working pit, piling and creating baseplate</td><td rowspan="3">Damage of nearby buildings</td><td>During craning works the object drop off</td><td>No damage</td><td>99.5</td><td>0</td><td>Because of serious precautions the risk won't occur near high.</td><td>Damage</td><td>0.5</td><td>60</td><td>Because of the serious precautions the probability of occurrence is very low, but the occurrence could endanger the whole project, leastways the duration of this task could prolong highly</td></tr>
<tr><td>Expected value of divergence (days)</td><td>Standard deviation (%)</td><td colspan="4">Risk response action</td><td colspan="2">Person in charge</td><td>Deadline</td></tr>
<tr><td>0.3</td><td>4.23</td><td colspan="4">The craning and lifting plans have to require the protection of nearby buildings, the adherence have to be strictly monitored</td><td colspan="2">Technical inspector</td><td>Continually till 01/01/2014</td></tr>
</table>

Source: author's construction

Following scenario analysis, Monte-Carlo simulation was run to simulate the risk-adjusted duration of the critical path using the results of scenario analysis. The main goal of running Monte-Carlo Simulation is to seek out the project activities which are mostly responsible for the divergence compared to the target value of the critical path. (See the Tornado diagram on Figure 2.) During Monte-Carlo Simulation lognormal distribution was selected as probability distribution because this type can describe the best way the nature of experts'

judgment during scenario analysis. In other words greater divergences with low likelihood can occur compared to the target value of project activities' duration.



Source: author's calculation

Fig. 2. **Tornado-diagram**

According to Figure 2, the suggested risk response actions for critical risk events/sources of "Finishing works" have to be executed first in order to finish the construction works on targeted date or earlier.

The risk assessment had to be repeated several times during the construction works due to the continuous changing of external and internal environment.

Assessing risks affecting the predefined quality parameters

The steps for assessing risk affecting the predefined quality parameters are as follows:

- Selecting concerned professional tasks.
- Identification of risk events/sources affecting the predefined quality parameters of selected professional tasks.
- Analysis of identified risk events/sources by qualitative risk assessment.
- Selecting critical risks events/sources, defining risk response actions to them.

Unlike risk assessment of execution time, the experts selected the tasks, for which quality parameters could be connected unequivocally. Table 2 gives an example for selecting the professional tasks and quality parameters.

Table 2

Professional tasks and quality parameters, example

Task	Sub-task	Quality parameter
Mounted walls, suspended ceilings	Walls	Dimensional accuracy (setting, dimensional compliance, flatness etc.)
		Compliance of plans (appropriate fire- and waterproof etc. materials)
		Plastering gaps
		Installation of large-sized doors and windows
		Connection to other structures
	Suspended ceilings	Dimensional accuracy (setting, dimensional compliance, flatness etc.)
		Compliance of plans (appropriate fire- and waterproof etc. materials)
		Preciseness of visible feathers
		Connection to other structures
Coverages	Pavements	Compliance of substrates
		Dimensional accuracy (compliance with the requirements of standards)
	Jointless floor	Compliance of substrates
		Compliance of covering materials
		Dimensional accuracy (compliance with the requirements of standards)
	Rasin floors	Compliance of substrates
		Compliance of covering materials

Source: author's construction

After selecting professional tasks and quality parameters, the following step was the identification of risk events/sources that can have an impact on achieving the target value of predefined quality parameters.

In this case the experts used qualitative risk assessment method. The usage of qualitative method was justified by the shortage of information; therefore quantitative method wouldn't lead to more precise final result. During the qualitative analysis the experts estimated both likelihood and impact of a risk event/source on a five-grade ordinal scale. The impact describes the possible corrective action once the underlying risk event has occurred.

The Table 3 gives an example for the five-grade likelihood and impact scale.

Table 3

Likelihood- and impact scale, example

Likelihood	Impact
1: 1-3%	1: Can be corrected by local reparation
2: 4-6%	2: Demands minor local modifications
3: 7-9%	3: Demands greater local modifications
4: 10-12%	4: Can be corrected by designers intervention only
5: 13-15%	5: Incorrect

Source: author's calculations

As can be seen in Table 3 the experts assigned one or more quality parameters for each professional task, so the risk assessment has to be made separately for each parameter.

As next step the critical risk events/sources during the qualitative assessment had to be selected. In this case the rule cannot be used as presented earlier. The experts marked a risk source/event as critical according to their experience. In general they indicated a risk source/event as critical when its impact is 4 or 5 on a five grade ordinal scale regardless from its likelihood.

The experts defined risk response actions with designated deadline and persons in charge for each critical risk. Similar to risk assessment affecting the execution time, the risk response actions had to be consolidated in this case as well.

Table 4 gives an example for qualitative risk assessment.

Table 4

Example for qualitative risk assessment

<table>
<tr><th>Professional task</th><th>Quality parameter</th><th>Name of risk source</th><th>Description of risk event</th><th>Like-lihood</th><th>Impact</th><th>Explanation</th></tr>
<tr><td rowspan="3">Manufacture of steel construction</td><td rowspan="3">Dimensional accuracy</td><td>Several manu-facturing location</td><td>The dimensional accuracy is inappropriate because of the several manufacturing location</td><td>2</td><td>3</td><td>There are always differences because the dissimilarity of manufacturing locations, but this don't cause non-compliance in the dimensional accuracy of steel elements, if it does, it requires serious local modifications</td></tr>
<tr><td colspan="3">Risk response action</td><td>Person in charge</td><td>Deadline</td></tr>
<tr><td colspan="3">The technical inspector have to reveal the problems caused by the dissimilarity of manufacturing locations</td><td>Technical inspector</td><td>01/02/2014</td></tr>
</table>

Source: author's construction

The results of risk assessment on execution time and quality parameters can have an effect on each other. Because in spring 2014 the duration of the construction work was shortened by a month based on project owner's decision, the experts emphasized the importance the joint application of time and quality risk assessment in order to meet the quality expectations.

Winterization

Since the construction works were proceed during winter period it was important to analyze the requirements of uninterrupted works. The experts formulated suggestions that help the flexible working in order to avoid any delay in case the winter was hard. Table 5 gives an example for that.

Table 5

Suggestion for ensuring uninterrupted works in the winter, example

Task	Suggestion
Grandstand roofing	The primary contractor has to grant the flexible (suitable for weather conditions) manpower and the work organization ensures the continuous work under appropriate conditions. The continuity of snow clearance have to be granted (for example flooring terfil leafs)

Source: author's construction

Conclusions

The risk assessment method has been developed by the author was performed eight times by the experts during the construction period. The first analysis indicated that the construction work could only be finished a month later compared to the originally planned 18 months. One month such slippage is not considered as too high, however, the project owner and the primary contractor insisted on finishing the construction works on targeted date. Therefore the experts established a register where the execution status of suggested risk response actions could be followed up. The next analysis (performed circa 2 months later) indicated that the slippery could be reduced to 21 days thanks to the execution of suggested risk response actions. The latter updates indicated an even lower slippery. Meanwhile with the help of quality risk assessment the fulfillment of required quality parameters could be monitored in parallel with risk assessment of duration of construction works.

A new situation arose when the decision had been made about finishing the construction works an extra month earlier. The new focus of risk assessment was to examine the technical possibility of earlier finish by monitoring the execution of delivery/acceptance process.

Besides risk management, several other tools could support the construction works to be finished two months earlier than originally scheduled. However after finishing the construction works the project owner gave expression to his judgment that the execution of suggested risk response actions had gone a long way towards finishing the project earlier as scheduled and at

the same time had helped to meet the quality expectations. The construction works were finally finished in 16 months only, this way this Stadium has become the fastest-completed Stadium in the world.

On the basis of experiences gained from stadium construction project it is recommended to use the developed method in the same way as was applied in this project during the implementation of other high priority investment projects. Of course it would be worth to investigate the other application opportunities of the method. One opportunity could be the development a procedure for risk based cost calculation.

Bibliography

Görög, M., 2008. Projektvezetés. *(Project Management)* Aula Kiadó, Budapest, pp. 137-150.

Watchorn, E., 2007. Applying a Structured Approach to Operational Risk Scenario Analysis in Australia, Australian Prudential Regulation Authority (APRA) Working Paper.

Fekete I., 2012. Does Lost Time Cost You Money and Create High Risk? First International Scientific Conference on Project Management in the Baltic Countries, February 8-9, 2012 Riga University of Latvia.

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FINANCING MODEL OPTIMIZATION OF LANZHOU YATAI GROUP REAL ESTATE PROJECT

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Abstract

Lanzhou Yatai Group, as the first listed real estate companies, occupies absolute advantage in the competition of the industry. Especially because of Lanzhou National Economic Development District, Yatai Group focuses Lanzhou new area as the target of the advantages and great location. With the business development and planning, the company also will create Lanzhou Yatai Group Technology Headquarters before 2016, and also will be followed by the huge business opportunities in the real estate industry driven by the financial industry, service industry, catering industry, and the education industry as well. At the same time, the asset number of investment companies in the new district has reached asset about 0.45 billion, so the vast number of these channels also makes traditional financing be in danger. Banking loans, equity financing, debt financing gradually are difficult to enable the company's rapid development growing so fast. Large-scale funding and financing inefficiencies of some large-scale projects also make the company's financial operations meeting some obstacles. In this paper, the author will analyse Yatai Group real estate financing process and the traditional financing channels to predict its financing risk prevention and the Group's real estate funds operating characteristics of the project. At the same time, we put forward the concept and characteristics of the real estate project financing. After financing inefficiencies of Lanzhou Yatai Group from 2011 to 2014, we make the analysis for real estate projects for the company and make a selection and optimization models. But also for the smooth development of real estate projects in Yatai Group, we provided a positive recommendation, which will become healthy and stable developments of the real estate industry in Gansu Province, and the development and construction of new district will be made as a good expectation.

Key words: *Real Estate Companies; Project Financing; Financing Model; Risk Prevention*

JEL code: M2

Introduction

With the development of world economy and continuous improvement of management applications, more and more scholars began to focus on project management (Chan A P C, Scott D, Lam E W M, 2002; Pheng L S, Leong C H Y, 2000; Deng Z M, Li H, Tam C M, 2001; Shen L Y, 1997), affecting factors of project management (Chan A P C, Scott D, Chan A P L, 2004; Chan A P C, Ho D C K, Tam C M, 2001) and the associated real estate project (Veale P R.,

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1989; Ginevičius R, Zubrecovas V, 2009; Krumm P J M M, Dewulf G, De Jonge H, 1998). Besides, many scholars are concerned about the development of Chinese enterprise (Steinfeld E, 2004), especially small and micro enterprises in China (Anderson A R, Li J H, Harrison R T, et al., 2003; Gibb A, Li J, 2003) , Chinese private enterprises (Chen W., 2007; Zhonghui W, 1990) and the Chinese collective enterprises (Tian G, 2000).

Over the last decade, China has experienced rapid development of the real estate industry, and the average annual increase rate of the GDP is about 8%. However, due to persistently high prices and overheated real estate market in recent years, the country has also changed the control of the intensity of macroeconomic policies and the implementation of real estate loans monetary tightening policies. To further promote the stability of the regional economic development, speeding up the development of stable housing prices is a crucial social problem.

Lanzhou Yatai Group is the largest real estate company as a capital-intensive industry in Lanzhou, Gansu Province. The financing of the company's development is of huge significance, and also in the development of Lanzhou Economical New District project financing still faces many problems and risks. Therefore enhancing the company's financing capacity, actively expanding the variety of new financing channels, optimizing various financing channels to avoid the risk of financing to solve our current problems are the top priorities.

Since the 1980s, China's real estate industry began a rapid development, and the real estate industry has become China's economic development to support the industry. In the past few years, the growth is more than 20% in each year. According to statistics, China's real estate industry investment in 2006 reached 1.315829 trillion RMB, and sales area reached 382,316,800 square meters. The first quarter of 2006, real estate investment reached 182.7 billion RMB, which is an increase of 42.1%. On the one hand, the investment in the real estate industry has reached a large amount risk earnings.

Also the large source of investment has been focusing on the developers who pay close attention to the economy, because it directly affects the construction problem of real estate projects. External environment has forced Yatai Group to consider the issue of financing in profit optimization process. From another point of view, due to mature capital market, housing prices have been listed can make a choice from more financing, which makes the premise of more stable financing.

This article is under such conditions, expanding the optimization of Yatai Group financing channels and making the financing of enterprises in time to meet the company's capital needs, and it can also minimize the cost of the investment risk under the control of the premise. Housing prices in solving optimization problems of financing channels is the smooth conduct of the company's development projects. And it can promote the healthy and stable development of the industry in Gansu province as well. This is the practical significance of this paper.

1. Real Estate Enterprises and Small and Medium Real Estate Companies

Based on the factors of production, real estate business refers to the land, human, finance etc. With the risk to carry out real estate development, real estate consulting provides management services, economies transfer of land use rights and other aspects of the business. From the definition of real estate corporate, it can be seen that the real estate market and the business of enterprise are more complicated, as long as the real estate business-related companies are able to be called the real estate business or real estate companies. Due to the

number of real estate companies and more widely involved business, according to different criteria, real estate corporate can be divided into different categories. This paper defines the following two reference standard for the real estate business to be divided.

According to China State Council's State-owned Assets Supervision and Administration Commission, the National Bureau of Statistics 2008 reference principle, the latest standard criteria for the classification of companies was divided. Small and Medium Real Estate Companies (that own 300 or less employees in the real estate business, or total sales at 250 million RMB or below, or total assets of 500 million RMB or less.) Large Enterprises (require both of the following conditions: more than 300 people and total sales of 250 million RMB and above.) As is shown in table one below (Unit RMB).

Table1

Real Estate Business Classification Table

Businesses Types	Total Sales	Numbers of Employees	Total Assets
Small and Medium	less than 250 million	less than 300 people	Less than 500 million
Large	more than or equal to 250 million	more than or equal to 300 people	500 million and above

According to the new provisions of China in April 2007, in accordance with the Ministry of Construction, implementing the qualification grading criteria is in addition to the real estate enterprise engineering quality, results of operations, assurance system and professional and technical staff as well as the qualifications of the person responsible, engineering major accident the exact requirements. There is a clearly defined capital registration requirement of the occurrence rate. The first class enterprise is with registered capital of 60 million RMB; the second class company is 30 million RMB; the third is of 900 million RMB; the fourth class is of 150 million. Combined with the actual situation in the real estate business in the standard basis of a comprehensive analysis of the above two types, taking the total assets, total sales, business intelligence, and the number of employees as the basis for the division of real estate enterprises is necessary.

2. Traditional Financing Overview of Yatai Group Real Estate Projects

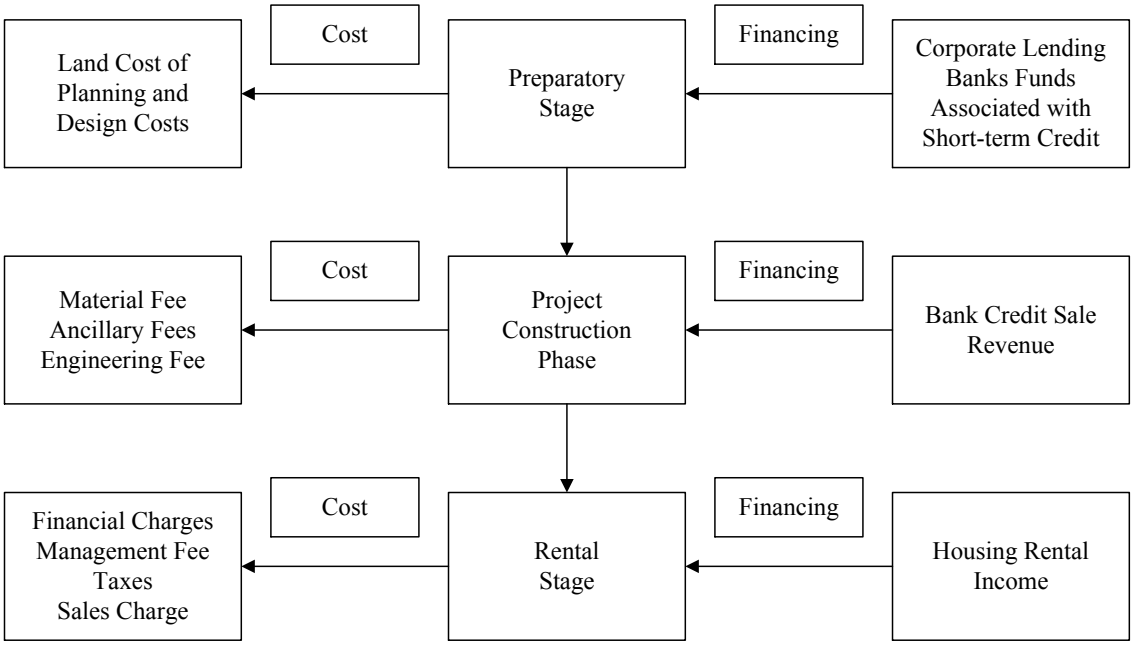
2.1. Lanzhou Yatai Group Real Estate Project

Lanzhou Yatai Group Real Estate Development Group is headquartered in Lanzhou City, Gansu Province, and it was established in 1998 with registered capital of 760 million RMB, and the total number of employees is 279. The company always adheres to the "people-oriented" business philosophy. With emphasis on the central position of the real estate industry, it has a very high value quality and progress of construction. And in the early days, the company was accumulated more than 4,000,000 square meters building area.

In support of the Lanzhou Municipal People's Government, Yatai Group real estate company took the investment of 10 billion RMB to further strengthen cooperation between government and enterprises. In 2012 the central government approved the construction of the

fifth Lanzhou National Economic Development District, then Yatai Group will invest 2.5 billion RMB construction in Lanzhou Yatai technology headquarters, which covers an area of up to 1,300 acres; in second phase in which the project has standardized industrial plants, industrial incubator, high-tech parks and youth entrepreneurship zone cover an area of approximately 650 acres.

It has attracted a variety of research and development, production, business, entrepreneurship and service agencies. Financial operation of Yatai Group headquarters in Lanzhou New Technology Development Project is shown in Fig. 1.



Source: authors' construction

Fig. 1. **Financial Operation of Yatai Group Headquarters in New Technology Development Project**

2.2. The Operational Funding Characteristics of Yatai Group

Since its establishing in 1997, Yatai Group in Gansu province is in a leading position in real estate companies. And Real Estate Group, founded in 1998, gradually became capital-intensive enterprises. Real estate is a long payback period typically in the building industry as well as the late great potential value, so Yatai Group financial operations have the following characteristics:

(1) High Investment Costs

The high cost of Yatai Group real estate development projects is on large capital investment. In first quarter, 2010, the price of land transactions in Lanzhou city rose more than 11 percent, and Cheng Guan District of Lanzhou City Dong Gang Road 276 acres of land was

acquired by Yatai Group in on February 2, 2010 with a total amount of 460 million. Meanwhile the new project is located in the main area of Lanzhou industry functional area which is 4.6 km from the Lanzhou Airport, and the second phase of the project in the new district is expected to be 4.6 billion RMB, and it has been put into building which covers an area of 450 acres of land. Group companies also cooperate with the municipal government to raise 2.5 billion for Lanzhou City Qin WangChuan residential buildings and the construction of affordable housing, with a total area of up to 320,000 square meters. So we can see the high cost investment.

(2) Long Payback Period

Yatai International Group mansion in the initial design is due to the introduction of building in the design which was spent nearly a year's time. In this process, pre-qualification of construction units employ construction had already spent 30 million, including some entertainment at the end of 2009 , hire experts, select the project plan, the municipal government's opinion, and on the preparation of the project, it was spent nearly eight million. In the phase of the project, real estate was completed in May 2011, and in December 2011, it began to be put into use, including a large number of office buildings, commercial plaza, family homes.

This will be the time to begin a gradual recovery of the funds. Generally, Lanzhou Yatai Group real estate project on the average time from starts to recovering funds up to 3-5 years. These data also show that the use of return on investment to raise funds needs to design a lot of products on the market, such as building materials market, financial markets, such as participation in the talent market funds. Mixing these markets also further increases the real estate market made hybrid, and raising funds intermediation cycle becomes longer.

(3) Value-added Funds

With starting building Lanzhou rail traffic, most people would consider the purchasing of their homes which are not far from the subway station. Rail Transit Line 1 invested in early 2014 has begun in the government's strong support of the construction of the second phase in which line one will also be extended to the Lanzhou New Area in 2020, and it is located at the intersection of the suburban railway station Airport Expressway only 100 meters from the Yatai headquarters base. These conditions are certainly convenient transportation facilities for the development of real estate projects in Yatai Group, so Lanzhou Area laid a huge value-added space.

It is coupled with the light rail project and also makes the city from the new district to shorten the time from the original 1.5 hours to 25 minutes. But it also fully embodies the public to Lanzhou New buyers convenience. Therefore, Yatai Group in the business and financial circles gradually joined the ranks of the team, and it will be followed by a more value-added real estate funds.

2.3. REITS Financing of Yatai Group

This method is similar to a mutual fund, so it takes the form of a trust company or business organization to issue revenue certificates. Thus multiple investors raise funds, and they are managed by professional investment institutions in various ways to invest in real estate projects. A new real estate trust financing system has great advantages. It only involves the construction of real estate investment companies and other investment, therefore trust fund is

not the same, and in recent years it supports the healthy development of the Yatai Group Rose Garden project. Currently, under the macro-control policy, Lanzhou Yatai Group is also gradually mature to adopt this way of financing, and trust circulation gradually increased. Usually it is in the financing process. In the following there are three mainly common financing models shown in table two.

Table 2

Three Modes of REIT Financing of Yatai Group

Mode	Features
Capital Trust Loan Category	This mode is similar to traditional bank loans. However, funding patterns are different. Capital trust fund loan category opens from issuance trust scheme.
Equity Trust	It refers to the unique housing prices which are repurchasing a stake in equity financing mode. This financing model is not only to meet the financing needs of the Asia Pacific Group, but also improve the company's credit rating. Making the overall capital structure of the company is optimized. Performance without increasing asset-liability ratio of the situation increases the real estate business capital.
The Transfer of the Trust Beneficial Interest	The property transaction-based trust model is for the transfer of property of real estate companies to the state investing public in the community to achieve the purpose of financing.

Source: authors' construction

After 2010, Yatai Group in the context of the country's economic macro-control started using this financing model. Through the statistical data from the perspective of Yatai Securities Department, REITS senior management team under the leadership of chairman, Zhu Quanzu, has raised 175 million RMB of funds according to the characteristics of the project on the Rose Garden project. Yatai Group on financial supervision are concerned, and trust funds and equity loan category can absorb direct investment trusts to effectively reduce the risk of bank credit.

3. Problems and Causes of Traditional Financing of Yatai Group

Traditional financing forms the basis for the company's early development, but except few above described common current way of financing, a small business was also applied to a number of financing working capital debt financing, venture capital, mezzanine financing. Generally speaking, when used together, these financing reduces the risk of corporate finance, but sometimes the choice of various financing will be a certain percentage of disharmony, or an over-reliance on a particular financing channels. In the absence of financing, the system of early warning mechanisms should be cautious about company found problems.

3.1. Problems of Reasonable Financing Structures

Yatai Group real estate project financing structure will be different because of the division of corporate capital and different ways. It will be shown in table three.

Table 3

Real Estate Project Financing Structure Parameter Table

Division of Financing	Parameter Ratio of Financing Structure
According to Different Ways of Funding Sources	The proportion of internal and external sources of financing is 69%.
According to Different Long Term and Short Term Capital	The proportion of Long-Short term Financing is 93%.
According to the Division of Funds in Different Ownership	Proportion of equity capital and liabilities is 87%.

Source: Report of the First Quarter 2013: http://www.ythouse.com.cn/show.asp?id=1426

From Yatai Group financial statements from 2011 to 2013, the average debt ratio is up to 87% which can be seen that the pressure is already very large, and debt is significantly higher than shareholders' equity. The ratio of internal financing and external financing reached 69%, and it shows that the proportion of outside financing is much higher than the source of inside financing, and corporate financing costs are increasing year by year. Long-term financing and short-term financing ratio reached 93%, and totally reached 170 million RMB.

The financing structure can be seen from property ownership and financing risks, such as some of the features. It reflects the pressure on corporate financing unabated. If companies continue to use the previous financing, the ratio will be high debt ratio. The phenomenon makes the financing structure distortions appear. Therefore, a reasonable structure is a serious problem in conventional financing.

3.2. The Lack of Early Warning Mechanism for Financing Risk

Yatai Group is a capital-intensive industry. In the operation process of real estate projects in more urgent need for capital, the risk of the project financing is the group need to focus on financing targets, but it also becomes the object of prevention. Balance Sheet on June 2012 (Securities Department) in the first half year shows the company's bank loans have reached 260 million RMB. (80 million from China Merchants Bank, 120 million from Shanghai Pudong Development Bank, 40 million from Industrial and Commercial Bank of China, 20 million from the rest of the bank).

Due to some reasonable use of the real estate trust, the company gradually reduces the number of bank loans within three years. However, by 2011 Yatai Group remains widespread attention focused on the pursuit of profit concern for risk prevention and early warning efforts is small. Therefore, enterprises should improve the financing risk warning mechanism.

3.3. Over-Reliance on Bank

Yatai Group at the time of start-up is only a very small real estate company. With the increase in business it is gradually developing into a large, publicly traded real estate company with a total construction area of more than 400 million square meters, and awards of "China Famous 100" and "China Real Estate Top 50 famous enterprises" and other awards; recent years, "Yatai • City Moonlight", "East Yatai and Yatai • Constellation" are about to complete the development and construction.

But in the early stages due to excessive reliance on bank loans, the company has been defeated some difficulties in financing situation in the 2009 financial crisis through this most direct financing channels. And Gansu underdeveloped regional government also controls the Lanzhou soaring housing prices which did not fall as an unprecedented slump. So in 2010, the company entered the bottleneck stage in a slow development.

4. Financing Mode Design of Yatai Group Real Estate Project

The author believes traditional financing within a certain time would be replaced by financing part of the project. Financing models will be combined with traditional financing and project financing. According to the special nature and characteristics of project finance real estate projects in Yatai Group, this chapter is suitable for the development of real estate projects in Yatai Group's financing model, and it is suitable for the development of Yatai Group project financing mode in-depth analysis and discussion.

4.1. Significance of Yatai Group Real Estate Project Financing Mode Selection

Financing behind the company has paid a high cost of capital as the price. At this point, the Group Finance Department has indicated that the current debt ratio to Group headquarters has been in a high level. A rapid increase will be in the cost of capital if it will bring the debt ratio increased. According to the trade-off theory and financial leverage, it was coupled with land reserves leading to long-term lack of funding sources.

On the above analysis of Yatai Group, the group should now be considered an appropriate way to improve project financing and financing efficiency. So, from the above analysis, the traditional financing methods are hard to meet the high efficiency of the financing, but also hindered Yatai Group further development.

4.2. Factors of Yatai Group Real Estate Project Financing Model Design

(1) National Policy

In recent years, not only the national macro-control policies continues to strengthen financial policy and land policy, but also from the administrative, tax and other aspects of the real estate industry is under macro-control. From Gansu Province in recent years, the trend of macro-control is in the point of view, and it is also from the macro to the general micro trend. Local government macro-control of the real estate industry to take its starting point is to stabilize the people's livelihood, stable prices, but also to stabilize Gansu Province real estate financial markets.

However, due to a series of macro-control and monetary policies on the real estate development, our company created a relatively strong impact, even in the short term there is no impact on the real estate, but in a period of time after an impact it is on the further development of real estate. From 2012 to 2013, the average housing price of Lanzhou was from 8500 RMB / square meter falling to 7800 RMB / square meter. However, not all of the housing prices at this time will be subject to the impact of these policies.

Some well-funded real estate companies can still borrow some money and take advantage of loopholes and gaps policy control through small acquisitions of weaker company growing

their own strength. As for Yatai Group, it was affected by fluctuations in the capital market, stock ups and downs. In the year 2013 falling 14.96 points from the highest to the lowest point of 6.95.

(2) Interest Rates

In 2009, the hot real estate situation made the whole industry a big demand for funds, as well as to reach a peak. But from the beginning of the year before last March, due to the central macro-control policy, making tightening credit policy and raised the bank deposit reserve ratio are a clear trend in the real estate market declining. Interest cost is defined as the use of funds in the financial science. Because of the higher level of interest rates, companies will need to pay interest on the higher cost of doing business, so its financing costs will rise as well.

Conversely, if interest rates are too low, the banks and other financial institutions will lose a source of profit. So some real estate financing initiative of financial institutions will be affected by both situations. And the level of interest rates will also have impact on the residents, thus affecting the ability of consumers to pay the loan and repayment pressures confidence. Thus, the interest rate lever can effectively control the bad real estate market development trend and prompt real estate companies to seek more funding and open up wider financing channels.

(3) Soundness of the Financial System

Safety of the financial system for financing the external environment plays a very crucial role. Central bank is important to commercial banks and financial institutions. Real estate and efficiency of financial factors affecting the real estate development will become key factors, such as the degree of perfection of real estate financial system, regulating the level of development of real estate and financial markets, the implementation of monetary policy. Yatai Group basically relies on good reputation and leads position in Gansu Province. Gansu real estate sector is in obtaining bank loans, but the financial system is not perfect in less developed western regions of the financial system. They are still not perfect real estate project financing channels.

(4) The Cost of Capital Financing

The most direct factor of Yatai real estate financing behavior is the cost of capital. Therefore, in terms of exogenous type of financing, bank loans are low-cost and relatively stable as a means of financing. However, project financing and financing costs also determine the effect of financing enterprises. Such costs can also be used to some extent. In the face of a different mode, financing companies to choose a project financing is bound to give up the rest of the project financing mode. Because project financing will also face certain risks and difficulties, uncertainty and cost of financing will result in an absolute impact on the results of financing. By this time some investment experts and technical staff of the prediction and assessment of project financing will select the highest expected rate of return to minimize the cost of a model.

(5) Size of the Business and Brand

In 2012, group board of directors declared that our enterprise development within a decade would become the first international company in Northwest China. Yatai Group should measure their own advantages and characteristics to increase the attractiveness of the provider. The funds should be considered in different financing model for enterprises to raise the required amount of capital financing, financing costs, and the impact of time. High-quality low-cost financing to fund the traditional financing channels was represented in the stock market only to

meet the diverse needs of financing in which a small part of the funds are in Yatai Group. In the past financing within a few years the number is gradually increasing. In determining the validity of the policy of some real estate financing, the Group's project investor should also consider the time and flexibility needed financing process.

5.3. Yatai Group Real Estate Project Financing SWOT Analysis

From a view of the concept of competitive strategy, competitive strategy renowned innovative departure from the company's proposed strategic SWOT analysis. This combination of factors analysis of internal and external aspects of the enterprise reflects enterprise's own strengths and weaknesses, corporate external opportunities and threats in these areas to analyze the company's direction and strategy. While the enterprise is on the development, SWOT analysis is still a practical analysis method. According to Yatai Group the author figures out the company's own internal conditions and external environment. The following table four is Yatai Group SWOT analysis of the real estate project financing.

Table 4

Lanzhou Yatai Group SWOT Analysis of Real Estate Project Financing

S-Strength	W-Weakness	O-Opportunity	T-Threat
After1997, it has been the first listed real estate companies in Gansu Province, and its brands have obvious advantages which is easy to carry out more development projects.	The mortgage is very cumbersome. At the same time, and operation of the project period is longer through large capital investment.	New construction of Lanzhou absorbed much national attention, and national leaders have attached great importance to the construction and development as the fifth national economic development zone in Lanzhou New Area.	Local banks or financial industry developed, and lead to the traditional financing channels to be sluggish, inefficient. Therefore it slightly impedes the rapid development of project financing.
Dedicated management personnel are in all levels, and laid the foundation for the strategic development of the company. So the preliminary work on the project financing is more fully prepared.	Some employees sometimes conceal some materials data, thereby kickbacks from construction materials inside.	Lanzhou Rail Transit Line one phase II project in 2020 will lead to the Lanzhou new Area, because Yatai Group headquarters will be helpful to Lanzhou new technology district development.	Some large factories and enterprises gradually migrate to Lanzhou Area, so that these companies can complete projects here as well. So it brings competitors to Yatai Group.
"Yatai International Residence" won the 50 Chinese famous communities. Therefore it helps attracting more businesses to invest and settle down.	Human resource allocation is unreasonable. Cooperation between employees and leadership do not understand each other.	The city's light rail project will be complete before 2016, which makes more and more citizens buy house in the new district.	National regulation of real estate will continue, as well as tight control policy trends. So the government intervention in the financial markets is frequent.

Source: authors' construction

From the SWOT analysis above we can see the advantages and disadvantages of Yatai Group real estate project financing, also internal strengths and weaknesses. Generally, this analysis obviously lists these positive and negative factors. But money is necessary from the perspective of a business in terms of corporate finance. Only in a short time to rise the number of lower-cost business is meant success. Through the above analysis and summary we seem to have seen the traditional financing channels gradually become more and more narrow. Also in 2013 Wanda Group will be settle in Lanzhou to compete with Yatai Group, so Lanzhou gradually become more intense, opportunities and challenges coexist. So we need to more effectively carry out deeper discussion of Yatai Group project financing.

4.3. Yatai Group Real Estate Project Financing Mode

(1) Sale-Leaseback Financing Model

Yatai Group on some real estate business process used this model in order to increase the amount of financing. It used asset once again after the sale, then leaseback the asset from the purchaser's hands, such as the Yatai mobile phone Lanzhou Guang Wu Men hypermarkets, Lanzhou Zhongshan Road, New Oriental English School campus. These are my company's success leaseback typical case. So I think that Yatai Group can continue to use the asset not only in this way, but you can get money to the asset realized. This sale-leaseback of project financing model significantly improves the efficiency of Yatai Group financing, while authors believe that this leaseback can still be practical and widely used in a number of projects in Lanzhou Area.

Basically, its main operational processes to operate are through the following steps:

1. In the real estate project company after a good pre-sale estimate of housing rents and prices, it ensures high rate of return on the basis of interest rates on bank deposits above the pre-sale estimate of real estate projects ROI.
2. In Yatai Group and the project company to complete the necessary real estate purchase signed contract, the project must be in accordance with the agreed sale and leaseback of these properties again.
3. In the project company, it leased property during the processing of users, and monthly rent must be used to pay the landlord. At this point Yatai Group has sold the property to recover the backlog cost, so not only it can complete the sale and leaseback, but also can gradually solve some of the project's financing problems, such as short-term financing gap. And for a lot of buyers and property purchased already, the company can avoid bankruptcy suffered unnecessary losses due to the project.

(2) The 'Delivery' as the Basis of the Financing Model

This financing model is based on expected sales of all purchase loans from banks, financial intermediaries project, part of the product or rental income over equity. In the late 1970s in some countries in North America, solar, wind, geothermal and other project financing are derived. Listed companies are often able to compare accurately calculation from the annual statement. (Securities Department, Finance Department report shows per year). Therefore, Yatai Group financing model will not only improve the return on assets, and financial intermediaries will receive advance funds or bank financing in advance to reduce the risk.

This financing model is based entirely on the lending bank to buy the company or part of the revenue base over the interests of future sales. Yatai Group was building land 170 million

RMB investment in the new project in Lanzhou Area. Company executives have decided to build 20% of the land area for office or financial institutions.

Most banks will be designed to the same specification on the floor or lower floors of residential buildings. In recent years, more commercial banks enter to Lanzhou. (2013 Industrial Bank, Ming Sheng Bank 2014) So this financing model can also be used to consider this point. Also under this project financing mode of operation, the bank will provide loan funds to buy shares from the project specific products, and these products revenue share of project financing will become the main source of funds. At this time the bank will loan direct ownership of the usufruct project products, so you can get extra profit. About the gradual appreciation of these fixed assets, it is not necessary to achieve credit secured financing through a variety of ways to transfer or mortgage equity.

This financing model has the following characteristics: First, real estate companies and lenders through this mode is actually constructed a "financial intermediary" platform. Secondly, about financial institution or bank check before the development of real estate projects it will be paid to the investment company based on contracted projects to ensure the project schedule. Thirdly, in the real estate company's real estate projects into the sales phase, the project company as a financial intermediary will be based on sales agency agreement to sell the real estate agent, and the financial institution or a bank can also get a commission through the intermediary of real estate to expand their strength. This makes the real estate finance system more closely.

5. Optimized Design and Implementation of Yatai Group Real Estate Project Financing Mode

5.1. Management Objectives of Optimized Project Financing Mode

Based on the macro and micro levels, the goal of risk management is a clear distinction.

(1) Macro Risk Management Objectives

From the perspective of financial markets, macro-financial risks goal is to maintain the stability of the entire financial market, to avoid financial market turbulence. While maintaining the stability of the financial market's confidence in the country's financial system, it promotes efficient development of financial markets orderly, and promotes regional economic of Gansu Province. When a country's macro-stability objective of financial risk management is required to achieve basic standards, the ultimate goal of financial risk management is to reduce as much as possible to avoid the risk of economic loss avoided by economic agents. Maintaining financial system stability and development is a basic requirement management, so financial risk management should be reported to the attitude of continuous improvement and ultimately financial order and the continuous optimization of resources.

(2) Micro Risk Management Objectives

About the pursuit of profit maximization, financial risk management is to aim to minimize the risk of loss. That is to ensure the integrity of the proceeds as possible. However, in some cases there is a contradiction between the two. When the Group companies only focus on the pursuit of profits before ignoring synchronization prevention of risks, the direct purpose of

financial risk management is to reduce getting interests with the overall objective of economic agents relative. In addition, due to the financial risk management objectives, it will inevitably require adjustment. Two contradictory goals need to seek to maximize the interests of prudent risk prevention. Also in Yatai Group project in 2016, the first phase of construction of new district should pay their bills, and this still needs enough money to improve things. But the main purpose is to increase the group's estate value of the business, thereby increasing the wealth of the owner and expanding the business.

5.2. Optimization Principles of Yatai Group Real Estate Financing Models

For the actual situation of Yatai Real Estate Group, in a real estate project operation process, a variety of financing do not exist in isolation. It often requires combination of traditional financing and project financing, and therefore in Yatai Real Estate Group you can spread the risk of certain financing. At first, the source of financing and external financing combines principles seen in the financial analysis is much higher than the total amount of financing endogenous financing. Furthermore, it is a traditional financing structure optimization principle, as well as traditional financing with a combination of project financing.

At last, before the Real Estate Group established a practical way of financing, be sure to consider the issue of financing costs. For Yatai Group, the cost of financing refers to some cost of corporate financing in the course of business. In Yatai Group's overall view, because the type of items can be used in New financing channels range, some of the previous traditional financing package also includes two new proposed models of project financing. However, no matter what form the results of financing options have, an objective evaluation and judgment should optimize the entire Group's capital (financing) structure. So we need to calculate the weighted cost of comprehensive channel model under various funding sources.

5.3. Optimized Measures of Yatai Real Estate Group Investment Fund Financing Models

For the current financial regulatory policy and some large real estate case studies, Yatai Real Estate Group as top 10 companies in Gansu Province should also develop real estate investment funds.

By the characteristics and nature of real estate investment trusts, we identified a number of properties of this financing high-efficiency and low-risk. This financing way to get good results in the past few years is in the use of Yatai Group getting 20 million funding in 2011. Thereby sharing the risk of financing has a number of other channels. The author believes this approach can meet the financing of Lanzhou Yatai Group in the amount of financing, because it is combined with the use of project financing. This is the better operating system which is concrete. REITs can be improved to some extent. Yatai Group capital structure can reduce the cost of business-related financial risk and financing.

And more importantly, you can also get an additional discount of the high real estate prices and the right priority to purchase real estate, so investors at this time will give the principal at a lower capital cost. We can make even trust loan interest rates lower than the interest rates banks. Thereby increasing the customer's investment in Yatai Group makes full use of investment trusts. In order to develop real estate projects in Yatai Group to raise large amounts of external funding, while addressing the development and operation of real estate projects in the process of financing shortage problem. By real estate investment trust fund to carry out, effective operations also can

absorb large amounts of private lending capital, and ultimately the real estate investment trust come into the Yatai Group as an important financing channel.

5.4. Optimization Measures in Various Stages of Financing Development

When Yatai Group made a selling permitting to enter the sales stage in June 2012, it has become a major source funds of Yatai group, which is not only for enterprise developers, but also conducive to the timely repayment of project funds. Marking the beginning of the project is to enter the profitable stage, and this time it pays a progress payment and selling expenses. This phase of sales for the supply of funds also have a key role, such as the sale and leaseback, underwriting and other sales model. Through table five description of Yatai Group, the selection and the ratio of the cost of capital at every stage will be indicators of project development financing mode.

Table 5

Financing Cost of Capital in Yatai New Projects at Different Stages

Different Stages of Financing Costs	Financing	Cost of funds
Obtain Building Land Qualification Stage	Equity financing and public financing	14-22%
Obtain the Construction Permit Stage	Trust	12-18%
	Fund	10-14%
Development for Marketing Stage	Engineering Loaning and Bank Loans	7-8%

Obviously, we can see that the first phase of operation of the project in the whole process in 2012, and the cost of capital financing rates show a gradual downward trend. Because some of the macro-control policies are in recent years, the development of four cards before the project is complete before funds enters some financing channels. With the establishment of the progress, there will be a new project as well as the headquarters of Lanzhou Yatai New Technology Area. Project development funding needs are affected as little as possible to national and local financial policies of Lanzhou City, while the cost of capital has been effectively reduced.

Conclusion

In recent years, financing decisions have been in the real estate business which is good for sustainable development as key factors. So naturally financing has become the company's most important issue in the real estate industry. The problem is that real estate corporate finance, insurance, real estate and other related industries are in a system. Unity of the real estate financing channels for enterprises and other issues is mainly in the business of traditional financing channels. Coming to an end at the time of this article combined with Yatai Group real estate project financing channels for optimization problems, the financing of basic theory and empirical research are combined with social background which exists in the real estate business.

Through a series of problems in the real estate financing model of Yatai Group, I proposed the implementation of policies and strategies to protect innovative real estate project financing

selection optimization model and the new financing program. I also believe that the financial institutions, real estate development companies and the government should actively strive to take advantage of national policy to build a better Yatai Group. At the same time, financial institutions should speed up innovation of financial products and improve the system construction, which will effectively promote Lanzhou Yatai Group to maximize the use of value for money and to choose the best combination for their own development needs in financing mode. It will gradually increase in the rapid development of the real estate industry projects in Lanzhou New Area, so as to promote the sustainable and healthy development of the local economy.

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Bibliography

Anderson A.R., Li J.H., Harrison R.T., et al., 2003. The increasing role of small business in the Chinese economy [J]. Journal of Small Business Management, 41(3), pp. 310-316.

Chan A.P.C., Ho D.C.K., Tam C.M., 2001. Design and build project success factors: multivariate analysis [J]. Journal of construction engineering and management, 127(2), pp. 93-100.

Chan A.P.C., Scott D., Chan A.P.L., 2004. Factors affecting the success of a construction project [J]. Journal of construction engineering and management, 130(1), pp. 153-155.

Chan A.P.C., Scott D., Lam E.W.M., 2002. Framework of success criteria for design/build projects [J]. Journal of Management in Engineering, 18(3), pp. 120-128.

Chen W., 2007. Does the colour of the cat matter? The red hat strategy in China's private enterprises [J]. Management and Organization Review, 3(1), pp. 55-80.

Deng Z.M., Li H., Tam C.M., et al., 2001. An application of the Internet-based project management system [J]. Automation in construction, 10(2), pp. 239-246.

Gibb A., Li J., 2003. Organizing for enterprise in China: what can we learn from the Chinese micro, small, and medium enterprise development experience [J]. Futures, 35(4), pp. 403-421.

Ginevičius R., Zubrecovas V., 2009. Selection of the optimal real estate investment project basing on multiple criteria evaluation using stochastic dimensions [J]. Journal of Business Economics and Management, 3, pp. 261-270.

Krumm P.J.M.M., Dewulf G., De Jonge H., 1998. Managing key resources and capabilities: pinpointing the added value of corporate real estate management [J]. Facilities, 16(12/13), pp. 372-379.

Pheng L.S., Leong C.H.Y., 2000. Cross-cultural project management for international construction in China [J]. International Journal of Project Management, 18(5), pp. 307-316.

Shen L.Y., 1997. Project risk management in Hong Kong [J]. International Journal of Project Management, 15(2), pp. 101-105.

Steinfeld E., 2004. Chinese enterprise development and the challenge of global integration [J]. Global production networking and technological change in East Asia, pp. 255-96.

Tian G., 2000. Property rights and the nature of Chinese collective enterprises [J]. Journal of Comparative Economics, 28(2), pp. 247-268.

Veale P.R., 2009. Managing corporate real estate assets: current executive attitudes and prospects for an emergent management discipline [J]. Journal of Real Estate Research, 1989, 4(3), pp. 1-22.

Zhonghui W., 1990. Private enterprise in China: an overview [J]. The Journal of Communist Studies and Transition Politics, 6(3), pp. 83-98.

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CURRENT STATUS AND FUTURE POTENTIAL OF THE RESEARCH ON CRITICAL CHAIN PROJECT MANAGEMENT

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Abstract

Critical Chain Project Management (CCPM) is a relatively new method which introduces a new mechanism for managing uncertainties in projects. A high number of studies on CCPM have been published and it seems it is now time for an extensive review. This study consults the CCPM literature in an inductive manner in order to answer the following questions: Is ongoing research being conducted on CCPM or has it lost its popularity among researchers? What have been the different approaches towards CCPM in the literature and what has each of them contributed to the knowledge area? What improvements have been made to the method since its introduction in 1997 and have these answered the critiques of the method? In what direction should future research be directed and what are the potential areas of CCPM for further development? The main aim is to describe the current status of research on CCPM and explore CCPM aspects that require more research. This study covers 140 journal and conference papers written on CCPM through an "exhaustive with selective citation" approach identified through online and reference searching. Those papers are categorised into six groups of introductory, critical, improving, empirical, case-reporting and exploiting papers, using the "hierarchical coding" method. As the result of this, the current status of research on CCPM is critically reviewed, themes are identified and 21 areas for future investigations are recommended that mostly need operational research analyses.

Key words: *Critical chain, Project scheduling, Literature review, project management*

JEL codes: O21, O22

Introduction

Critical Chain Project Management (CCPM) was first introduced by Eliyahu Goldratt as a new method of managing projects at the International Jonah Conference in 1990 (Bevilacqua et al., 2009). It remained unexplored until he decided to repeat his success in writing "The Goal" business novel in 1984, this time with "Critical Chain" in 1997. In his book, Goldratt extended the principles of the Theory of Constraints (TOC) to project management. TOC was based on the principle that every system has a constraint that prevents it from reaching higher levels of performance and the only approach to improve the system performance is to enhance the capacity of that constraint. With regard to CCPM, this unique constraint in single project environments is the longest chain of activities in the project network, taking into account both activity precedence and resource dependencies (critical chain) and in multi-project environments is the resource impeding projects' earlier completion. Goldratt (1984, 1997)

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provides a 5-step procedure for the process of ongoing improvement (identify the constraint, exploit the constraint, subordinate other non-constrained entities to the constraint, elevate the constraint, return to step one if the constraint is changed). CCPM also suggests estimating activity durations to their 50% probability of being completed on time and consider a buffer (project and feeding buffers) at the end of each chain of activities to allow for uncertainties. There are also some other buffers, namely resource buffer, drum buffer, capacity buffer and cost buffer. Some other characteristics are that it is completely against multitasking, does not consider activity due dates and schedules non-constraint activities to their latest start.

CCPM is not a holistic approach towards managing projects and is more a scheduling method addressing schedule-related aspects of projects. It only includes human aspects in terms of scheduling activities and not related to leadership, project governance and communication. These aspects should be addressed through TOC philosophy or Lean principles, as explained in the TOC Handbook (Cox and Schleier, 2010). As it is outside the scope of this study to explain in more detail the principles of CCPM, readers are encouraged to read the CCPM classic book by Leach (2014) for a comprehensive explanation.

Methodology

Since its introduction in 1997, CCPM has been the subject of a large number of studies. This study aims to describe the current status of research on CCPM and explore CCPM aspects that require more research in the future by means of a literature review in order to identify different approaches towards the method, avoid reinventing the wheel by studying existing knowledge, gain methodological insights and differentiate between what has been done and what needs to be done in the future. To achieve this aim, this study answers the following questions: 1. Is ongoing research being conducted on CCPM or has it lost its popularity among researchers? 2. What have been the different approaches towards CCPM in the literature and what has each of them contributed to the knowledge area? 3. What improvements have been made to the method since its introduction in 1997 and have these answered the critiques of the method? 4. In what direction should future research be directed and what are the potential areas of CCPM for further development?

To address the mentioned aim, this study conducted an extensive literature search through an "exhaustive with selective citation" approach meaning that it only included journal and conference papers (Cooper, 1988). These types of sources, because of their reviewed nature, are able to provide more reliable and valid discussions on CCPM.

Online search facilities were used to identify the maximum number of sources containing one or more of the following keywords generated from a relevance tree: critical chain, Goldratt, buffer management, fever chart, time buffer, cost buffer, resource buffer, project buffer, feeding buffer, drum buffer, capacity buffer, drum resource, capacity constrained resource, buffer sizing, Parkinson's law, Murphy's law, student syndrome, project scheduling, theory of constraints, roadrunner mentality, relay race work ethic and multitasking.

As the online search, based on keywords, only identifies a small percentage of all available sources (Randolph, 2009), the reference lists of all papers were also analysed to find any remaining resources. Only papers where the main discussion was related to CCPM were selected and others that merely mentioned it as an existing method without discussing it under an exclusive heading within their texts were ignored. Eventually, a total number of 140 English

journal and conference papers were selected, from which 52 are conference papers mostly (41 papers) presented in conferences and symposiums organised by PMI and IEEE, 68 are academic peer-reviewed journal papers from 39 different journals (29 of these papers published in the well-known journals of International Journal of Project Management, Project Management Journal, International Journal of Production Research, Production and Inventory Management Journal and South African Journal of Industrial Engineering) and 20 are practice-focused reviewed journal papers mostly (12 papers) published in PMI's PM Network[2].

The full texts of all papers were analysed and coded based on the "hierarchical qualitative coding" method explained by Saldana (2009). As he explains in his manual, "a code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data. The data can consist of interview transcripts, participant observation field notes, journals, documents, literature, artefacts, photographs, video, websites, e-mail correspondence, and so on". This method was used as a basis for categorising the literature and identifying the existing themes ("a theme is an outcome of coding, categorization, and analytic reflection" (Saldana, 2009)) in the CCPM studies explained in the following sections. After coding every single passage in all papers, they were categorised into six groups based on their position on CCPM: introductory, critical, improving, empirical, case-reporting and exploiting. Every paper, depending on the codes of its content and the subcategories, have been categorised in one or more of those categories. This study answers the above research questions using the information obtained from reviewing the CCPM literature in the following sections.

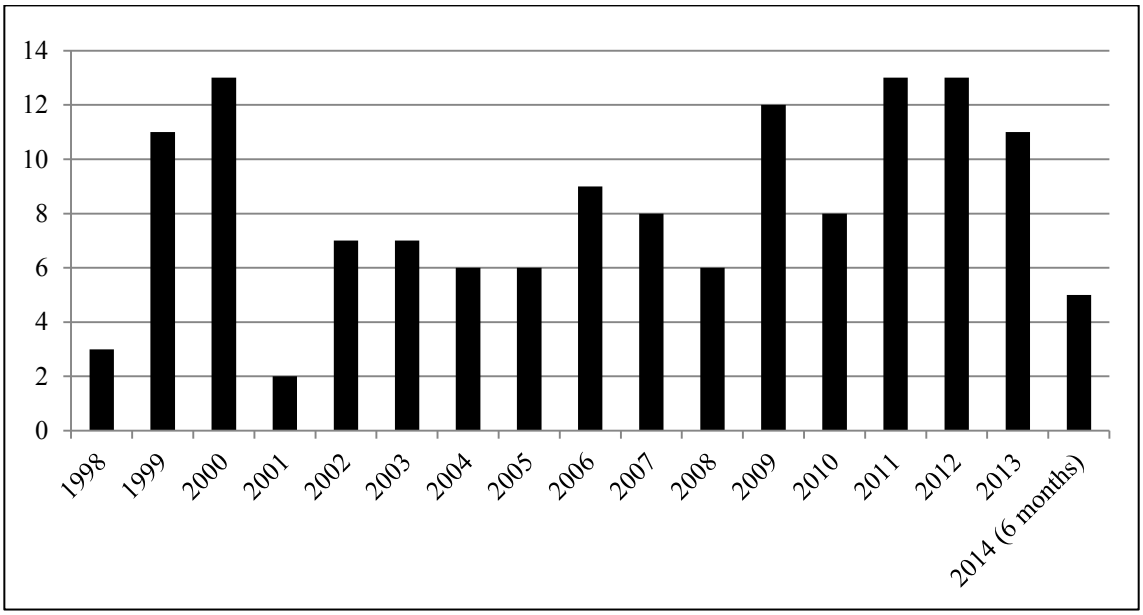
An Overview on the Literature

This section answers the first research question of this study. Figure 1 illustrates the distribution of all 140 CCPM studies considered by this paper. This bar chart represents the level of interest of researchers in CCPM between 1998 and the first half of 2014. As can be seen in the figure, there has been a sharp increase in the number of studies between 1998 and 2000. This is the period when the project management community was showing its first reactions to the introduction of CCPM and attempting to analyse its various aspects compared to traditional methods. The number of studies reached a maximum of 13 in 2000, a record that was only reached again in 2011 and 2012. In 2001, the number of studies plummeted to 2 and started an overall rise that continued until 2012. This sudden fall in number of studies in 2001 is probably because of the change in researchers' position on CCPM from introductory to improving and the need for more evaluation of the method that will be shown below (Figure 2). The number of studies again went down from 13 to 11 in 2013 and reached 5 studies in the first 6 months of 2014.

These changes show that an average number of around 8 studies have been conducted in every single year after the introduction of CCPM. The high number of studies published in recent years and those 5 studies completed in the first half of 2014 show that the subject is still under scrutiny of researchers and has not lost its appeal for them. This also indicates the potential of CCPM for more investigations. Answering each of the three remaining research

[2] See https://www.dropbox.com/sh/7pww2luszyzjksm/AAAH0B3-DyZRY8XdoOFmCCWaa?dl=0 for more details about the selected papers.

questions of this study will provide reasons for changes in authors' interest in CCPM demonstrated in Figure 1.

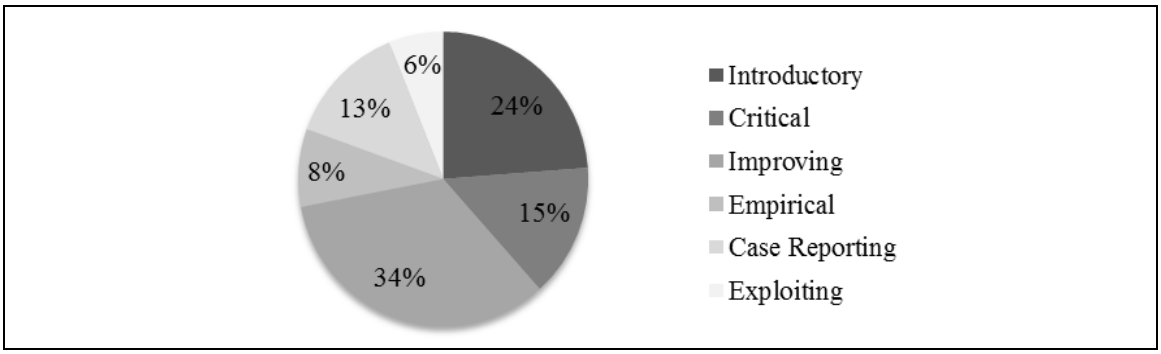


Source: authors' construction

Fig. 1. **Distribution of 140 CCPM studies between 1998 and the first half of 2014**

Codifying, subcategorising and categorising the literature were conducted in order to answer the second research question of this study: "What have been the different approaches towards CCPM in the literature and what has each of them contributed to the knowledge area?". Six different approaches towards CCPM were identified to be introductory, critical, improving, empirical, case-reporting and exploiting. Definitions of these approaches are provided as follows:

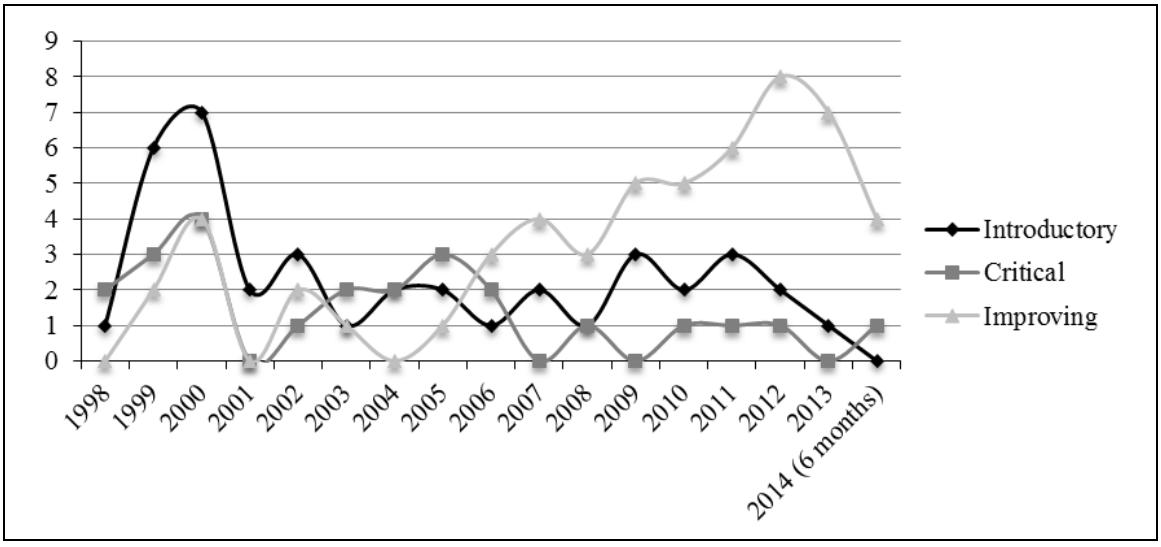
1. Introductory studies: those sources that provide an introductory explanation of CCPM basics and principles in comparison with traditional methods without advancing or criticising the theory and practice of the method.
2. Critical studies: those sources that provide a critical perspective on the practicality and feasibility of some or all the CCPM basics and principles.
3. Improving studies: those sources that enhance the tools and techniques of CCPM through adopting other existing methods or inventing new ones.
4. Empirical studies: those sources that attempt to enrich, compare, validate or invalidate CCPM principles or techniques through simulations, games or statistical analysis.
5. Case-reporting studies: those sources that report on implementation and deployment cases of CCPM.
6. Exploiting studies: those sources that apply CCPM principles to different project sectors and non-project work beyond scheduling.



Source: authors' construction

Fig. 2. **Illustrates the proportions of papers in each category**

Following the above categorisation, it can be noticed from Figure 2 that the largest portion of studies on CCPM has been on improving its tools and techniques (34%) while the smallest belonged to exploiting CCPM in other sectors (6%). This shows that researchers have focused their best efforts on advancing the tools and techniques of CCPM. Despite this, it has not yet become practitioners' favourite project management method by any means (Repp and Wright, 2013). Moreover, introductory and critical studies have been the second and third most popular subjects among researchers with 24% and 15% of all papers respectively. Despite the need for more case studies on CCPM applications, case-reporting papers still constitute a small segment of the total (13%). Finally, 8% of all 140 studies have been written on evaluating the existing CCPM techniques using games, simulations and statistical analysis.



Source: authors' construction

Fig. 3. **Changes of numbers of introductory, critical and improving studies between 1998 and the first half of 2014**

In order to provide a better understanding of changes of the bar chart shown in Figure 1, Figure 3 shows the breakdown of number of studies between 1998 and the first half of 2014 for the introductory, critical and improving categories explained above. The other three categories were ignored because they have a much smaller impact on the numbers in Figure 1 as a result of their lower number of studies.

Looking at Figure 3 and comparing it with Figure 1, one would realise that the general trend is approximately the same in both figures (two peaks in 2000 and 2012 and a steadily rising number of studies in the middle). However, it is Figure 3 that helps us understand those changes more thoroughly. In the figure, introductory studies are the most popular in the early years of CCPM from 1999 to 2002. As one would expect, researchers firstly attempted to introduce CCPM to the project management community during this time. This did not continue after 2003 although at least one introductory study was conducted in every single year until 2014. It is worth mentioning that introductory studies are still being published 17 years after the introduction of CCPM despite empirical data showing that the majority of project managers are aware of CCPM principles (Repp and Wright, 2013). Another important observation is the dramatic rise in the number of improving studies from zero in 2004 to 8 in 2012 that shows the attempt of researchers to expand the boundaries of CCPM knowledge. Regarding critical studies, there is a general decreasing trend during the considered period of time that can be attributed to successfully overcoming CCPM weaknesses through time.

Literature Review Under Six Categories

In order to answer the other half of the second question and the third question, each category of papers will be reviewed in detail in the following sections:

Introductory Studies

The main aim of these studies was to highly publicise CCPM in the early years of its introduction. Their authors normally had a positive approach towards CCPM by mentioning its benefits and advocating its deployment in organisations. They also attempted to gain recognition for CCPM as a possible substitute for traditional methods by the project management community and explaining its tenets. In addition, they paved the way for other more critical and improving studies in the future through precise clarification of CCPM principles and fundamentals. Some of the most cited introductory papers (out of all 39 studies) have been written by Leach (1998, 1999, 2001), Gray et al. (2000), Cerveny and Galup (2002), Blackstone et al. (2009), Steyn (2000), Rand (2000), Rizzo (1999), Umble and Umble (2000), Hoel and Taylor (1999) and Patrick (1999a, 1999b). They cover a wide variety of subjects that were subcategorised and codified as follows:

- *Issues with traditional methods from a CCPM perspective:* task estimates based on 90% probability of completion, procrastination or student syndrome, Parkinson's law, Murphy's law, task convergence, task due dates, failure to report early task completions, loss of focus, railway scheduling, early start scheduling, rescheduling, resource dependencies, multitasking.

- *CCPM principles:* fundamental theories behind CCPM, 5-step continuous improvement process, single and multi-project scheduling using CCPM, buffer insertion and management methods, buffer sizing methods.
- *CCPM benefits:* task estimates based on 50% probability of completion (shorter tasks and eventually project durations), buffering the project and tasks against uncertainty in a strategic way, clear instructions for multi-project scheduling, built-in risk management, accommodating human factors of projects into the schedule, simple buffer management and project monitoring and control, encouraging early report of task completions (no due dates), roadrunner (relay race) scheduling, late start scheduling, no multitasking, less work-in-process (tasks waiting for resources to be performed) at any point in time, more throughput of the system and higher chance of finishing on time.

One of the issues with introductory studies is that they lack critical and practical analyses of the method and are not inclusive enough to discuss both advantages and disadvantages of CCPM. In addition to this, many of them do not include a literature review section and thus provide a weak contextual background. As a result, about 64% of introductory papers have been published in conference proceedings or practice-focused journals and have fallen short of academic journals' standards. Those that were published by academic journals usually also included empirical, critical or improving approaches. Another issue is that they mostly have a very restricted view towards projects' success and failure by limiting them to projects' time performance only. This is while a project's scheduling or time performance is only one of many identified project success/failure factors and criteria (Ghaffari, 2014).

Critical Studies

Each time a new method is introduced for the first time, it will encounter some levels of resistance. This will trigger beneficial discussions that predominantly strengthen the novel method. This is the same for CCPM and critical discussions on the value and principles of it immediately started from the year after its introduction in 1997 (Figure 3). They (25 identified critical studies) have mostly encouraged critical thinking, recognised CCPM as an effective development of project management, identified its weaknesses and invited researchers to investigate means of overcoming them (e.g. McKay et al.,1998; Elton and Roe, 1998; Koskela et al., 2010; Cohen et al., 2004; Globerson, 2000; Herroelen and Leus, 2000, 2004; Raz et al., 2003; Herroelen et al., 2002; Lechler et al., 2005a; Wilkens, 2000; Ribera et al., 2003; Pinto, 1999; Millhiser and Szmerekovsky, 2012). There are also some others who believe that traditional methods have a satisfactory performance if implemented correctly and there is no indispensable need for adopting CCPM (e.g. Duncan, 1999; Zwikael et al., 2006; Trietsch, 2005a). In general, critical studies have benefited CCPM by preparing conditions for further development of its tools and techniques by authors of the improving studies.

A critical review of the critical and some complementary sources will be presented in the following sections that have been organised based on the codes identified in the process of coding the literature. This will provide a better understanding of the common topics discussed within CCPM literature and the groundwork for improving studies discussed later.

Is CCPM a New Method?

The introduction of CCPM in 1997 became the centre of a controversy between Goldratt and his proponents and some academics who believed that the CCPM principles are not novel to project management. They accused Goldratt of gathering together some existing concepts and introducing them as new ones using new terminology. Trietsch (2005a) has drawn some of the most severe criticisms of Goldratt's methods (from TOC to CCPM). He questions their originality and uses the term Management By Constraint rather than TOC. In his opinion, TOC is only a paraphrased form of the Just In Time principles already deployed all over the world. Trietsch (2005a), in order to show that CCPM adds nothing new, adds a "zero" step to the CCPM 5-step continuous improvement process mentioned above and attempts to match each step to the stages undertaken in the CPM/PERT methods. Although he is successful in mechanically matching the steps of the two methods, he ignores some of the changes in the principles of CCPM such as the inclusion of human factors (student syndrome, Parkinson's law and no multitasking in the schedule) and benefits of considering resource dependencies in determining the critical path (raising awareness about resource constraints and giving the appropriate level of priority to real critical activities requiring the constrained resources when allocating them).

Trietsch (2005a) continues his critique by citing some of the concepts similar to the principles of CCPM that already existed in the literature at the time of CCPM introduction. He firstly discusses the consideration of resource constraints in project scheduling. CCPM proponents claim that it takes into account limited resources in addition to activity precedence (Umble and Umble, 2000; Steyn, 2000; Leach, 1999); however, Trietsch (2005a) and some others (Herroelen and Leus, 2001; Millhiser and Szmerekovsky, 2012) believe that resource constraints have always been at the centre of attention since the emergence of CPM/PERT methods in the 1950s. Trietsch (2005a) mentions Wiest (1964) who introduced the term "critical sequence" and Raz and Marshall (1996) who analysed the relationship of free and total slacks with resource constraints as two instances. Herroelen and Leus (2001) also added another example of precedent sources that developed a method for considering the critical sequence that includes resource limitations rather than the normal critical path. Trietsch (2005a) correctly argues that Goldratt has not cited these sources in his own work and has simply changed the name to critical chain. In his opinion Goldratt is an entrepreneur who does not value academic rules and practice, although an assumption is that this may be due to the inertia Goldratt encountered when he introduced his previous innovations in an academic style (Watson et al., 2007).

Secondly, Trietsch (2005a) criticises the rule of no activity due dates in CCPM. Although he admits the significance of due dates in project delays by citing the studies of Schonberger (1981) on the effects of deterministic scheduling and Gutierrez and Kouvelis (1991) on the effects of Parkinson's law, he does not mention that those papers have not provided any solution for the existing problems while Goldratt (1997) suggested to eliminate due dates in all cases in order to avoid Parkinson's law and the student syndrome. Thirdly, Trietsch (2005a) questions the originality of using buffers as a method of protecting the project schedule, citing previous work by O'Brien (1965 cited in Trietsch 2005a). Herroelen and Leus (2001) cite another example from Clough et al., (2000) but they both neglect the point that different kinds of buffers (e.g. feeding and resource buffers) are deployed in CCPM and not only the project buffer which was used in the examples provided.

The novelty of the rule of no multitasking in CCPM is the fourth and last principle to be challenged by Trietsch (2005a). He refers to the issue of multitasking in past studies to show that proving its deficiencies is a simple deduction and Goldratt is not the first person to mention this. It seems that some aspects of Trietsch's (2005a) and other authors' (McKay and Morton, 1998; Elton and Roe, 1998) critiques regarding the novelty of CCPM are credible; however, as Steyn (2000) asserts, the aim in the analysis of CCPM should be to discover whether or not Goldratt has been successful in providing a package of pre-existing concepts which is able to benefit project management theory and practice. In another study, Lechler et al. (2005a) identify the differences of CPM/PERT and CCPM methods in a very precise manner and outline them in four well-organised tables. In contrast to Trietsch (2005a) who believes most of CCPM principles are not new to project management, Lechler et al., (2005a) conclude that CCPM is fundamentally different to traditional methods. In their viewpoint, CCPM is able to improve some behavioural aspects leading to continuous improvement of the project system.

Task Estimates and Durations

CCPM suggests estimating tasks to their 50% probability of on-time completion in order to exploit the constraint (critical chain) (Goldratt, 1997). This has become a very controversial issue within the CCPM debate. Raz et al., (2003) argue that there is not sufficient academic research to prove that estimators always include considerable safety times within activity durations. They provide an example of a case study conducted by Hill et al., (2000) in a software development organisation which demonstrated that even in a company where many tasks are familiar to the estimators, although the majority of them (60%) overestimated activity durations, the overestimations were only 1% more than the actual duration and about 30% of tasks were completed later than estimated. They conclude from the case study that the estimators do not overestimate noticeably. However, a weakness of this judgment is lack of consideration of the CCPM rationale for 50% probability estimation, which is that these significant safety times which are added to the 50% probable finish date are not deployed efficiently because of student syndrome and Parkinson's Law (Goldratt, 1997; Leach, 1999; Steyn, 2000). Contrary to what Raz et al., (2003) deduce, the study of Hill et al., (2000) proves that the large safety times included in the task durations are not being used to deliver activities earlier and still a noticeable percentage of them are being completed late. In another study, Ribera et al. (2003) showed by means of a survey that about two third of respondents admitted that they embed safety times in their task estimates.

Raz et al. (2003) continue their critique by correctly asserting that not every employee considers the same amount of safety time and not every task contains the same amount of uncertainty. Herroelen and Leus (2001) raise the same issue in their paper. In addition, Nicholas (1990 cited in Steyn, 2000) states that there are many people who underestimate the time of their allocated tasks because of their high confidence in completing them on time. On the other hand, Umble and Umble (2000) assert that CCPM has the proper means for responding to this issue within its probabilistic principles. It advises estimators to consider a 50% probability for their tasks to be completed, thus it expects only half of the tasks to be completed on time and another half to be finished later than expected. With half of the tasks predicted to be delayed, CCPM includes a reasonable safety time for different types of estimations (overestimation and underestimation) and different levels of activity risks (Umble and Umble, 2000).

Raz et al. (2003) and Lechler et al. (2005a) also question whether or not employees of the organisation will agree to halve their estimated durations and not to add safety to their estimates in the future. While this is a possible phenomenon, the CCPM process includes: "do not allow inertia to become the constraint of the system" as its fifth step of continuous improvement process (Leach, 2005). Generally, a more important problem is the place of the considered safety times and not their length (Steyn, 2000). CCPM recommends separating the safety times from activities in order to prevent student syndrome and Parkinson's law from wasting those contingencies.

Rescheduling

Although CCPM proponents claim that the critical chain rarely changes during the project's execution, there is also some contradictory evidence regarding this issue. Herroelen and Leus (2004) believe that inevitable changes in the projected schedule (the CCPM schedule without showing buffers and gaps in the network) is in fact a type of project rescheduling that is being undertaken in CCPM and is remaining unacknowledged by its advocates. They also claim that this emphasis on rescheduling prohibition may be the reason for CCPM not being appreciated in projects such as new product development projects where reiteration of project stages necessitates rescheduling (although Sood (2002) provides contrary evidence to this by giving examples of a number of research-based organisations that adopted CCPM successfully). Lechler et al., (2005a) correctly mention that the critical chain might alter during the project execution due to the difference in principles of determining the critical chain and the buffers. They state that while the critical chain is selected using both activity precedence and resource dependencies, the buffers are only based on the duration of their preceding chain of activities.

Furthermore, Hoel and Taylor (1999) and Herroelen and Leus (2001) show that the critical chain might change when, on some special occasions, a feeding buffer with a longer duration than the available slack and shortened activity times is added to a non-critical chain. As Herroelen and Leus (2001) continue, there are two solutions for this problem. The first one is to begin the whole schedule earlier in time in order to make the buffer insertion possible. The second one is to reschedule the entire project. Moreover, Cui et al. (2010) provide two methodologies to be considered after a change has occurred to the schedule. Piney (2000) also suggests cutting the feeding buffer in two segments and leaving one as a feeding buffer and moving the other part to the end of project and adding it to the project buffer.

On the other hand, Steyn (2000) states that appropriate management of buffers can guarantee the stability of the critical chain. Newbold (1998) also recommends project managers not to reschedule projects or reconsider the critical chain unless significant changes occur to buffer levels or resource timetables. However, it can also be beneficial to take the critical chain into account as the chain of activities that is able to alter the project duration during the monitoring function (a focusing tool) (Herroelen and Leus, 2005).

Buffer Sizing

CCPM separates the safety times from the median task time and aggregates them after each chain of activities under the name of project buffer after the critical chain and feeding buffer after each chain of non-critical activities (Leach, 2014). In order to shorten the project duration, these aggregated contingencies must be shorter than when they were calculated as part of the task durations. Goldratt (1997) simply suggests deducting 50% of the safety times based on the 50% probability of task estimations where at least half of them are expected to be completed on time. Raz et al. (2003), Lechler et al. (2005a) and Herroelen and Leus (2001) raise

this issue of buffer sizing in their papers. Herroelen and Leus (2001) explain the problem by asserting that Goldratt's method of buffer sizing is linear and buffer sizes constantly increase as time increases. They have shown by their calculations that using the 50% buffer sizing method can lead to unnecessary long project durations. To answer those criticisms, there are also some sources that have provided more accurate methods for buffer sizing that will be discussed in the next section for improving studies.

Simple or Complicated Monitoring

Project monitoring in CCPM is conducted by measuring the level of feeding and project buffers' penetration during the project. Some authors have identified this as an advantage of CCPM because of its simplicity compared to traditional methods (Steyn, 2000; Leach, 1999). However, some others show that buffer consumption monitoring is a complicated function in large projects (Raz et al., 2003; Lechler et al., 2005a; Wilkens, 2000).

Resource Buffers

Resource buffers are the alarms that are triggered by the tasks approaching their start time on the critical chain. They inform the resource allocated to a specific critical task of the time the resource should be ready to begin working on that activity. Lechler et al., (2005a) assert that this is an alarm already used in the traditional methods. Raz et al., (2003) also add that using resource buffers causes a disorganised environment and does not enhance the previous method of exposing the project schedule to all project team members. Moreover, Herroelen and Leus (2001) mention the weakness of resource buffers to address the situation when two equal resources are able to perform a task.

In addition, Tukel and Rom (2006) mention a number of more practical problems with implementing resource buffers. Firstly, a resource might receive many alerts at the same time from the project manager if s/he has been allocated to several tasks in different projects. If this happens it may lead to higher confusion and anxiety and it is not clear whether the resource is allowed to stop working on a critical task and start another. Secondly, the project manager is not able to plan for the time and number of resource buffers and needs to wait for the project to be executed in order to decide whether s/he needs to create them. In this regard, Piney (2000) recommends using optimistic estimates of tasks' duration, as carried out in PERT, to identify the correct time when resources must be available. Tukel and Rom (2006) also believe that resource buffers have a number of benefits: delay is less likely when resource buffers are used to manage highly uncertain tasks and shorter project buffers are needed for project protection when using resource buffers.

Multitasking

CCPM does not allow multitasking in general. Clarke and Wheelwright (1993) suggest that the most efficient number of tasks that can be allocated to one resource is two which McCollum and Sherman (1991) confirmed by achieving the same outcomes in a study of a number of high technology companies. In addition, Herroelen and Leus (2001) claim that multitasking does not cause negative effects all the time and keeping employees under stress to complete a single task earlier can destroy morale. As Pinto (1999) asserts, this effect on morale is intensified in organisations that require fundamental cultural changes in order for their employees and top management to agree on full commitment to completing one task before proceeding to another.

Multi-Project Management

In contrast to traditional project management methods, CCPM contains clear instructions for multi-project management that have encountered some criticisms (Lechler et al., 2005a). Raz et al., (2003) state that the volatile environment of projects does not match CCPM techniques for multi-project management, since many resource contentions might occur and they might change during project execution. In response to this critique, Leach (2014, p.201) suggests selecting one of them as the Capacity Constrained Resource (CCR) based on criticality of a resource to the type of company (e.g. an engineer in an engineering company) or how difficult it is to elevate a resource. It is also claimed that the iterative nature of CCPM (5-step process) can ensure the consideration of other resources if the CCR changes in the process of project execution (Dass and Steyn, 2006).

In addition, research conducted by Cohen et al., (2004) showed that the CCPM method for managing multi-project environments is not the best and some other methods provide better results, although they only considered its performance in projects identical to aircraft maintenance projects. On the other hand, Rizzo (1999) advocates the use of CCPM techniques in a multi-project environment and claims that they provide project and top management with the essential "operational measurements" they need to manage risk and resource allocation in an organisation while maintaining control on all projects being undertaken.

Late-Start Scheduling

Smith-Daniels and Aquilano (1987) conducted research showing that using the late-start schedule leads to considerably shorter duration and better cash flow. Goldratt (1997) and Leach (1999) provide some benefits of starting tasks as late as possible (shorter duration with better cash-flow, less major change effects and better control over the project). Moreover, Newbold (1998) describes that late-start scheduling reduces the work-in-process. He also explains that reducing work-in-process can minimise the number of reworks because the less time the client has the less changes s/he imposes on the initial design.

On the other hand, work-in-process is not a significant factor in some types of projects, instead minimising the schedule is the first priority (Herroelen and Leus, 2001). In addition, Zwikael et al. (2006) mention some of the drawbacks of late-start scheduling to be the higher risk involved in finishing a project on time, less efficient resource utilisation, little justification for negotiating for more resources in a right-shift project and missing the opportunity of achieving a sense of unity in the project team because of later team assembly. However, they fail to support their claimed disadvantages with sufficient evidence. As another critique, Herroelen and Leus (2004) remind researchers that there are projects (e.g. new product development projects) that have no clear completion date and as a result their activities need to be scheduled as soon as possible. In general, it seems that selecting the early or late start schedule primarily depends on the priorities of every single project.

Improving Studies

This section attempts to answer the third research question of this study. Following the identification of CCPM weaknesses by critical studies, researchers started focusing on the improvement of different aspects of the method. Half of all 56 improving studies focused on improving the buffer sizing methods as a major issue in CCPM principles and the other half

were written on a variety of subjects that will be discussed below. This section identifies improvements and helps to compare them with the previously discussed critiques of CCPM in order to locate the areas that still need further investigation in the future.

Task Duration Estimation Improvements

Following the critiques of the arbitrary task estimates in CCPM, Schuyler (2000) suggested using Monte Carlo simulations to identify more reliable task durations in projects. Others (Shou and Yeo, 2000; Rezaeie et al., 2009) related the duration estimate of each task to its level of uncertainty.

Buffer Sizing Improvements

After Goldratt (1997) recommended the 50% buffer sizing rule (placing half of the reduced duration of each path in the end of it as a time buffer), many other authors have attempted to create more scientific and effective rules. The Product Development Institute (1999) introduced the Root Square Error Method (RSEM) (Leach (2005) identifies this as Square Root of the Sum of the Squares (SSQ)). Newbold (1998) also provides a formula that encompasses the level of safety times considered for different tasks and therefore the uncertainty associated with them, using a lognormal distribution. Furthermore, Leach (2003b) considers possible biases included in buffer estimation that might lead to its underestimation. He defines bias as "anything that might invalidate pooling of variances of the individual tasks to size schedule or cost buffers" and introduces the Bias Plus Root Square Error Method (BPRSEM) in order to include those biases. BPRSEM is a combination of buffer sizing techniques for common cause variances and a safety time (about 10-25% of the buffer) added to the outcome of calculations because of the biases included in estimating task durations due to special cause variances (Leach, 2005).

In addition to the above, there are some other buffer sizing methods, namely High Confidence RSEM by Ashtiani et al., (2007), Adaptive Procedure With Resource Tightness and Adaptive Procedure With Density by Tukel et al., (2006), Improved RSEM (IRSE) by Xue-mei et al. (2010), Forecasting Error Approach by Caron and Mancini (2008), RSEM Based on Lognormal Distribution and Dependence Assumption Between Activities by Bie et al. (2012) and some other highly sophisticated approaches using computerised simulations (Tenera and Cruz Machado, 2007) and Fuzzy Logic (Shi and Gong, 2009; Min and Rongqui, 2008; Long and Ohsato, 2008).

Apart from the 50% rule, RSEM (based on normal and lognormal distributions) and BPRSEM methods, others have not been used in CCPM software products or implementation cases and not even widely mentioned in other academic investigations. However, based on positive results of validations mentioned in those papers, they can be considered as improvements in the way they take into account factors such as resource tightness, number of activities, number of dependencies, levels of risk and past experiences of the same project organisation that makes their produced buffer more reliable than the prevalent methods.

Project Monitoring Improvements

As mentioned above, the complexity of CCPM monitoring method has been a subject of discussion among researchers. In order to address this complexity, a number of studies have considered a simplified CCPM that does not include feeding buffers (Lechler et al., 2005b cited in Lechler et al., 2005a; Leach, 2003a). Leach (2003a) suggests a simplified CCPM that can

eliminate the gaps sometimes created in CCPM schedules and make a simpler network for monitoring. Some others used earned value techniques to improve how CCPM monitors projects (Piney, 2000; Schuyler, 2000; Levine, 1999; Silber, 2002) which helped them to be able to predict the effect of delay in each task on its subsequent buffers, using the existing software products such as Microsoft Project.

Late-Start Scheduling Improvements

In accordance with late-start scheduling issues, there are a number of authors such as Ming and Wuliang (2009) and Peng and Xu (2012) who have introduced a new method of CCPM called Active CCPM. This new method deploys an early-start schedule for specific types of projects such as those in the IT industry.

Other Improvements

Improving studies also focused on aspects of CCPM that had not been criticised by critical studies before. One of them is to find an optimised scheduling algorithm for CCPM using the operations research methods (Peng et al., 2007; Long and Ohsato, 2008; Peng and Huang, 2013; Wuliang et al., 2013; Liu et al., 2013; Pawinski and Sapiecha, 2012; Wei-xin et al., 2013; Weixin et al. 2013). Their objectives have been to find an optimum solution for resource allocation, rescheduling, buffer insertion and project duration in CCPM. Another aspect is to improve CCPM reliability via combining it with the existing risk management techniques (Steyn, 2002; Mansoorzadeh and Yusof, 2011; Mansoorzadeh et al., 2014; Thipparate, 2014). One last aspect considered by improving studies has been identification of CCPM success factors by Repp and Wright (2013) and Simpson and Lynch (1999).

Empirical Studies

These studies constitute only 8% of total of studies under consideration of this paper; however, they play an important role in evaluating some of the core CCPM tools and techniques. Empirical papers have mostly used games, experiments, simulations and statistical analyses to investigate CCPM principles and, as explained under the following codes, the majority of them demonstrate better performance of CCPM compared to other methods.

Comparing CCPM and Traditional Project Management Methods

Budd and Cooper (2004, 2005) compared the time performance of the same project schedule with CPM/PERT and with CCPM techniques using both experimental analysis and simulations. In both cases CCPM performed considerably better in terms of projects' finish times. In another study, Huang et al. (2012) compared the time performance of PERT and CCPM schedules by means of simulations and concluded that: a) in a single project environment, CCPM performs slightly better than PERT in producing a shorter schedule b) in a multi-project environment, PERT performs slightly better in producing a shorter mean duration while CCPM is more stable and reliable during the project execution. Bhushan and Raghavan (2013) also compared CCPM and line of balance in construction projects and concluded that the line of balance provides a better time performance in such an environment. Another experimental study conducted by Yang (2007) observed that CCPM schedule performs better compared to the traditional CPM method in a construction environment. Moreover, one last study compares CPM and CCPM schedules by means of a simulation and achieved shorter

project durations and higher chance of meeting project deadline with CCPM. Despite above results, it was found by Tian and Demeulemeester (2014) that the roadrunner mentality in CCPM cause inferior results in terms of stability and cost compared to the traditional railway mentality.

Validating the CCPM Reasons for Multi-Project Time Performance Failures

Huang et al. (2011) invited 210 project managers, resource managers and engineers to take part in a game designed for simulating a multi-project environment. They demonstrated that in contrast to the general belief (90% of more than 300 managers and engineers surveyed in their study) that multi-project attempts fail because of the high level of uncertainty, they mostly fail because of detrimental project planning and management practices addressed by Goldratt, such as multitasking, lack of understandable prioritisation of projects, wasting safety times and losing control.

Comparing CCPM Priority Rules and Some Other Alternatives

CCPM uses rates of buffer consumption for allocation of constrained resources to new projects in a multi-project environment. Cohen et al. (2004) compared this with other traditional priority rules for resource allocation such as the minimum slack and first come first served rules and concluded that the minimum slack rule performs slightly better than the CCPM buffer system in meeting the project deadline. In another study, Dass and Steyn (2006) showed by means of an experiment that there is no considerable difference between the performance of CCPM and minimum slack priority rules while CCPM produces shorter project duration.

Comparing Buffer Sizing and Insertion Methods

Geekie and Steyn (2008) examined the two most prevalent buffer sizing methods of the 50% rule and RSEM by means of simulations. They realised that while the former overestimates the buffer sizes, the later produces appropriate buffer sizes in the absence of bias. This can validate the importance of BPRSEM buffer sizing method introduced by Leach (2003b). Regarding the best place for inserting buffers in a CCPM schedule, Van de Vonder et al. (2005, 2006) showed that a better duration and schedule robustness trade off is achieved when buffers are located after each path, as CCPM suggests, instead of scattering them among the tasks as in traditional methods.

Case-Reporting Studies

A total of 20 studies (13%) on CCPM case studies or results were identified by this paper. This number excludes websites such as Realization.com or Goldratt.com that have reported on CCPM implementations (all reporting 100% success). Shortage of practical evidence has always been a reason for organisations not to adopt CCPM and these studies help to overcome this. The studies have been conducted in various industries, from construction and pharmaceutical industries to maintenance projects in the US Department of Defence shipyards. This variety shows that there is successful evidence for implementation of CCPM in all sorts of projects, from low to high uncertainty/complexity. Only one case of failure was reported in the construction industry that was attributed to late initiation of the transition programme while other cases have all been successful with an average reduction of 40% for project durations. Some other reported benefits of implementing CCPM were more productivity, more

transparency, better communication and collaboration, better on time delivery rate, less multitasking, better control and monitoring, increased throughput and reduced work in progress in multi-project management. These studies were subcategorised as follows:

- *Engineering Projects Cases:* Sood (2003), Hunsberger (2012), Fenbert and Fleener (2002), Morais and Sbragia (2012), Hwang et al. (2009), Taylor and Rafai (2003), Phillis and Gumede (2011), Ribera and Grasas (2003), Best (2006) and Srinivasan et al. (2007).
- *Construction Projects Cases:* Sood (2003), Hunsberger (2012), Barber et al. (1999), Archibald et al. (2007), Kishira (2006), Stratton (2009) and Spanholtz and Stokes (2000).
- *Pharmaceutical Projects Cases:* Sood (2003), Hunsberger (2012), Marris (2011) and Sood (2002).
- *Maintenance Projects Cases:* Srinivasan et al. (2004), Bevilacqua et al. (2009) and Hunt (2004).

Exploiting Studies

TOC is claimed to be a holistic management philosophy and based on this it can be applied to any management environment, from personal life to most complex systems in manufacturing or project management. As a result of this, its principles, that also apply to CCPM, can be adapted to different environments. A number of authors (10) have used this capability and applied CCPM to sectors other than project scheduling. Those applications (with no codifying or subcategorising because of the low number of them) are: audit operations of an accounting firm (Yang, 2011), procurement and supply chain management in construction and other projects (Yeo and Ning, 2002, 2006; Wei and Ying, 2013; Trietsch, 2006), location-based management in construction projects (Buchmann-Slorup, 2013), determining the functionality of software products (Miranda, 2004), maritime disaster rescue operations (Yan et al., 2009), optimising the maintenance period of power plant electrical equipments (Dong et al., 2013) and reduction of costs in a manufacturing company (Taylor and Rafai, 2003).

Future research

Leach (2014) believes that CCPM is not yet the standard in industry; however, it has overcome obstacles of ignorance and rejection from the project management community. During the last 17 years, many suggestions have been made by researchers for improvement of initial CCPM tools and techniques with the aim of promoting CCPM in mainstream project management, but there are still a number of subjects that require researchers' attention; 21 of them were extracted from the 140 studies under scrutiny of this paper using their recommendations for future research and critiques developed within their contents and comparing them with the improvements already achieved in the improving studies. The aim is to answer the fourth and last research question of this study. The studies in the literature show that there is still need for more research on:

1. Severity of the schedule robustness issue in CCPM after insertion of buffers and during the execution of the project and providing solutions for it (Gray et al., 2000; Lechler et al., 2005a; Koskela et al., 2010). Both case studies and simulations can investigate this.

2. Safe resource loading and availability rates (sizing an organisation's resource pool) in order to meet the scheduled deadline especially in multi-project management and after eliminating task due dates (Tukel and Rom, 2006; Patrick, 1999a, 1999b; Wilkens, 2000; Rizzo, 1999; Trietsch, 2005a).
3. Differences between project durations produced by optimised and heuristic scheduling algorithms (Tukel and Rom, 2006). This helps to find out how much time and resources are wasted in heuristic scheduling rules being used in existing software products and whether they are negligible compared to the existing optimised algorithms mentioned earlier.
4. Advantages, disadvantages and feasibility of using EVM for time and cost control purposes in a CCPM environment (Piney, 2000, Schuyler, 2000; Levine, 1999; Silber, 2002).
5. The appropriate level of multitasking in CCPM projects as it has always been a controversial subject in CCPM because of its need for severe cultural changes in an organisation (Herroelen and Leus, 2001, 2004; Pinto, 1999).
6. CCPM performance (using its software packages) in determining the critical chain, keeping it stable throughout the project, identifying CCRs and staggering projects in volatile projects such as product development projects (Herroelen and Leus, 2004; Raz et al., 2003).
7. Cultural and organisational barriers to the implementation of CCPM as it has always been mentioned as a major obstacle to CCPM adoption by new organisations (Pinto, 1999).
8. Financial aspects of managing projects, such as budgeting and cost control, in CCPM (Raz et al., 2003; Goldratt, 1999). Only one paper (Steyn, 2002) has focused on lack of rules for cost management in CCPM.
9. Effects of delays in completion of non-critical tasks on the project duration when they require same resources used to undertake critical tasks (Lechler et al., 2005a).
10. Sizing drum and capacity buffers in multi-project environments (Wilkens, 2000; Rizzo, 1999; Lechler et al., 2005a).
11. The best sequence for inserting buffers: feeding or project buffers (Herroelen and Leus, 2000).
12. Effects of non-project work distractions on the level of multitasking, dependency of activities on each other and project duration (Leach, 2003b).
13. Benefits of using the Criticality Index concept for selection of the critical chain using Monte Carlo simulation rather than doing it arbitrarily (Hoel and Taylor, 1999; Schuyler, 2000).
14. Possible applications of the queuing theory in sizing buffers and resource pools in organisations by considering each resource as a server and each task as a customer (Xiao-Ping and Pan, 2011).
15. The probable negative effects of considering the wrong critical chain as the initial constraint of the project or keeping focus on a chain that is no more the real constraint (Herroelen and Leus, 2001).
16. Conflicts between organisations' standard cost accounting procedures and CCPM principles that prevent them from adopting CCPM. Role of EVM and cost buffers in finding a solution for those conflicts (Piney, 2000, Schuyler, 2000; Levine, 1999; Silber, 2002).

17. Modelling project tasks' variability in CCPM simulation studies and considering their dependencies on each other (e.g. same risks) and relative dispersion values (Shou and Yeo, 2000; Herroelen and Leus, 2001; Lechler et al., 2005a; Bie et al., 2012; Leach, 2003b).
18. Effects of implementing a roadrunner (relay racer) mentality on availability of required resources for subsequent tasks (Tian and Demeulemeester, 2014).
19. The relationship between CCPM principles and risk management techniques for mitigating identified risks (Patrick, 2001).
20. Implications of using PERT probabilistic methods in estimating task durations in CCPM (Piney, 2000).
21. The application of a location-based method in CCPM in order to consider the location of work in the construction industry (Koskela et al., 2010).

Conclusions

This paper used the "hierarchical coding" method to critically review the literature of CCPM published in journals and conference proceedings since its introduction in 1997. 140 papers were analysed and it was shown that there is still ongoing research being conducted on the method and although with a slower pace, CCPM studies are still being published (first research question). In response to the second question, six categories of approaches towards CCPM (introductory, critical, improving, empirical, case-reporting and exploiting) were identified and their contributions discussed, one of them being improving studies. The improvements brought by these studies were then discussed and compared to other studies in order to find what shortcomings have been addressed and what aspects of CCPM still remain open to more investigations (third research question). Finally, to answer the fourth question and as a major contribution of this paper, these shortcomings were used to produce a list of CCPM areas to be developed in the future. Should these areas be more investigated, CCPM is probably able to become a more widely used method across all industries which use project management.

In general, this paper showed that CCPM has been on a long journey since 1997, from studies on introduction of the new method, evaluating it and finally improving its techniques. Following the "hierarchical coding" method, it can be concluded that the theme of research has been more introductory and critical during the first decade after the introduction of CCPM (Figure 4) while this later changed to an improving theme within the research on CCPM with more improving studies being published than others. In parallel, there have always been authors who reported on CCPM implementation cases (case-reporting), deployed its capabilities in other environments (exploiting) and verified its principles (empirical). With respect to the future, it seems that the focus of researchers needs to be on improving the method and reporting on its implementation cases in order to address the points raised within the list of the 21 identified areas of CCPM shortcomings.

Bibliography

Archibald, R., Mello, P. B. S. and Guimaraes, J., 2007. The Application of SDPM, Critical Chain and Portfolio Project Management Principles to the Construction of the 670 km Urucu/Manaus (Petrobras) Pipeline. In: Project Management Institute, PMI Global Conference, November 13, Cancun, Mexico.

Ashtiani, B., Jalali, G. R., Aryanezhad, M. B. and Makuti, A., 2007. *A new approach for buffer sizing in critical chain scheduling*. Industrial Engineering and Engineering Management, 2007 IEEE International Conference on, 2-4 Dec. 2007, pp. 1037-1041.

Barber, P., Tomkins, C. and Graves, A., 1999. Decentralised site management, A case study. *International Journal of Project Management*. 17, pp. 113-120.

Best, W. D., 2006. Critical Chain Project Management Flies. *Industrial Engineer.* 38 (11), pp. 46-47.

Bevilacqua, M. Ciarapica, F. E. and Giacchetta, G., 2009. Critical chain and risk analysis applied to high-risk industry maintenance: A case study. *International Journal of Project Management*. 27, pp. 419-432.

Bhushan, R. S. and Raghavan, V. S., 2013. A Relative Study on CCPM And LOB Scheduling Technique. *Indian Journal of Applied Research.* 3 (5). pp. 242-245.

Bie, L., Cui, N. and Zhang, X., 2012. Buffer sizing approach with dependence assumption between activities in critical chain scheduling. *International Journal of Production Research*. 50 (24), pp. 7343-7356.

Blackstone, J. H., Cox, J. F. and Schleier, J. G., 2009. A tutorial on project management from a theory of constraints perspective. *International Journal of Production Research*. 47, pp. 7029-7046.

Buchmann-Slorup, R., 2013. Applying critical chain buffer management theory in Location Based Managegement. *Construction Management and Economics.* 32 (6), pp. 1-14.

Budd, C. S. and Cooper, M. J., 2004. A Project Management Approach to Increasing Agency Margins. *Journal of Promotion Management.* 11 (1), pp. 29-49.

Budd, C. S. and Cooper, M. J., 2005. Improving on-time service delivery- The case of project as product. *Human Systems Management.* 24 (1), pp. 67-81.

Caron, F. and Mancini, M., 2008. *Project Buffer Sizing through Historical Errors.* [Online] Available at: http://www.aice-it.org/en/download/doc_view/26-ingegneria-economica-n-79-all-1 [Accessed 16 September 2014].

Cerveny, J. F. and Galup, S. D., 2002. Critical chain project management holistic solution aligning quantitative and Qualitative Project Management Methods. *Production and Inventory Management Journal.* 43(3), pp. 55- 64.

Clarke, K. B. and Wheelwright, S. C., 1993. *Managing New Product and Process Development: Text and Cases.* New York: The Free Press.

Clough, R. H., Sears, G. A. and Sears, S. K., 2000. *Construction Project Management.* 4th ed. New York: John Wiley & Sons.

Cohen, I., Mandelbaum, A. and Shtub, A., 2004. Multi-Project Scheduling And Control: A Process-Based Comparative Study Of The Critical Chain Methodology And Some Alternatives. *Project Management Journal*. 35, pp. 39-50.

Cooper, H. M., 1988. Organizing knowledge synthesis: A taxonomy of literature reviews. *Knowledge in Society,* 1, pp. 104-126.

Cox, J. F. and Schleier, J. G., 2010. Theory of Constraints for Personal Productivity/Dilemmas. In: Cox, J. F. and Schleier, J. G. eds. *Theory of Constraints Handbook.* New York: McGraw-Hill, pp. 1097-1136.

Cui, N., Tian, W. and Bie, L., 2010. Rescheduling after inserting the buffer in the critical chain scheduling. *Logistics Systems and Intelligent Management*, 2010 International Conference on, 9-10 January 2010, pp. 1105-1110.

Dass, S. and Steyn, H., 2006. An Exploratory Assessment of Project Duration in Multiple-Project Schedules Where Resources Are Allocated by the Theory of Constraints Method. *South African Journal of Industrial Engineering.* 17 (1), pp. 39-54.

Dong, L., Zhao, X. K., Zhou, W. P., and Lv, Q., 2013. Application of Critical Chain Project Scheduling Theory in Power Plant Electrical Equipment Maintenance. *Advanced Materials Research*. 614, pp. 1985-1989.

Duncan, W. R., 1999. Back to Basics – Charters, Chains, and Challenges. *PM Network.* 13 (4), pp. 29-30.

Elton, J. and Roe, J., 1998. Bringing Discipline to Project Management. *Harvard Business Review*, 76, pp. 153-159.

Fenbert, J. A. and Fleener, N. K., 2002. Implementing TOC Multiproject Management in a Research Organization. In: Project Management Institute, PMI Research Conference, July 14-17, Seattle, Washington, USA.

Geekie, A. and Steyn, H., 2008. Buffer Sizing for the Critical Chain Project Management Method. *South African Journal of Industrial Engineering.* 19(1), pp. 73-88.

Ghaffari, M., 2014. A detailed analysis of existing project success factors In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, pp. 897-906.

Globerson, S., 2000. PMBOK and the critical chain. PM Network. 14(5), pp. 63-66.

Goldratt, E. M., 1997. *Critical Chain*. New York: North River Press.

Goldratt, E. M., 1999. So ... So What??" Debate Over CCPM Gets a Verbal Shrug from TOC Guru Goldratt. Interviewed by Jeannette Casadin-Brewin [Journal] PM Network, December 1999.

Goldratt, E. M. and Cox, J., 1984. *The Goal*. New York: North River Press.

Gray, V., Felan, J., Umble, E., and Umble, M., 2000. A Comparison of Drum-Buffer-Rope (DBR) and Critical Chain (CC) Buffering Techniques. *In: Proceedings of PMI Research Conference*, June 21-24, Paris, France, Project Management Institute, 257 p.

Gutierrez, G. J. and Kouvelis, P., 1991. Parkinson's Law and Its Implications for Project Management. *Management Science*. 37, pp. 990-1001.

Herroelen, W. and Leus, R., 2000. On the Merits and Pitfalls of Critical Chain Scheduling. In: Project Management Institute, PMI Research Conference, June 21-24, Paris, France.

Herroelen, W. and Leus, R., 2001. On the merits and pitfalls of critical chain scheduling. *Journal of Operations Management*. 19, pp. 559-577.

Herroelen, W. S. and Leus, R., 2004. Robust and reactive project scheduling- a review and classification of procedures. *International Journal of Production Research.* 42 (8), pp. 1599-1620.

Herroelen, W. and Leus, R., 2005. Identification and illumination of popular misconceptions about project scheduling and time buffering in a resource-constrained environment. *The Journal of Operational Research Society.* 56 (1), pp. 102-109.

Herroelen, W., Leus, R. and demeulemeester, E., 2002. Critical Chain Project Scheduling: Do Not Oversimplify. *Project Management Journal.* 33, pp. 46-60.

Hill, J., Thomas, L. C. and Allen, D. E., 2000. Experts' estimates of task durations in software development projects. *International Journal of Project Management*, 18, pp. 13-21.

Hoel, K. and Taylor, S. G., 1999. Quantifying buffers for project schedules. *Production and Inventory Management Journal*, 40, pp. 43-47.

Huang, C. L., Chang, H. G., Li, R. K. and Tsai, C. H., 2011. Using Game and Statistical Analysis to Confirm Goldratt's Logical Analysis of Poor Delivery in a Multi-Project Environment. *South African Journal of Industrial Engineering.* 22 (2), pp. 133-150.

Huang, C. L., Chen, H. C., Li, R. K. and Tsai, C. H., 2012. A Comparative Study of the Critical Chain and PERT Planning Methods- No Bad Human Behaviors Involved. *International Journal of Academic Research in Business and Social Sciences*. 2 (8), pp. 379-394.

Hunsberger, K., 2012. Chain Reactions. *PM Network.* 26 (1), pp. 40-43.

Hunt, D., 2004. Shipyard Transformation. *Shipyard Log.* [Online] Available at: http://www.navsea.navy.mil/shipyards/pearl/default.aspx [Accessed 8 July 2014].

Hwang, Y. J., Chang, Y. M. and Li, R. K., 2009. Using TOC CCPM S&T Tree to Rapidly Improve Performance of New Product Development Projects: A Case Study in Taiwan. *20th Annual Production Operations Management Society (POMS).* Orlando, Florida. 1st to 4th May 2009.

Kishira, Y., 2006. A Case Study of Reengineering Public Works Management at a Japanese Government Ministry Through a "P2M#" Based Program and Project Management Method. *PM World Today,* 8 (11).

Koskela, L., Stratton, R. and Koskenvesa, A., 2010. Last Planner and Critical Chain in Construction Management- Comparative Study. in: 18th Annual Conference of the International Group for Lean Construction, 14-16 July 2010, Haifa, Israel.

Leach, L. P., 1998. Critical Chain Project Management. In: Project Management Institute, The 29th Annual Project Management Institute 1998 Seminars & Symposium, October 9-15, Long Beach, California, USA.

Leach, L. P., 1999. *Critical Chain Project Management Improves Project Performance.* Project Management Journal. 30(2), pp. 39-51.

Leach, L. P., 2001. Putting quality in project risk management Part 2. *PM Network.* 15 (3), pp. 47-52.

Leach, L. P., 2003a. *Simplified Critical Chain Project Management.* [Online] Available at: https://dl.dropboxusercontent.com/u/73964103/Simplified%20Critical%20Chain%20Project%20 Management.pdf [Accessed 16 September 2014].

Leach, L. P., 2003b. Schedule and Cost Buffer Sizing: How to Account for the Bias between Project Performance and Your Model. *Project Management Journal*. 34(2), pp. 34-47.

Leach, L. P., 2005. *Lean Project Management: 8 Principles for Success.* Boise: Advanced Projects.

Leach, L. P., 2014. *Critical Chain Project Management.* 3rd ed. Boston: Artech House.

Lechler, T. G., Ronen, B. and Stohr, E. A., 2005a. Critical Chain: A New Project Management Paradigm or Old Wine in New Bottles? *Engineering Management Journal*. 17, 45-58.

Levine, H. A., 1999. Shared Contingency – Exploring the Critical Chain. *PM Network.* 13 (10), pp. 35-38.

Liu, J., Ren, H. and Du, J., 2013. Fuzzy Optimization of Construction Engineering Project Schedule Based on Critical Chain Management. *TELKOMNIKA.* 11 (12), pp. 7277-7283.

Long, L. D. and Ohsato, A., 2008. Fuzzy critical chain method for project scheduling under resource constraints and uncertainty. *International Journal of Project Management.* 26 (6), pp. 688-698.

Mansoorzadeh, S. and Yusof, S. M., 2011. Reliable Project Scheduling with Combination of Risk Management and Critical Chain Schedule. In: IEEE, Student Conference on Research and Development, December 19-20, Cyberjaya, Malaysia.

Mansoorzadeh, S., Yusof, S. M., Mansoorzadeh, S. and Zeynal, H., 2014. A Comprehensive and Practical Framework for Reliable Scheduling in Project Management. In: A. R. Yusoff and I. Iskandar, eds. *Advanced Materials Research.* Switzerland: Trans Tech Publications.

Marris, P., 2011. The critical chain to reduce the time to market and increase productivity. *STP Pharma Pratiques.* 21 (5), pp. 379-390.

McCollum, J. K. and Sherman, J. D., 1991. Technical Management Notes. *IEEE Transactions On Engineering Management.* 38 (1), pp. 75-78.

McKay, K. N. and Morton, T. E., 1998. Review of Critical Chain Eliyahu M. Goldratt The North River Press Publishing Corporation, Great Barrington, MA, 1997. ISBN 0-88427-153-6. *IIE Transactions*, 30, pp. 759-762.

Millhiser, W. P. and Szmerekovsky, J. G., 2012. Teaching Critical Chain Project Management: The Academic Debate and Illustrative Examples. *Informs.* 12 (2), pp. 67-77.

Min, Z. and Rongqiu, C., 2008. *Buffer Sized Technique in Critical Chain Management: A Fuzzy Approach*. Wireless Communications, Networking and Mobile Computing, 2008. WiCOM '08. 4th International Conference on, 12-14 Oct. 2008, pp. 1-4.

Ming, C. and Wuliang, P., 2009. An active plan based critical chain method. *Control and Decision Conference*, 2009. China, 17-19 June 2009, pp. 2765-2769.

Miranda, E., 2004. *Combining Critical Chain Planning and Incremental Development in Software Projects*. In: Project Management Institute, PMI Global Congress-Europe, April 19-21, Prague, Czech Republic.

Morais, C. H. B. and Sbragia, R., 2012. Management of multi-project environment by means of Critical Chain Project Management – A Brazilian multi-case study. In: IEEE, Proceedings of Technology Management for Emerging Technologies (PICMET), July 29 – August 2, Vancouver, BC, Canada.

Newbold, R. C., 1998. *Project Management in The Fast Lane: applying the Theory of Constraints*. London: St. Lucie Press.

Patrick, F. S., 1999a. Getting Out From Between Parkinson's Rock and Murphy's Hard Place. *PM Network.* 13, pp. 57-62.

Patrick, F. S., 1999b. Program Management – Turning Many Projects into Few Priorities with TOC. In: Project Management Institute, The 30th Project Management Institute Annual Seminars & Symposium, October 10-16, Philadelphia, Pennsylvania, USA.

Pawinski, G. and Sapiecha, K., 2012. Resource Allocation Optimization in Critical Chain Method. *Annales UMCS Sectio AI (Informatica).* 12 (1), pp. 17-29.

Peng, W. and Huang, M., 2013. A critical chain project scheduling method based on a differential evolution algorithm. *International Journal of Production Research*. (ahead of print), pp. 1-10.

Peng, G., Junwen, F. and Huating, W., 2007. Grey Critical Chain Project Scheduling Technique and Its Application. *Canadian Social Science.* 3 (3), pp. 35-41.

Peng, W. L. and Xu, H., 2012. The Scheduling Problem of Active Critical Chain Method. *Information Technology Journal.* 11, 829 p.

Phillis, R. C. D. and Gumede, H., 2011. A case study on stoping shift buffering at Impala Platinum A critical chain project management perspective. *The Journal of the Southern African Institute of Mining and Metallurgy.* 111 (11), pp. 793-799.

Piney, C., 2000. Critical Path or Critical Chain Combining the best of both. *PM Network.* 14 (12), pp. 51-55.

Pinto, J. K., 1999. Some constraints on the theory of constraints- Taking a critical look at the critical chain. *PM Network.* 13 (8), pp. 49-51.

Product Development Institute, 1999. *A Tutorial On Critical Chain*. [Online] Available at: http://materias.fi.uba.ar/7546/material/Tutorial_critical_chain.pdf [Accessed 16 April 2015].

Rand, G. K., 2000. Critical chain: the theory of constraints applied to project management. *International Journal of Project Management*. 18, pp. 173-177.

Randolph, Justus, 2009. A Guide to Writing the Dissertation Literature Review. *Practical Assessment, Research & Evaluation*, 14(13). [Online] Available at: http://pareonline.net/getvn.asp?v=14&n=13.

Raz, T., Barnes, R. and Dvir, D., 2003. A Critical Look at Critical Chain Project Management. *Project Management Journal*. 34, pp. 24-32.

Raz, T. and Marshall, B., 1996. Effect of resource constraints on float calculations in project networks. *International Journal of Project Management*. 14, pp. 241-248.

Repp, L. and Wright, S., 2013. Factors that Influence Critical Chain Project Management Implementation Success. In: Project Management Institute, PMI College of Scheduling Conference PMICOS, June 19-22, Orlando, Florida, USA.

Rezaie, K., Manouchehrabadi, B. and Shirkouhi, N., 2009. Duration Estimation, a New Approach in Critical Chain Scheduling. In: IEEE, 3rd Asia International Conference on Modeling and Simulation, 25-29, 2009, Bali, Indonesia.

Ribera, J. and Grasas, A., 2003. *IZAR, Case Study*. IESEPublishing. Barcelona.

Ribera, J., Sachon, M. and Grasas, A., 2003. Putting the core elements of critical chain project management into perspective: A general framework for buffer management. In: G. Spina, A. Vinelli, ed. 2003. One world? *One view of OM? The challenges of integrating research and practice.* Padova: Servizi Grafici Editoriali (SGE).

Rizzo, T., 1999. Operational Measurements for Product Development Organizations – Part 2. *PM Network.* 13 (12), pp. 31-35.

Saldaña, Johnny., 2009. *The coding manual for qualitative researchers*. Los Angeles, Calif.: SAGE.

Schonberger, R. J., 1981. Why Projects Are "Always" Late: A Rationale Based on Manual Simulation of a PERT/CPM Network. *Interfaces*. 11, pp. 66-70.

Schuyler, J., 2000. Exploiting the Best of Critical Chain and Monte Carlo Simulation. *PM Network.* 14 (1), pp. 56-60.

Shi, Q. and Gong, T., 2009. *An Improved Project Buffer Sizing Approach to Critical Chain Management Under Resources Constraints and Fuzzy Uncertainty*. Artificial Intelligence and Computational Intelligence, 2009. AICI '09. International Conference on 7-8 November 2009, pp. 486-490.

Shou, Y. and Yeo, K. T., 2000. Estimation of Project Buffers in Critical Chain Project Management. In: IEEE, International Conference on Management of Innovations and Technology, 12-15 November, Singapore, Singapore.

Silber, G., 2002. Using Earned Value Management to Predict Buffer Penetration in Critical Chain Project Management. In: Project Management Institute, The Project Management Institute Annual Seminars & Symposium, October 3-10, San Antonio, Texas, USA.

Simpson, W. P. and Lynch, W., 1999. Critical Success Factors in Critical Chain Project Management. In: Project Management Institute, 30th Annual Project Management Institute 1999 Seminars & Symposium, October 10-16, Philadelphia, Pennsylvania, USA.

Smith-Daniels, D. E. and Aquilano, N. J., 1987. Using a Late-Start Resource-Constrained Project Schedule to Improve Project Net Present Value. *Decision Sciences.*18, pp. 617-630.

Sood, S., 2002. Critical Chain Buffering. *Drug Discovery and Development.* 5 (9), pp. 86-88.

Sood, S., 2003. Taming Uncertainty. *PM Network.* 17 (3), pp. 57-59.

Spanholtz, D. and Stokes, J., 2000. New Thinking Pays Off for Plant Project. *PM Network.* 14 (6), pp. 36-38.

Srinivasan, M. M., Best, W. D. and Chandrasekaran, S., 2007. Warner Robins Air Logistics Center Streamlines Aircraft Repair and Overhaul. *Interfaces*. 37(1), pp. 7-21.

Srinivasan, M. M., Jones, D. and Miller, A., 2004. Applying theory of constraints principles and lean thinking at the Marine Corps maintenance center. *Defense Acquisition Review Journal.* 11 (2), pp. 134-145.

Steyn, H., 2000. An investigation into the fundamentals of critical chain project scheduling. *International Journal of Project Management*. 19, pp. 363-369.

Steyn, H., 2002. Project management applications of the theory of constraints beyond critical chain scheduling. *International Journal of Project Management*. 20, pp. 75-80.

Stratton, R., 2009. Critical Chain Project Management – Theory and Practice. In: *20th Annual Production Operations Management Society (POMS).* May 1-4, Orlando, Florida, USA.

Taylor, A. G. and Rafai, S., 2003. Strategic budgeting – A case study and proposed framework. *Management Accounting Quarterly.* 5(1), pp. 1-10.

Tenera, A. and Cruz-Machado, V., 2007. *Critical chain project management: A new approach for time buffer sizing*. In Proc. of the Institute of Industrial Engineering Annual Conference, Nashville.

Thipparate, T., 2014. Fuzzy critical chain risk management for quantifying impact of variation in non-critical activity duration on project duration. *International Journal of Project Organisation and Management.* 6 (1/2), pp. 48-66.

Tian, W. and Demeulemeester, E., 2014. Railway scheduling reduces the expected project make span over roadrunner scheduling in a multi-mode project scheduling environment. *Annuals of Operations research.* 213 (1), pp. 271-291.

Trietsch, D., 2005a. Why A Critical Path by Any Other Name Would Smell Less Sweet? *Project Management Journal*. 36, pp. 27-36.

Trietsch, D., 2006. Optimal feeding buffers for projects or batch supply chains by an exact generalization of the newsvendor result. *International Journal of Production Research.* 44 (4), pp. 627-637.

Tukel, O. I. and Rom, W., 2006. Analysis of Resource Buffer Management in Critical Chain Scheduling. In: Project Management Institute, PMI Research Conference 2006 Proceedings, Newtown Square, Pennsylvania, USA.

Tukel, O. I., Rom, W. O. & Eksioglu, S. D., 2006. An investigation of buffer sizing techniques in critical chain scheduling. *European Journal of Operational Research*, 172, pp. 401-416.

Umble, M. and Umble E., 2000. Manage your projects for success: An application of the theory of constraints. *Production and Inventory Management Journal*. 41, pp. 27-32.

Van De Vonder, S., Demeulemester, E., Herroelen, W. and Leus, R., 2005. The use of buffers in project management: The trade-off between stability and makespan. *International Journal of Production Economics*, 97, pp. 227-240.

Van De Vonder, S., Demeulemester, E., Herroelen, W. and Leus, R., 2006. The trade-off between stability and makespan in resource-constrained project scheduling. *International journal of Production Research.* 44 (2), pp. 215-236.

Watson, K. J. Blackstone, J. H. and Gardiner, S. C., 2007. The evolution of a management philosophy: The theory of constraints. *Journal of Operations Management*. 25, pp. 387-402.

Wei, B. and Ying, D., 2013. Selecting Service Suppliers in Construction Supply Chains with a Critical Chain Model. In: P. Yarlagadda, S. F. Yang, and K. M. Lee, eds. *Applied Mechanics and Materials.* Switzerland: Trans Tech Publications.

Wei-xin, W., Xu, W., Xian-lang, G. and Lei, D., 2013. Multi-objective optimization model for multi-project scheduling on critical chain. *Advances in Engineering Software.* 68, pp. 33-39.

Weixin, W., Xu, W., Xian-lang, G., Ya. L., Yang, C. and Jia, G., 2013. Research of Multi-Attribute Trade Off Optimization on Critical Chain Multi-Project Scheduling. *Journal of Theoretical and Applied Information Technology.* 48 (2), pp. 786-794.

Wiest, J. D., 1967. A Heuristics Model For Scheduling Large Projects With Limited Resources. *Management Science.* 13 (6), pp. 359-377.

Wilkens, T. T., 2000. Critical Path, or Chain, or Both?. *PM Network.* 14 (7), pp. 68-74.

Wuliang, P., Hui, S. and Yongping, H., 2013. A Genetic Algorithm for The Critical Chain Project Scheduling Problem. *International Journal of Digital Content Technology and its Applications.* 7 (3), pp. 571-578.

Xiao-ping, Y. and Pan, G., 2011. *A quantitative research of the time buffer of Critical Chain Project Management*. E -Business and E -Government (ICEE), 2011 International Conference on 6-8 May 2011, pp. 1-4.

Xue-mei, X., Yang, G. and Lin, C., 2010. Software development projects IRSE buffer settings and simulation based on critical chain. *The Journal of China Universities of Posts and Telecommunications*, 17 (1), pp. 100-106.

Yan, L., Jinsong, B., Xiaofeng, H. and Ye, J., 2009. A heuristic project scheduling approach for quick response to maritime disaster rescue. *International Journal of Project Management.* 27 (6), pp. 620-628.

Yang, J. B., 2007. How the critical chain scheduling method is working for construction. *Cost Engineering.* 49 (4), pp. 25-32.

Yang, Y., 2011. Research of Audit Project Schedule Management Based on Critical Chain In: *Information Engineering and Applications: International Conference on Information Engineering and Applications (IEA 2011).* New York: Springer-Velrag London. 49-56. 5th ed. Indiana: Wiley Publishing.

Yeo, K. T. and Ning, J. H., 2002. Integrating supply chain and critical chain concepts in engineer-procure-construct (EPC) projects. *International Journal of Project Management.* 20 (4), pp. 253-262.

Yeo, K. T. and Ning, J. H., 2006. Managing uncertainty in major equipment procurement in engineering projects. *European Journal of Operational Research.* 171 (1), pp. 123-134.

Zwikael, O., Cohen, Y. and Sadeh, A., 2006. Non-delay scheduling as a managerial approach for managing projects. *International Journal of Project Management.* 24 (4), pp. 330-336.

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PROBLEMS OF STRUCTURAL FUNDS PROJECTS' IMPLEMENTATION IN ROMANIA AND ANALYSIS OF SEVERAL GOOD PRACTICES INDICATORS

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Abstract

The aim of this article is to investigate the implementation mechanisms of E.U. Structural Funds in Romania and to identify the problems faced by applicants in projects' implementation cycle as well as to discover what practices could represent good examples for other applicants and beneficiaries in terms of tools to absorb efficiently the E.U. money. We will present and analyse several indicators that impact on projects' implementation of Structural Funds and the relationship with the absorption rate and the achievement of objectives of the European regional policy.

One of the main objectives of this study is to identify the practices that can be characterised as successful, called generically *good practices* and are likely to be transferable to other systems of implementation. The analysis of good practices is constructed on the conclusions emerging from the evaluation studies and reports of the institutional framework for structural funds management, and after testing the opinions of applicants and beneficiaries with questionnaires and interviews.

Most of the examples of good practices are provided unilaterally by the Managing Authorities and it is not enough information available to conclude on what basis has been taken the decision to provide some projects as examples of good practices. Some opinions suggest that any type of project has the chance to become an example of good practice as long as it is managed in an efficient manner that includes the high involvement of the project manager and/or of the project team in solving the problems that appear. We believe that there are also some preconditions that influence the success of a future project and are related either to the financial power of the applicant or to the external environment for the development of the project.

Therefore, each project has the potential of becoming an example of good practice by fulfilling at least one of the indicators of success, if not all. Nevertheless, there are indicators that have a high influence over the implementation success of projects and they cannot be ignored.

Key words: *Structural Funds, project implementation, Romania, good practices*

JEL codes: O22, K23

Introduction

This article is an analysis of several projects implemented in Romania during 2007-2013. The projects have been financed through the seven operational programs and during our research they were finalized or in the implementation phase. The analysis refers to the problems faced by projects' implementers and to some good practices that have been identified during implementation of these projects and are recommended in order to amplify the results of future projects. In this study we try to find out what determines the successful implementation of EU

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projects, if it depends exclusively on the projects' implementers or there are also other preconditions involved.

The study acknowledges the difficulties encountered in accessing the EU funds and tries to contribute to the academic debates by proposing policy solutions and programme management ideas in order to ensure a higher absorption rate in Romania. The analysis of the opinion of projects' implementers brings a bottom-up view over the practical aspects of implementation of EU projects and allows the spread of new ideas among beneficiaries of funds.

Research results and discussion

Based on the data collected during interviews and on examples of good practices offered on the websites of the management authorities, we have identified some indicators of good practices that might be applicable to beneficiaries of structural funds.

The examples of good practices are provided unilaterally by the Managing Authorities and in some cases, it is not stated what the indicators of measurement are. The Forum of Good practices in SOP HRD (Sectoral Operational Programme Human Resources Development) projects from Romania, held on the 8th of February 2011 in Bucharest, specifies that through the method of good practices are mentioned those pragmatic approaches with a powerful managerial content that in some organizations proved to be extremely efficient in solving important problems, which appear with a relative high frequency and, which systemized in an operational methodological manner, are available for managers and interested specialists from that or other organizations.

This approach suggests that any type of project has the chance to become a good practice example as long as it is managed in an efficient manner that includes the high involvement of the project manager and/or of the project team in solving the problems that appear. The major problems that interfere with the implementation process might be foreseen by the management team with the help of risk analysis tools or might be unpredictable, such as the economic crisis. If and how management solutions are found to cope with those problems might turn the projects into being successful or failures.

We believe that there are also some preconditions that influence the successful of a future project and are related either to the capacity of the potential beneficiary, such as the financial power of the applicant or to the external environment, such as the context for the development of the project.

Preconditions for successful project implementation

During our research, we have identified two preconditions for successful project implementation. They are presented in Table 1.

The financial power of the applicant is clearly a precondition for any investment steps, including financing through Structural Funds of the European Union (E.U.). It is quite strange that some applicants and authorities ignore this basic requirement when submitting, respectively selecting projects disregarding applicant's financial situation.

It is well known that access to the E.U. Structural Funds is conditional:

- E.U. Structural Funds are offered on the principle of reimbursing that supposes that beneficiaries should have financial resources available to start the project and to cover the non-eligible expenses.

- Structural Funds are and should be treated as additional financial resources, complementary sources that fulfil in certain percentages the need of financing the development of beneficiaries. In comparison with pre-accession funds, most of the Structural Funds are not grants. That means that it is not offered 100% financing for project implementation.

Table 1

The financial power of the applicant/beneficiary

Indicator	Definition/Content/Explanation	Level of influence	Risks
The financial power of the applicant/ beneficiary.	The applicant/beneficiary has the possibility to ensure co-financing and to cover the non-eligible costs without any problems.	High and very high.	1. Impossibility to ensure co-financing. 2. Negative cash flow. 3. Withdrawal of projects.

Source: author's construction

Most of the projects whose implementation was delayed or even stopped were projects facing basically financial problems, such as the impossibility to ensure co-financing, beneficiaries going bankrupt or in procedure of reorganization.

Under the pressure of the economic crisis that strongly affected the Romanian economy in 2008-2009, the private companies had to focus on building survival strategies instead of engaging into long-term investments. Most of them, facing deep financial problems, decided to postpone the development of any E.U. financed projects, therefore affecting the general absorption pace and progress. The considerable number of withdrawn projects between the approval and the contracting stages support this statement: 15% withdrawal rate in the case of micro-enterprises financed under the Regional Operational Programme – R.O.P. (until June 2009) and 13% of the SMEs supported under the Sectoral Operational Programme Increase of Economic Competitiveness – SOP IEC (between December 2009 and January 2010) (Ministry of Public Finances, 2010).

The intermediate evaluation of the SOP IEC (Guvernul Romaniei, 2010) appreciated that the access of financing for SMEs was a real problem even before the launching of Structural Funds, and that the economic crisis just worsened the situation. A strong impact had the fall of the real estate market that decreased the value of constructions that were brought as guarantees for credits offered by banks. The evaluation report states that participation of companies in projects financed by Structural Funds became a result of *auto selection on somehow Darwinist principles,* in the sense that just companies with a strong financial situation afforded to submit and implement project from European funds.

In order to give to more private beneficiaries the possibility to access Structural Funds, it has been created the financial tool of pre-financing, which was not provided automatically, but on the basis of an analysis and following approval by the Managing Authority and within a limited budget. Beneficiaries we interviewed in Romania suggested that pre-financing was vital for start-up and that its value was quite important, amounting in the beginning 30% of eligible costs. After a decision has been taken to diminish the pre-accession to 10% provided in 2 or

even 3 instalments, its importance decreased and was not significant enough to help the beneficiary to cope with financial problems.

Another issue was related to the fact that pre-financing was not available to public applicants who had to count on their own budgetary resources or on the budget of a patron institution that they belonged to. This rule had an effect over projects submitted by public organizations which amounted, according to statistics, to almost 70% of all beneficiaries in Romania. Even if for public applicants in some cases the value of co-financing requested was up to 10% (mostly 2% or 5%), if it was about strategic projects whose budgets were in millions Euro, then even this minimum co-financing rate was significant in absolute value.

Additionally, as mentioned before, some public organizations at regional and local level depending financially on money transfers from a patron institution were interdicted through legislation to receive extra budgetary revenues, and that meant that their financial dependency was total. The possibility to have additional own resources would allow them to ensure co-financing or even to cover temporary some expenses until resources from the national budget would be available.

Another consequence of the fact that public institutions were not able to receive pre-financing, but private organizations were (companies and NGOs), was the fact that if the project promoter was a public organization, it could have the possibility to receive pre-financing on behalf of a private partner, therefore, most of their projects included a private partner in order to benefit from the advantage of pre-financing. That supposed that the relationship between the promoter and the partner should be very trustful, as the promoter was obliged to transfer the funds into partner's account not later than 3 days after receiving it. We believe that this procedure led to rather strange dependency and power relationships among project partners and from this point of view we appreciate that good partnership relations might also be considered as an indicator of success for project implementation.

Another aspect that is related to the financial power of the beneficiary in relationship with administration of funds provided by the Managing Authorities in Romania is the high delay in reimbursing the funds by the authorities that created the negative cash flow. These delays were due to several reasons that are mostly originating in the functioning of the Managing Authorities, such as a large volume of work with limited number of personnel and their reluctant attitude in processing the applications for reimbursement. Bureaucracy increased, as Managing Authorities were asking for more additional supportive documents which attracted delays in processing the applications, as new terms were calculated. These reasons created delays of 3 up to 6 months in reimbursing the money to beneficiaries who considered this practice unacceptable and dangerous for their financial stability.

In the case of private beneficiaries, who engaged credits for financing their contribution and for pre-financing, the late reimbursement of funds by the Managing Authorities affected the contractual relationship with the banks. The most affected were the start-up and the spin-off companies. The late reimbursement of financing affected the credit return schedules agreed between beneficiaries and banks, the later ones applying usually penalties for late payments as well as creating a possible negative evaluation of the client for future credit demands. In Romania banks haven't been very flexible in applying the rules of crediting to beneficiaries of Structural Funds. Even if the likeliness of credit return was very high in these cases, banks were applying the same procedures as for admittance of any other credit, asking for the same guarantees and collaterals, without any special facilities for project promoters.

The late reimbursements were also due to other reason: the difficulty of the Government to ensure the proper national co-financing of the Operational Programmes (OPs), once the economic crisis appeared. Consequently, the measures that were taken led to serious negative impacts, such as the blocking of projects and even of programmes, leading to a stagnation of the absorption rate. Such measures like the non-eligibility of pre-financing for certain OPs or for certain beneficiaries (e.g. private) or lowering the rates of pre-financing (up to 10% of project value) made even more difficult the access to Structural Funds.

A solution was to temporary allocate amounts of money from the national Treasury, namely revenues from privatization, to ensure the necessary amounts of money at the disposal of Managing Authorities to make reimbursement payments to beneficiaries until expenses are certified, approved and paid by the European Commission. According to the 2013 report of the Ministry of European Funds (Ministerul Fondurilor Europene, 2014), in the period March-December 2013, there have been adopted a number of 11 Government decisions which allocated around 2 billion Euro for payments to beneficiaries. The disadvantage of this system was that for each supplementary budgetary allocation, there was a need to pass a Government Decision to allocate money for each OP, which was bureaucratic and time consuming.

A solution which would address the poor financing of both the Managing Authorities and the beneficiaries is the creation of a Bank of Development. This model exists in Poland and France. The role of the Bank of Development is to be an instrument for working the European funds, by managing all the financial aspects in the relationship with beneficiaries of funds. The Bank of Development could offer credits guaranteed up to 100% by the state, to all beneficiaries, public authorities, private companies and even individuals who propose concrete projects. The scope would be to co-finance not only eligible but also non-eligible expenses with a comfortable interest rate for beneficiaries. The mechanism to be implemented is one of guaranteeing of credits from a fund of guarantees to which any European investment bank would be able to participate.

In Romania we meet a specific situation in the case of public beneficiaries whose budgets have been considerably decreased during the economic crisis. A measure that had a negative effect on the human resources from public institutions was to declare (even if temporary) the non-eligibility of salaries for civil servants working with Structural Funds. This determined a visible decrease of their involvement in drawing up, implementing or monitoring projects, both numerically and qualitatively, backed up by the release from office of around 25% of civil servants in 2010, fact that increased the volume of work for those who remained actually in job. Apart from the dissatisfaction factor of financial nature, the personnel of public institutions dealing directly with implementation of projects faced professional challenges, such as insufficient skills for project management, both technical and financial, as well as their charging with different tasks not related with project management but part of the current job description. This requested additional working hours that according to the law have been limited in length and extra payment as well, either by the internal rules of the public organization or through the project that was implemented. This situation brought the civil servants in a discriminatory position as such rules did not apply for their private partners whose extra working hours within the project were not limited and their payment was more flexible.

Considering the above analysis, we tend to believe that Structural Funds are dedicated only to those financially strong beneficiaries. The reality shows that applicants come from all categories while their reasons for applying for financing from the Structural Funds are different.

During interviews we found out that some financially strong companies that in terms of co-financing the project wouldn't meet any problems, nevertheless beware to apply for financing through Structural Funds, because they fear bureaucracy and corruption, considering safer and easier to make investments from their own resources (reinvested profit) or from bank credits. Despite all difficulties, most of beneficiaries appreciate as positive their experience and would recommend to others to apply for European financing.

In the table below, we present another precondition that we consider to be the context of the project implementation.

Table 2

The context of project implementation

Indicator	Definition/Content/Explanation	Level of influence	Risks
A stable or easy predictable context during the project implementation.	Those external conditions that influence the implementation of projects and that should be or remain stable or easy to predict from the moment of submitting the application until the end of the implementation period. Includes mainly political factors, legislation, procedures, rules of authorities and other financing institutions. They are not under the control of the applicant/beneficiary and depend mainly on the decision power of other stakeholders. The applicant might identify those external conditions through the risk assessment matrix and prepare action plans to address those risks.	High and very high	1. Fast changing legislation. 2. Increased requirements. 3. Bureaucracy and corruption. 4. Fluctuation of the exchange rate. 5. Economic crisis. 6. Changes of programme indicators. 7. Suspension of Operational Programmes.

Source: author's construction

A changing context during project's implementation can produce both types of effects for beneficiaries: negative and positive. Unfortunately, in the beginning of the programming period in Romania most of public decisions had a negative effect on beneficiaries and only after the implementation system entered a deep crisis (in 2010-2011), with the suspension of several Operational Programmes and of payments by the E.C., the changes adopted started to produce benefits. These positive changes appear when there are initiatives of the public authorities to improve the situation of the beneficiaries or to ease the implementation process. We refer to changes of legislation or procedures initiated by the Managing Authorities that come to beneficiaries' support, such as, for example, decreasing the administrative burden of submitting certain documents or improving the public procurement procedures for private beneficiaries. Clear and stable legislation and procedures, user-friendly for applicants and beneficiaries can

constitute examples of good practices if they are build on their needs and requirements and respect the principles of predictability, transparency, simplicity, availability, overall applicability and innovation.

The context of the project implementation is an external factor that has to be analysed by the applicant before submitting his application for financing and a very useful tool in this respect is the *risk assessment analysis*. This analysis refers to the factors that might influence the implementation of a project, the likelihood of their appearance and their consequences and includes an action plan for addressing them. It is appreciated that at both Managing authorities and beneficiaries' level there is a low practical knowledge and experience of the management of risk as an instrument of management.

Except for the SOP Transport and SOP Environment, the applications for financing do not include the risks' assessment analysis and where beneficiaries include one, they do not receive additional points during project evaluation. The risk assessment analysis is not common for most of Romanian organizations and even less common when applying for financing through the Structural Funds. Only banks make a risk analysis of those clients that request credits for co-financing or for pre-financing of their projects. As for the SOP Transport, the evaluation of risk and sensitivity counts for 5% of the evaluation criterion *"the quality of project proposal"* which represents one third of the entire evaluation criteria (Ministerul Transporturilor, 2010). For the SOP Environment, in some applications the applicant is requested to mention the main constraints and risks for project implementation and their impact, as well as the measures taken to address them (Ministerul Mediului şi Pădurilor, 2014).

There are different attitudes towards risks of private and public beneficiaries. Private beneficiaries have a more pro-active attitude towards risks; they are more flexible and tend to find faster solutions to problems. They tend usually to get involved in projects that have a low complexity and therefore have fewer risks. For public beneficiaries the situation is different. Public beneficiaries have first of all a higher aversion to risk and this reduces their management capacity itself. The personnel of some public beneficiaries are reluctant to get involved at decisional level as, according to the laws, their responsibility can be attracted for the failure of a project and financial penalties may be applied against individuals. For major infrastructure projects, even if there is an obligation to keep a record of risks, this one includes just a listing of them and not a serious analysis with concrete solutions to address them. Concrete activities for the management of risks are neither planned, nor implemented in practice.

The *ad-hoc* evaluation report regarding the capacity of the beneficiaries (Ministry of Public Finances, 2011) mentions that the lack of risks assessment management skills becomes more evident especially when the applications for reimbursement are delayed. Shortly after, it appears a temporary insufficient money liquidity that troubles the beneficiary financially and the project implementation process as well, as further planned activities have to be postponed due to money shortage. Having not properly foreseen this risk, some beneficiaries, especially those having a low financial power, meet serious difficulties in covering the non-eligible expenses.

The monitoring of risks during implementation is a step forward for the success of the projects. For the Operational Programme Transport, beneficiaries were asked to submit at certain intervals of time, along with other documents, two scenarios regarding implementation, one optimistic, without risks, and another one pessimistic, and including the risks identified and the measures to overcome them (Ministerul Transporturilor, 2014).

The economic crisis affected especially the Romania's public finances, as macro-economic indicators show: the share of Government expenditure in GDP went up to 40.4% in 2009 from 36% in 2007; the share of Government revenues decreased from 33.5% to 32.1% for the same period of time; the public deficit grew to 8.3% in 2009, while the public debt reached 23.7% of GDP in 2009 in comparison with 12.6% in 2007 (Ministry of Public Finances, 2010). Combined with the lack of multi-annual financing, the decline of public finances put pressure of the Ministry of Public Finances to raise funds in order to ensure co-financing of Operational Programmes. Solutions have been identified, such as contracting of a co-financing facility of 1Billion Euro with the European Investment Bank for ensuring national co-financing of strategic infrastructure projects; temporary borrow of money from the Treasury to cover the absence of financial resources for reimbursements; increase of the Government capacity to co-finance projects by enlarging of the maximum ceiling of revenues from privatisations' fund to 4 Billion RON (Guvernul României, 2014).

Additionally, the private sector was strongly affected by the tightening of the credit standards by banks, which based their decisions on the expectations with regard to the evolution of the economic activity in general, the evolution of financial markets, the monetary policy decisions of the National Bank of Romania as well as due to the drop of the real estate market that decreased the value of the collaterals.

In Romania, the exchange rate of the national currency RON is fluctuating; it is not tight to Euro or Dollar, depending freely on imports and exports of the country. As exports decreased and the general economic situation worsened, the exchange rate started to fluctuate strongly in a short period of time, especially in 2008 and 2009. For example, the exchange rate increased with 20% from the moment of submitting a project until its approval that made the previous estimations unrealistic. In the case of projects foreseeing imports, such as equipments produced abroad, the reduction of the value of the national currency increased investments costs, making more difficult for beneficiaries to implement the project in the absence of additional financing sources.

The regulatory framework including laws, regulations and procedures for the implementation of projects is another external factor for applicants/beneficiaries that they cannot control but more than that, they depend on, because it sets the rules for eligible activities and expenses, potential beneficiaries and target groups, monitored indicators, partnerships, documents to be submitted, VAT recovery, procurement etc. The Romanian legal framework has been constantly characterized as being incoherent and not coordinated with the reality, often changing, contradictory, and not compatible or poorly aligned with European regulations or even more restrictive and demanding than requested by the E.U. (for example, in the case of procurement regulations). This led to confusion and frustration among beneficiaries, and consumption of material and financial resources to produce the documentation and time-consuming (for example, as one beneficiary mentioned in the interview, it was requested provision of documents in the submission stage, such as construction permits, documents which according to laws have limited viability and if their validity was expiring during the project selection, the documents needed to be submitted again). An overwhelming bureaucracy was accused by beneficiaries: project's documentation was requested both in paper (2 or 3 samples) and electronic format, several signatures and stamps had to be applied on each page within the Application File etc.

Some indicators of good practices for project implementation

If preconditions are fulfilled, there is a high chance that projects will be implemented in a smooth way. Preconditions are necessary but not sufficient circumstances to generate a successful implementation of projects. Following discussions with beneficiaries and analysing implementation and evaluation reports of Operational Programmes, we present below a list of several indicators of good practices identified in several projects that could contribute to overall success of projects' implementation.

Table 3

Synergy and complementarity

Indicator	Definition/Content/Explanation	Level of influence	Risks
Synergy and complementarity.	The project's scopes and objectives are integrated into a multilateral development strategy (local or regional); the projects' activities fulfil the needs of the target group and represent a support/link for the development of other projects from other fields of activity.	Medium.	1. Incoherence. 2. Low impact. 3. Non-sustainability.

Source: author's construction

Synergy and complementarity of projects have to be followed up from the moment of drawing up of the application for financing. Most of applications request that the project applicant would fill in the key intervention area of the Operational Programme to which the results of the projects are supposed to contribute. In some cases, projects promoters are just "hunting" for financing and are not looking to solve problems from our society. Projects are not just some ideas for creating a better (financial) situation for the project promoter. Projects have to be part of a multilateral local or regional strategy or plan and get integrated into them. Projects have to be built on concrete needs of the target group and bring a positive change into their lives. Synergic and complementary projects produce unexpected positive effects in other spheres of public life, such as environment, citizens' security, tourism, business competitiveness, transport, social services etc.

The creation of synergic and complementary projects is possible especially if we think about large projects but it is equally possible for smaller projects. Large projects are usually promoted by regional level implementers who have a more strategic view on the local and regional needs of development. Smaller scale projects can be a link in networking and combining similar projects or can develop into a larger project with a more integrated approach. The experience cumulated through these projects is not lost, on the contrary, can be capitalized and used for ensuring continuity of development measures.

The involvement of partners in projects financed by EU Structural Funds is in most of the cases an obligatory requirement, during the evaluation process, the application receiving more points if the project foresees one or more partners. The partnership principle is one the four

main principles of Structural Funds. The partnership principle has to be present in all the stages of the Structural Funds implementation scheme, from programming to projects' implementation.

Table 4

Partnership

Indicator	Definition/Content/Explanation	Level of influence	Risks
Partnership – selection of partners/suppliers and their capacity to influence the project implementation.	The ability of project promoter to select and involve within the project reliable partners/suppliers and with relevant experience that can contribute positively to the successful implementation of the project's activities.	Medium to high.	1. Withdrawal of partners. 2. Bankruptcy of partners/suppliers. 3. Dependence on suppliers who won contracts of public procurement. 4. Delay in project's activities implementation.

Source: author's construction

During project's evaluation for selection for financing, the implementation capacity of applicant and of his partner/s is equally evaluated, if both are involved in project implementation. After analysing several models of applications from different calls of proposals, we have concluded that both applicant and partner are evaluated if they have previous experience in implementing similar activities; if human and financial resources are allocated according the implementation needs of the project; etc. From this point of view, it is understood that partners have the same responsibilities in project implementation as the applicant itself. Additionally, in some cases, the internal management capacity of partners for project implementation is similarly evaluated, for example if they have a clear strategy for monitoring the project implementation or if there is a clear delimitation of tasks, procedures and human resources allocated therefore.

From the organizational point of view, the partner/s should be as much involved in project implementation as the applicant at such a level, that, if necessary, it could take over project implementation if applicant fails to do it. Unfortunately, in most of the cases, partners are less than a support organization for the applicant and sometimes they negatively influence the project implementation.

It is the obligation and responsibility of the applicant as project promoter to control the partners, and in order to ensure a good management of the project, they should take immediate measures to replace the bad performing partners, even if this decision means in most of the cases delays in project implementation and additional costs (Ministry of Public Finances, 2011). Private beneficiaries tend to have more control on their partners as most of their partnerships are based on previous collaborations.

In a more difficult situation are the public beneficiaries that rely almost totally on their suppliers, and their relationship is usually dictated by the contractual obligations born from public procurement procedures.

During the interviews, beneficiaries of funds have mentioned that during project implementation, they had met difficulties in running the project due to partners' behaviour. Most of the reasons mentioned refer to the following attitudes: lack of promptitude and consequence in running the specific activities; partial accountability for the implementation of the project by some partners; exchange of responsibilities among partners; failure to observe the deadlines; some transnational partners were not able to cope with frequent changes of the project's activities implementation and requirements from Romanian authorities; partners who had to deliver activities of project went bankrupt during project implementation etc.

Table 5

Human resources – project team

Indicator	Definition/Content/Explanation	Level of influence	Risks
Human resources involved in project implementation – project team.	The optimal quality and quantity of human resources allocated for the implementation of project's specific activities.	Medium to high.	1. Insufficient personnel. 2. Low experience of personnel. 3. Low motivation of personnel. 4. High fluctuation of human resources. 5. Non-integrity of personnel.

Source: author's construction

Most of beneficiaries of E.U. Structural Funds implement projects using the human resources available in their organizations, while some promoters employ consultancy companies for drawing project applications and for the so-called administrative and financial implementation.

In this section, we will discuss only the situation when promoters apply independently for financing and implement projects with own resources. Large organizations, applying intensively for financing from E.U. sources, usually have established separate departments responsible for drawing up applications and for administrative and financial implementation. Most of human resources are highly qualified and have relevant experience in the field of project management. Consequently, their salaries are competitive and motivating, and due to the financial reason, fluctuation of personnel is not high in these cases.

Unfortunately, situation is opposite for small and medium-sized organizations. Having low operational budgets, they fail to attract project managers or other experts, since they cannot afford to pay them competitive salaries. Such organizations do not invest either in constant training of their personnel in accessing and implementing Structural Funds. Nevertheless, some organizations understood the key role of a project manager in their organization's development and they tend to invest in employing and maintaining such jobs. The project manager is the organizational link for implementing successful projects, creating the bridge among people having different jobs in organization – the project team. In these cases, the salaries offered are

more competitive than those of civil servants working in the same field of activity as project managers. As interviewees mentioned, working in the private sector on a relatively higher salary than in the civil service, has advantages and disadvantages: if in the public sector the working schedule is not flexible, in the private sector you can agree easier on your schedule; in the private sector, the performance criteria are more closely taken care of; in the public sector, the financial and non-financial incentives are determined by laws, while in the private sector they are more flexible and suitable to employees' needs; in the private sector, sometimes extra-working hours are not accounted by the employer etc.

The promoters of projects from the public sector (e.g. local public administrations) have encountered a series of problems related to the human resources allocated for projects' implementation: personnel was not sufficiently trained or training was rare (just once in two years) and irrelevant (too general, not tailored to specific needs); the institution did not have enough resources to employ the needed personnel or to pay for the training if personnel, due to budgetary constraints (especially during the economic crisis); the salaries of civil servants were not competitive and the personnel was not motivated enough to perform effectively (in average, 250-300 euro); due to low salaries and lack of professional perspective, there was a high flow of personnel; the personnel was overload with other job related tasks apart from project implementation etc.

Table 6

Involvement of the target group

Indicator	Definition/Content/Explanation	Level of influence	Risks
Involvement of the target group.	The collaborative and participative attitude of the target group as main beneficiaries of the activities of the project.	Medium to high.	1. Low number of participants from the target group. 2. Non-achievement of the project's and programme's indicators.

Source: author's construction

While developing projects financed from the SOP HRD, promoters had to mention into their applications which were the final beneficiaries of their projects. The target group was identified quantitatively (a certain number of participants benefiting from project's activities) and qualitatively (from a certain social group: e.g. unemployed, women, young or old people etc.). The Managing Authority was requesting proofs based on documents (for examples, lists of participants with names and surnames, personal data, signatures) regarding the achievement of the declared number of participants. There were cases that went to the attention of criminal investigators, when such data was falsified, either because the project promoters wanted to get the benefits for themselves, or because they were in the impossibility to gather the total number of participants anticipated in the project application.

During the interviews, some promoters mentioned that it is highly important to know very well the needs of the target group when you draw up the application, and this will guarantee their full involvement. In some cases, that meant for promoters being themselves part

of the target group or identifying the needs of the target group by applying questionnaires for analysis of problems and needs. Additionally, some promoters mentioned that their projects foresaw different methods of determining the involvement of the members of the target group, by using different stimulations, such as: financial and non-financial incentives for participating to trainings and consultancy, bonuses for drawing a business plan of about 10% of its value etc.

Important roles in gathering the necessary amount of participants were played also by other aspects: the accurate and permanent monitoring of the number of participants for each event that was offering the project team a clear view on the achievement of results and could apply corrective measures; intensive public communication activities and large and diverse media coverage that helped the information to get to the target group, including the attraction into the projects of partners such as the local agencies for employment, local public administration or companies.

Table 7

Innovative methods of implementation

Indicator	Definition/Content/Explanation	Level of influence	Risks
Innovative methods of implementation.	The innovative approach used in all spheres of the project, starting with the identification of the general and particular objectives, the methodology of determining the needs of the target group, the tools and instruments used for implementation.	Medium to high.	1. Low impact. 2. Limitation of the impact by the applicant who play the role of a gate-keeper. 3. Non-sustainability.

Source: author's construction

Innovative projects attract the attention of the financing authorities, of the target group and of public institutions as well. These types of projects have usually a high impact on the market and tend to be more sustainable over time than other projects. They have a multiplier effect at local and regional level and sometimes cross-border. In some cases, they tend to standardize and become part of local or national public policies. Their innovation character and powerfulness determines their transformation and validation from a one-time/one-level practice into a national/cross-national policy.

Innovative projects bring the changes needed into our society and transform them into legislative measures. For example, assisted employment of adults with disabilities promoted in one project did not have any legislative basis, but following constant and successive applications promoting this idea, it provoked and contributed to the creation of the needed legal framework.

The impact of projects can be limited by the applicants themselves who block intentionally their multiplication effects. The applicants play the gate-keeper role for a piece of information that could become everybody's key to success. They fear to provide freely such ideas, expecting a substantial financial profit, willing to safeguard the know-how and to get

additional benefits, especially after European financing is over and they are unable to refinances multiplying activities.

Conclusions

Promoters and implementers of E.U. financed projects, through their common and unified efforts are having an important role in today's society in Romania. They do not only contribute to the achievement of an Operational Programme indicators or targets, but also to the implementation of the national development plan for the creation a more sustainable and competitive society. Promoters of projects have understood that in the process of accessing European funding, it is important not only to respect the rules of the financer, but also to make a positive difference through their projects at local, regional or even national and European level.

The financial support offered by the European Union is a deep breath into the Romanian economy and the effective use of the whole amount of investments can make the difference between rich and poor regions in Europe. Unfortunately, this aspect was not understood from the very first beginning, and means to fraud the funds for personal or political interests have brought a negative reaction from the European Commission, which suspended in 2012 some Operational Programmes. Apart from corruption, bureaucracy kept away a lot of possible project promoters or made them give up with their projects. The unstable institutional framework, often changing legislation, inflexibility and over-regulatory administration of Structural Funds are the realities of the 2007-2013 financial framework in Romania. It is also true that most of project promoters weren't prepared neither financially nor professionally to cope with the implementation requirements of the Operational Programmes. All these explain the lowest absorption capacity of Structural Funds registered by Romania among the Member States of the E.U.

During our research, we have analysed several indicators of good practices identified during the implementation of several projects financed by the E.U. funds. These projects have been declared by the Managing Authorities as examples of good practices but in some situations, the criteria for their selection were not revealed. We have presented two preconditions that could guarantee the success of projects, namely the financial capacity of the promoters and the external environment. Organizations are living entities that easily react to the external environment and if this environment is unstable, it creates malfunctions into their activity as well.

We consider that if the two preconditions are fulfilled, any project that applies and respects the indicators of good practices have the capacity to become an example of good practice. Some indicators might have a higher influence on the success of a project but if applied all together, they tend to influence each other. Promoters don't have to forget that projects are not a one-time and static effort to create economic and social wealth but a small step in the cyclic existence of public policies. No matter how small might be, every step counts, and especially if this step is of high quality. Therefore, we encourage project promoters to keep this in mind when applying for financing from Structural Funds and consider the indicators of good practices in any of their future initiatives.

Bibliography

Guvernul României, 2010. Evaluarea intermediară 2009 a Programului Operațional Sectorial Creşterea Competitivității Economice. [Online] Available at: www.evaluare-structurale.ro [Accessed 12 January 2015].

Guvernul României, 2014. Ordonanța de Urgență nr. 29/2014 pentru modificarea şi completarea Ordonanței de urgență a Guvernului nr. 64/2009 privind gestionarea financiară a instrumentelor structurale şi utilizarea acestora pentru obiectivul convergență. [Online] Available at: www.cdep.ro [Accessed 2 February 2015].

Ministry of Public Finances, Authority for Coordination of Structural Funds, 2010. A Formative Evaluation of Structural Funds in Romania, Final report. [Online] Available at: www.evaluare-structurale.ro [Accessed 12 January 2015].

Ministerul Fondurilor Europene, 2014. Raport de activitate pentru anul 2013. [Online] Available at: www.fonduri-eu.ro [Accessed 25 January 2015].

Ministerul Mediului şi Pădurilor, Autoritatea de Management pentru POS Mediu, 2014. Ghidul Solicitantului Axa prioritară 2, DMI 2 "Reabilitarea zonelor poluate istoric". [Online] Available at: http://www.posmediu.ro/upload/pages/Ghidul%20solicitantului%20Axa%202(1).pdf [Accessed 2 February 2015].

Ministry of Public Finances, Authority for Coordination of Structural Instruments, 2010. A Formative Evaluation of Structural Instruments in Romania, Final Report. [Online] Available at: www.evaluare-structurale.ro [Accessed 02 February 2015].

Ministry of Public Finances, Authority for Coordination of Structural Instruments, 2011. First *Ad-hoc* Evaluation, Challenges in the Capacity of Public and Private Structural Instruments Beneficiaries, Final Report. [Online] Available at: www.evaluare-structurale.ro [Accessed 2 February 2015].

Ministerul Transporturilor, Autoritatea de Management Programul Operațional Sectorial Transport, Instrucțiune nr. 13 din 28.03.2014. [Online] Available at: http://www.ampost.ro/fisiere/pagini_fisiere/Instructiune_DG_-_13.pdf [Accessed 2 February 2015].

Ministerul Transporturilor şi Infrastructurii, Autoritatea de Management Programul Operațional Sectorial Transport, 2010. Ghidul Solicitantului. [Online] Available at: http://post.mt.ro/ghid%20solicitant/Ghidul%20solicitantului%2014%2005%20%202010%20FINAL.pdf [Accessed 2 February 2015].

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EXTERNAL FINANCIAL AUDIT IN PROJECT-BASED COMPANIES. SUPPORT OF INTERNAL CONTROL SYSTEM IN THE ASSESSMENT OF ENTITY'S GOING CONCERN

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Abstract

External financial audit is one of the instruments that aims at confirming the reliability of financial statements prepared by the company, and assesses if the entity will be able to continue the operation in the foreseeable future. The main objective of the paper is to examine the support of internal control system in the assessment of project-based entity's going concern status that is one of the tasks of external auditors. The conducted research raises the following issues: how can the auditors confirm the going concern status in project-based company? Is the support of internal control system (ICS) needed and required in the external financial auditing (EFA) process of project-based company? What are the possible links between ICS and EFA? The research findings result from participant observation of external financial auditing conducted during year closure processes, and many discussions with auditors and bookkeepers. In order to answer the research questions, analysis of literature in the fields of finance and management were conducted. The study showed that without information obtained from internal project control system the auditor's assessment of going concern status in project-based company would be much more difficult, even not possible. The external auditors should base on products coming from managerial accounting system, such as project economic estimations, project risk assessments. The above mentioned correlation influences the methodology of project controlling that has to adhere to financial accounting principles and fulfil the manager needs.

The conducted research pointed out that the cooperation between auditors, bookkeepers, and project controllers is needed. But the scientific papers in the field of management science do not analyse comprehensively the influence of managerial accounting on operations and results of external auditing. The issue seems to be more complex in project-based companies where sustainability of the entity bases on current and predicted performance of projects.

Key words: *audit, internal control, going concern opinion, project-based company*

JEL codes: M40, O22

Introduction

Operating on the market, project based-companies face many threats that are connected with risk, uncertainty and unknown conditions of environment and the nature of project life cycle – as a long-term undertaking. At the same time, due to equal mechanisms, during project execution additional opportunities can appear (Hällgren, Wilson, 2008). Both occurrences influence the achievement of final results which differ from targets. Due to uncertainty and unknown conditions, prediction of future becomes much more complicated than in the past and sometimes impossible. The above mentioned process intensified since 2008 when the national

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economies in the US and Europe experienced the fiscal-financial crisis (Krugman, 2013). Deterioration of macroeconomics indicators began to influence strongly project-based companies, such as the other market entities. In times of crisis the organisations suffer from e.g. lack of demand for new investment projects and problems with borrowing money. A number of bankruptcies is the result of recession in economy. The crisis conditions influence the behaviour of market participants. They analyse more often the financial conditions of the business partners using very complex tools. But the first stage of the analysis should be the exploration of the annual opinion prepared by external financial auditor, who has to assess the company's going concern ability.

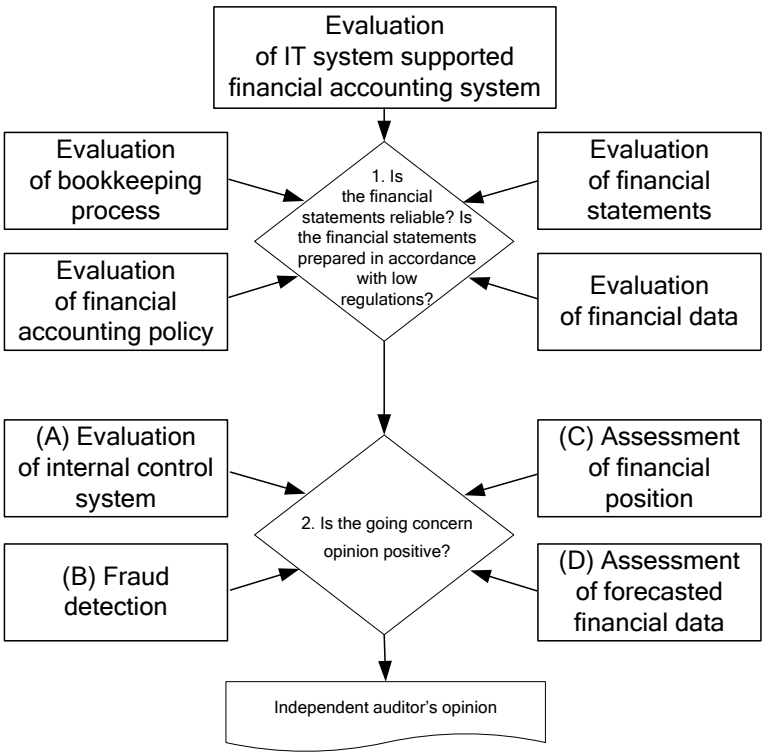
The research investigates the range of correlations between project managerial accounting system and external financial auditing. The study is conducted from manager's point of view. The research focuses mainly on the issue of entities' going concern assessment. Project-based companies were selected for the research because in literature there is no analysis in this field, in accounting journals, such as: *Accounting, Auditing & Accountability Journal*, *Accounting and Business Research*, *Accounting, Organizations and Society*, *Management Accounting Research*, *The Accounting Review* in project management journals, such as: *International Journal of Project Management*, *International Journal of Managing Project in Business*, *Project Management Journal*, and in sector project management journals, such as: *Construction, Management and Economics*, *International Journal of Construction Project Management*, *Journal of Construction Engineering & Management*. However, the correlations between companies' managerial accounting system and external financial auditing are the topic of numerous studies. In literature can be find the analysis of entities' going concern as well. The main findings connected with non-project companies in the above mentioned fields will be discussed in the paper.

The research raises the following issues: how can the auditors confirm the going concern status in project-based company? Is the support of internal project control system (ICS) needed and required in the external financial auditing (EFA) process of project-based company? What are the possible links between ICS and EFA? The empirical part of research findings results from participant observation of external financial audits conducted during year closure processes between 2007 and 2014 and a lot of discussions with financial directors and bookkeepers, as well auditors from leading market companies, such as PricewaterhousCoopers and Deloitte. The use of participant observation as a major data collection method enables to study the needs of auditors and recognise openness / willingness of the companies to share the information. The paper compares collected information with the requirements of financial accounting and auditing guidelines.

Entity's going concern opinion as a task of external financial audit

External financial audit certifies financial annual data and accounting system because it is conducted by independent auditors according to many international regulations. Applied accounting standards are approved in many countries. They are treated as a global language of finance which guarantees: comparability, comprehensibility, reliability, transparency. Regarding the European Commission robust audit is the key to re-establish trust and market confidence (Executive summary …, 2006). The financial revision enables to certify the financial presentation of company activity (mainly financial statements) and predict continuous operations

for the foreseeable future – at least till the end of the next reporting period. The scope of financial statements analysis and auditing requirements are defined in accounting legal regulations e.g.: IFRSs (International Financial Reporting Standards) and IASs (International Accounting Standards), SICs Interpretations (International Accounting Standards Interpretations), IFRICs (International Financial Reporting Standards Interpretations), Euro-Sox 8th Directive of the European Parliament and the Council (Directive on …, 2006), NAC (National Accounting Standards published by various countries), GAAS (Generally Accepted Auditing Standards), and local (national) accounting acts, International Standards on Auditing and Quality Control (Handbook of …, 2012). A lot of non-European Union countries are using other accounting standards than the above mentioned, such as US GAAP (US Generally Accepted Accounting Principles) and Sarbanes-Oxley Act of 2002. Additionally, numerous guidelines describe the roles and responsibilities of external auditors. They are prepared and published by a number of organisations, such as International Federation of Accountants and American Institute of Certified Public Accountants. The above mentioned guidelines have to be applied in project and non-project organisations.



Source: author's construction

Fig. 1. **Major issues to be clarified in the process of external financial audit**

One of the key tasks in external auditing process is to conduct the assessment of financial statements. Initially "the objective of the ordinary audit of financial statements by the independent auditor was the expression of an opinion on the fairness with which they present, in

all material respects, financial position, results of operations, and its cash flows in conformity with generally accepted accounting principles. (Auditing Standards …, 1972). The auditor's report consists of an opinion if the financial statements are presented in conformity with generally accepted accounting principles (e.g. local or international accounting standards) and to identify those circumstances in which such principles have not been consistently observed in the preparation of the financial statements. Over a time, occurred numerous frauds of auditors and managers, after a lot of bankruptcies that could be predicted during statutory audits, the requirements have expanded. Today they can be divided into two main areas – the confirmation of reliability of financial statements and the issuing of going concern opinion (Figure 1). The paper analyses the second above mentioned aspect.

The main objective of going concern concept is to assess if a company in foreseeable future will operate in the market. The concept in accounting provides a point of view to facilitate and implement assembling, communicating, and interpreting enterprise financial information (Wiseman, 1957). Auditing regulations require auditors to assess a client's going concern status. If, after considering all relevant information, the auditor has substantial doubt about the entity's ability to continue as a going concern, then the auditor is required to modify the audit report and point out the doubts (Menon & Williams, 2010). Market participants are interested in the auditor's assessment of going concern, particularly in light of the increasing number of bankruptcies because they see its usefulness in explaining excess returns occurring around bankruptcy filings (Chen and Church, 1996). On the other hand, one can observe significant influence of audit reports on loan rating decisions in organisations (Guiral-Contreras, Gonzalo-Angulo, Rodgers, 2007). However, according to the study of Menon and Schwarz (1987) less than 43% bankrupt companies were qualified on a going concern basis prior to bankruptcy. That shows the difficulties of assessing an entity's going concern status. In order to meet the needs of auditors and mangers, numerous researchers have designed support tools, such as Altman (1993) and fuzzy models (Dainiene & Dagiliene, 2013).

Although the auditing regulations inform that the auditor is not responsible for prediction of bankruptcy but for fraud detection (Auditing Standards …., 2002). In complex environment of companies it is possible only using professional support tools. A lot of surveys present the methods of fraud detection. Generally the managerial instruments are based on quantitative analysis, such as regression analysis (Mercel, 1990) and network technology (Green & Choi, 1997).

It should be emphasized that the assessment of bankruptcy or fraud detection by auditors has a lot of limitations. First is the cooperation between external control and contact persons in the analysed company. Auditors always use the data and information received from enterprise. That suggests, except for assessing current and predicted financial and non-financial data, evaluating of internal control system, especially that the audit committee plays a vital role in improving financial reporting and supporting work of external auditors (Braiotta, Gazzaway, Colson & Ramamorti, 2010). Internal control is the process by which an entity manages and controls its activity (Norman, 1991). A control system is an element to reduce the difference between the actual and desired performance levels (Meredith & Mantel, 2006).

The research shows that lack or insufficient internal control in company affected the auditor's work (Naiker & Sharma, 2009). It is a significant handicap of the auditing process because the external auditors relay on internal audit work (Schneider, 2009). Simultaneously, one should believe that the internal audit may be a tool that disclosures material weaknesses of organisations (Shu, Pizzini, Vargus & Bardhan, 2011).

Summarised, the going concern opinion can not be issued using only publicly available information (Mutchler, 1985). It is a very complex process that compares various activities, such as: evaluation of internal control system, assessment of entity's financial position in the environment, assessment of the forecasted financial and non-financial data, and fraud detection. The above mentioned activities should be executed through the cooperation between external auditors, bookkeepers, and members of internal control or audit departments. As it was mentioned in the introduction, in literature one can observe lack of analysis presenting comprehensive relations between managerial accounting and financial external audits, using project-based companies as research-subjects.

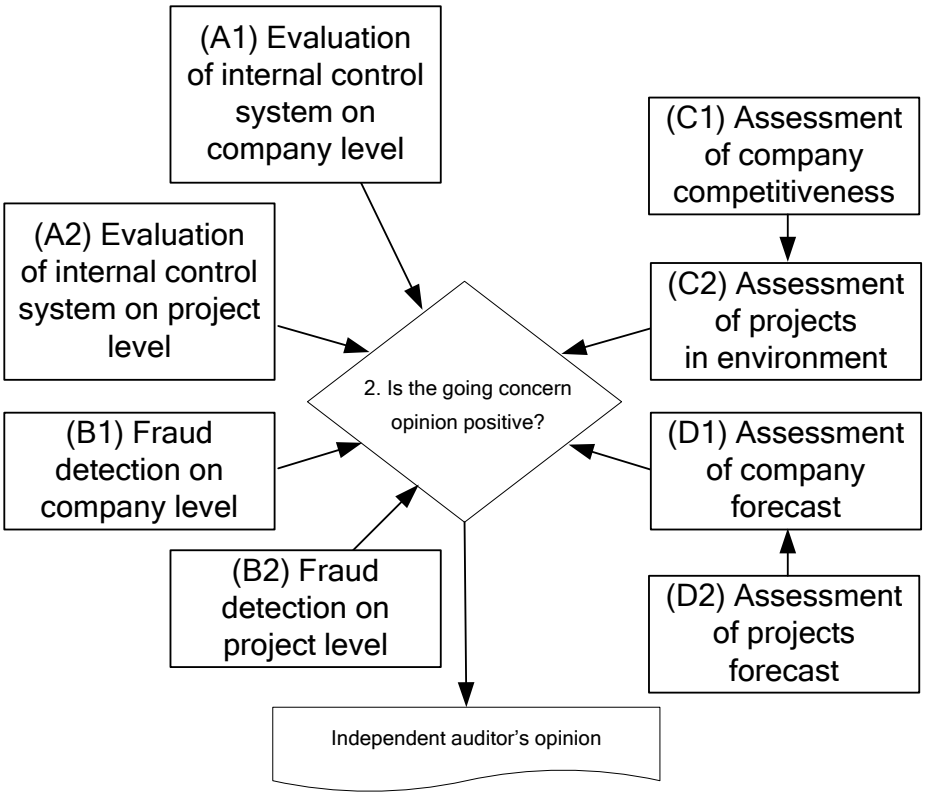
Assessment of entity's going concern status in project-based company

The main objective of going concern concept in project-based company is to assess if the entity in foreseeable future will operate in the market. Analysis of key running projects and liabilities from finished projects is required. The presented concept assumed that the projects play a vital role in described types of organisations. Going concern concept is analysed on the company and project levels (Figure 2). The assessment consists of: evaluations of internal control system and prepared predictions, the study of project statement regarding its environment, and fraud detection. The methodology of certification on the first level is in general the non-project organization equal. The main differences refer to the second one because the entity is obliged to adopt special legal requirements regarding project revenues and costs recognition.

In project-based organisation the auditor is obliged to analyse current and future situation of projects that are significant in accordance to total activity. External auditors may review project plans, designs and the completed solution, including any aspects that are linked to financial transactions. An external auditor ensures that the project meets an adequate standard from the audit perspective (Camilleri, 2011).

The specific accounting requirements regarding projects are described especially in International Accounting Standard IAS 11 "Construction Contracts", International Financial Reporting Interpretations Committee IFRIC 15 "Agreements for Construction of Real Estate", and other national regulations, such as in Poland National Accounting Standard NAS 3 "NotFinished Construction Contracts". After 1 January 2017 International Financial Reporting Standard IFRS 15 "Revenue from Contracts with Customers" will supersede the above mentioned sector regulations. The most important requirements regarding the projects refer to (IAS 11, 2012):

- separation of construction contracts (presentation each project separately),
- calculation and the change of contract value during the project execution (introduction to project budget all contractual updates),
- calculation of completion stage of a project (calculation the project progress based on real executed part of the contract),
- recognition of revenues (based on the concept percentage of completion),
- recognition of contract costs (recognition separately all project direct and indirect costs that are used to calculation of percentage of completion),
- recognition of anticipated losses (creation of reserves that have to cover additional project costs not included in accounting books).



* Capital letters in brackets are correlated with figure 1

Source: author's construction

Fig. 2. **Major areas of assessment of going concern status in project-based companies**

The above mentioned tasks are a part of internal project control system. The procedures of project execution and collected data should be evaluated in external financial auditing process. The above mentioned link is the first explored correlation between external financial auditing and project internal control. Further research enabled the preparation of more complete list of documents that should be analysed during external financial audit and pointed out the responsible departments (Table 1).

The presented table shows that external financial auditing use a lot of information preparing not only in financial accounting system but in managerial ones as well. The auditors relay on: findings of internal audit, especially regarding tests of internal controls, account records or transaction documentations, manager reports, and use internal auditors to directly assist in conducting audit procedures (Schneider, 2009), which suggests wider direct collaboration between control, risk management and audit commitment departments and the external financial auditors. It should be pointed out that the significant role of financial departments (bookkeeping, treasury etc.) is not threaded. They should be still first contact unit for external auditors.

Table 1

The selected documents required for external financial audit of project-based company

	Scope of required analysis	Departments delivered data & information
financial accounting system	General information (framework, board members, external audits and checks conducted by public institutions, guidelines and other documents of management system, financial statements, list of subsidiaries company, list of collaborating banks, etc.)	Various units of company
	Current and previous financial statements (balance sheet, profit & loss account etc.), accounting policy	Bookkeeping
	Equity, changes in equity, structure of shareholders	Bookkeeping
	Booking documentations (invoices, accounting notes etc.)	Bookkeeping
	Deferred liabilities and assets, prepayments	Bookkeeping
	List of assets (tangible/intangible) and changes during balance sheet year, valuation of assets, assets in leasing etc.	Bookkeeping
	Inventory list (in quantity and value), valuation of inventories	Bookkeeping
	Booked costs and revenues – divided into financial accounts	Bookkeeping
	Investment list, investment agreements	Finance, R&D
	Reports: cash flow, balance of ledger accounts, bank overdraft, valuation of cash, credits etc.	Bookkeeping, Finance
	Receivables list, current valuation of receivables, list of overdue receivables etc.	Bookkeeping, Finance
	Liabilities list, current valuation of liabilities, list of overdue liabilities etc.	Bookkeeping, Finance
	Taxes, deferred tax liabilities	Bookkeeping, Finance
managerial accounting system, therefore internal control system	Provision/reserve list and descriptions, thereof provisions created on projects	Controlling, Bookkeeping
	Booked costs and revenues – divided into managerial accounts and projects	Controlling
	Contract conditions, progress protocols, protocols of client's handover, project invoices	Controlling
	Planning and forecasting key data and methodic of calculation	Controlling
	Revenue calculation, stage of project completion	Controlling
	Chances and risks profile of the projects and their potential influences on the projects and company results	Controlling, Risk Management
	Audit reports regarding evaluation of business processes and status of project execution	Internal Audit
	Court cases, disputes etc.	Legal

Source: author's construction

Contribution of controlling system to going concern opinion

Controlling system continuously supports managers in taking more rational decisions (Marciniak, 2008) regarding general activity of the enterprise and especially execution in the

project phase. Its main objective is to inform right people, in right time about the state of current measures, such as: project costs divided into various cost groups (wages, salaries, materials, equipments, energy, external services etc.), work done (project performance), project and company results, ending order backlog (work done secured), and (project EBT, backlog etc.). In uncertainty conditions controlling should be supported by risk management system that is focused on continuously assessment, evaluation, treatment, and monitoring chances and risks which can occur. Internal control system should encompass both subsystems and internal audit that additionally certified them. Project control system contains the internal control system of project-based company that enables the comparison between planned and actual performance in cost and schedule (Moselhi, Li & Alkass, 2004). It aims at ensuring that the status of a project is reported accurately to the management so that problems can be identified before any detrimental impact becomes evident (Bower, 2002).

In order to better understand the existing correlations, it is important to point out the peculiarities of the above mentioned subsystems. Controlling consists of: controllers (people working in controlling department), the processes of planning, foreseeing the future, controlling the past, reporting the assessed objects, the tools enabling execution of the processes, and links between these objects and subjects (Weissman, 2005). It means that controlling:

- creates rules for planning, assessing, control, and reporting,
- supports the financial accounting by providing the data and information,
- supports external financial auditors,
- aggregates the elementary data from various units and areas of company,
- assesses and interprets the data,
- reports the prepared data and information (Horvath, 2009).

The conducted study enabled to mix the major objectives of external financial audit with the range of use the internal control system (Table 2).

Using internal control system the auditors are able to evaluate booked data with the current, real state in place (e.g. comparing costs and revenues with progress protocols or project calculations) and verify the quality of prospects (e.g. assessing applied methods and comparing the data with the results of project risk assessment). The above mentioned tasks are key objectives of external financial statements. Reliability of plan and forecast data is premise for confirmation of going concern status.

Almost all project management methodologies (Prince 2, Project Management Body of Knowledge etc.) emphasize the importance of project procurement management. It is one of the major areas of project execution and a vital element of controlling the system. The functions of such a system are to analyse and assess planning, conducting, administering, and closing the procurements. They encompass subcontractor orders, material and equipment purchases. Procurement controlling provides the data and information about current and predicted results on transactions with subcontractors and suppliers. It involves the transparency in tender processes, which should enable to achieve efficiency and effectiveness. Due to significant impact of procurements on the financial statements, they are an object of statutory audit. It requires analysing the process of procurement management and confirming the data. Proper method for it is matching the economic figures from financial accounting with the subcontractor/supplier agreements and their changes.

Table 2

The use of data and information prepared by controlling for external audit purposes

Major objectives of external financial audit*	Range of use the internal control system (information required for audit purposes)
(A) Certification of financial reporting process and provided results (financial statements etc.)	• Current costs, revenues, expenditures, incoming payments, deviations in costs to confirm the data from bookkeeping • Stage of completion to confirm the revenue from bookkeeping
(A) & (D) Certification of internal control system and provided results	• Result of analysis of controlling system (regulations, methodics of project controlling to confirm the above mentioned data) • Analysis of selected cases to confirm the controlling system operation and its usefulness as an early-warning-system • Current result of orders to subcontractors and analysis of the tender process • Current result of purchasing of materials, equipment etc. and analysis of the tender process • Result of analysis of internal audit data to compare those with result from statutory audit
(B) Approval of management system regarding fraud and compliance with laws and regulations	• Analysis of selected cases to prove the controlling system operation and its usefulness as a independent early-warning-system • Analysis of controlling system and financial accounting to confirm their collaboration and independence from direct influence on the produced data
(C) & (D) Certification of predicted data	• Chances and risks occurring and disappearing especially on the running projects to calculate the results at the project completion • Planned and forecasted data (predictions of costs, revenues, expenditures, incoming payments) to calculate key figures influencing the state of the company • Results of planning and forecast system analysis (regulations, methodics of calculation, reliability of data, fulfilling the targets) to confirm the process of creation of the above mentioned data

* Capital letters in brackets are correlated with Figures 1 and 2

Source: author's construction

Cash flow controlling analyses the incoming and outgoing payments. One of the major tasks is to warn about overdue receivables and liabilities. The analysis should provide acceptable level of liquidity on each: project, group of projects, programme, and company as well. The role of auditor is to certify the data and the process of its creation according to IAS 7 (IAS 7 …, 2012). It should confirm fulfilling the principle of going concern using cash flow history and predictions.

Conclusions

The major objective of the study was to examine the scope of support internal control system of project-based company in the assessment of entity's going concern. The research showed that external financial auditors use the additional information from managerial accounting system, to issue the opinion in the mentioned topics. It was pointed out that without information obtained from internal control system the auditor's assessment of going concern status would be much more difficult, even not possible. However, the cooperation is not a requirement and its quality depends on company openness on the auditor's needs. Mutual trust and transparency during the audit process should be a good practice. The needs of cooperation between company and its external auditors results from the objectives of external financial audits. The financial accounting system is proper to certification of entity's financial statements but insufficient to issue the going concern status. Assessing the cooperation ones should be remembered, that the auditor's opinion based on data and information obtained from entity. In many cases the company does not want to be transparent because its financial situation is not sufficient. In such case the cooperation transforms into a play between managers and auditors that have contradictory objectives. The weakness can be overcome using various method of double checking and taking to assessment adequate analysis sample.

The range of collaboration between controllers and external auditors is generally very wide. Only accounting department plays more significant role in certification of financial statements. Controlling provides data and information which confirm account records, projects stage of completion, project forecasts etc. The confirmation is especially important regarding the peculiarities of project-based companies. Without controlling many requirements from IAS and IFRS e.g recognition of revenue regarding stage of project completion in accordance with IAS 11 could not be evaluated. On the other hand risk management system informs about the risks and chances, described the conditions of uncertainty. All the above mentioned elements aim at issuing going concern status.

The presented research has a lot of limitations. First one is connected with selected method of data collection. During participation observation the opinion of expertises and their behaviours may influence the researcher's findings. Additionally, the opinion of auditors from the leading market company can be not representative for all population. However, the auditing process is standardised, which can provide comparability. Next limitation is high diversity of research subject. The peculiarities of companies from construction, pharmacy or IT sectors differs each other. Finally, the study analysed the situation where IFRS were applied. The research conducted in other legal environment could show different results.

Bibliography

Altman E., 1993. *Corporate financial distress and bankruptcy*. NewYork: John Willey & Sons.

Auditing Standards Board of the AICPA, 1972. *Statement on Auditing Standards No. 1, Section 110: Responsibilities and Functions of the Independent Auditor*. American Institute of CPAs.

Auditing Standards Board of the AICPA, 2002. *Statement on Auditing Standards No. 99: Consideration of Fraud in a Financial Statement Audit*. American Institute of CPAs.

Bower D., 2002. *Engineering Project Management*. London: Blackwell Publishing.

Braiotta L., Gazzaway R.T., Colson R.H. & Ramamorti S., 2010. *The Audit Committee Handbook*. John Wiley & Sons.

Camilleri E., 2011. *Project Success. Critical Factors and Behaviors*. Gower Publishing Ltd, 103 p.
Chen K.C.W. & Church B.K., 1996. Going Concern Opinions and the Market's Reaction to Bankruptcy Filings. *The Accounting Review*, 71(1), pp. 117-128.
Dainiene R. & Dagiliene L., 2013. Company's Going Concern Evaluation Fuzzy Model. *Economics and Management*, 18(3), pp. 374-382.
European Union, 2006. Directive on statutory audits of annual accounts and consolidated accounts. *Official Journal of the European Union*, 43/EC with updates.
European Union, 2012. Executive summary of the opinion of the EDPS on the Commission proposal for a directive amending Directive, *Official Journal of the European Union*, C 336/04.
Green B. & Choi J., 1997. Assessing the Risk of Management Fraud through Neutral Network Technology. *Auditing*, 16(1), pp. 14-28.
Guiral-Contreras A., Gonzalo-Angulo J.A. & Rodgers W., 2007. Information content and recency effect of the audit report in loan rating decisions, *Accounting and Finance*, 47(2), pp. 285-304.
Hällgren M. & Wilson T.L., 2008. The nature and management of crises in construction projects: Projects – as-practice observations, *International Journal of Project Management*, 26, pp. 830-838.
Horvath P., 2009. *Controlling*, München: Verlag Franz Vahlen, pp. 19-20 (in German).
Internal Auditing and Assurance Standards Board, 2012. *Handbook of International Quality Control, Auditing Review, Other Assurance, and Related Services Pronouncements*. The International Federation of Accountants (IFAC).
International Accounting Standards Committee, 2007. *IAS 7 Statement of Cash Flow*, IFRS Foundations.
International Accounting Standards Committee, 1993. *IAS 11 Construction Contracts*, IFRS Foundations.
Krugmann P., 2013. *End this depression now!*. New York: W.W. Norton & Company Inc.
Marciniak S., 2008. *Controlling. Teoria, zastosowanie*. Warsaw: Difin, p. 13 (in Polish).
Mercel L., 1990. Fraud Detection via Regression Analysis. *Computers and Security*, 9, pp. 331-338.
Menon K. & Schwarz K.B., 1987. An empirical investigation of audit qualification decisions in the presence of going concern uncertainties. *Contemporary Accounting Research*. 3(2), pp. 302-315.
Menon K. & Williams D.D., 2010. Investor Reaction to Going Concern Audit Reports, *The Accounting Review*, 85(6), pp. 2075-2105.
Meredith J.R. & Mantel S.J.Jr, 2006. *Project Management: A managerial Approach*. NewYork: John Wiley & Sons.
Moselhi O., Li J. & Alkass, S., 2004. Web-based integrated project control system. *Construction Management and Economics*, 22(1), pp. 35-46.
Mutchler J.F., 1985. A Multivariate Analysis of the Auditor's Going-Concern Opinion Decisin. *Journal of Accounting Research*, 23(2), pp. 668-682.
Naiker V. & Sharma D.S., 2009. Former Audit Partners on the Audit Committee and Control Deficiencies. *The Accounting Review*, 84(2), pp. 559-587.
Norman R.P, 1991. Internal control: What is it, and why is it important?. *Financial Executive*, 7(2), 1 p.
Schneider A., 2009. The nature, impact and facilitation of external auditor reliance on internal auditing. *Academy of Accounting and Financial Studies Journal*, 13(4), pp. 42-43.
Shu L., Pizzini M., Vargus M. & Bardhan I.R., 2010. The Role of the Internal Audit Function in the Disclousure of Material Weaknesses. *The Accounting Review*, 86(1), pp. 287-323.
Weissman F., 2005. *Unternehmen steuern mit Controlling*. Berlin – Heidelberg: Springer Verlag, pp. 42-43 (in German).
Wiseman D.E., 1957. The going concern concept in accounting, *The Accounting Review*, 34(4), 633 p.

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CLUSTERING APPROACH FOR ORGANIZATIONAL EVALUATION PROJECT: INTEGRATING BSC AND DEA

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Abstract

In this paper a new comprehensive clustering method is introduced which integrates data envelopment analysis (DEA) into the balanced scorecard (BSC) for complex organizations. However, DEA is essentially applied to assess organizations from the best; BSC is not used for organizational comparison. The incapability of the DEA in the input and the output index definition is the major weakness of the method. Besides, combining BSC and DEA has another complexity which is the number of decision making units (DMUs) in comparison with the number of inputs and outputs as a major drawback of the integration. Nevertheless, this is not efficient in the suggested method, which makes it to be more hard-nosed. The method considers the most important strategic factors obtained from BSC as the input data for DEA and finally calculates the relative closeness (RC) of each DMU to the ideal one. Screening out the RC indexes and plotting the scree diagram may lead us to a comprehensive clustering method to achieve the reliable appropriate results for each establishment in each point, linked to their strategic design. Finally, the proposed method is practically tested and the results are illustrated in the following paragraphs.

Key words: *Balanced Scorecard, DEA, Ranking method, Clustering, Evaluating project, project management*

JEL code: D60

Introduction

Clustering is a branch of statistical analysis that enables the analyst to divide similar objects into the same bunches (Jain et al., 2000; Goudarzi, and Ansari, 2012). Clustering methods are, in general, classified into the five categories: (1) Hierarchical clustering (Hartigan, 1975; Po et al. 2009), (2) mixture-model clustering, (3) learning model clustering, (4) partition clustering (Po et al. 2009; Mooi and Sarstedt 2011) and (5) objective-function-based clustering (Goudarzi, and Ansari, 2012). Many algorithms are proposed to cluster data based on minimizing total dissimilarity (Po et al. 2009) such as hard C-means (HCM) (Hartigan, 1975; Ross, 2004), fuzzy C-means (FCM) (Ross, 2004) and possibilistic C-means (PCM) (Krishnapuram and Keller, 1993). Po et al. (2009) introduced a new clustering method based on data envelopment analysis (DEA) in CCR scheme and Goudarzi and Ansari (2012) used the BCC concept of DEA in their method. In this paper, we propose a new method based on the Wang and Luo (2006) for clustering sub-organizations of a complex organization. The method not only uses this model as a substructure of the method, but applies balanced scorecard (BSC)

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to introduce the outputs and rather the inputs to have a complete comprehensive method for organizational clustering.

Budget and resource assessment are taking place in the competitive environment (Bentes et al. 2011), particularly in large, complex organizations. Given the multidimensionality and the complexity of the concept, Chakravarthy (1986), Venkatraman and Ramanujam (1986), and Barney (2010) advise the use of multiple measures of organizational performance. One of the most well-known multi-dimensional assessment methods is the BSC method (Kaplan and Norton, 1996). The method is first introduced by Kaplan R., (1980) and by Johnson and Kaplan (1987). But its university based idiom was denoted by Kaplan and Norton (1992). Despite, it is not completely emphasized on balanced measurement and related factors in any publication of Kaplan and Norton; Cobbole and Lawrie (2002) highlighted it and finally, the strategy plan is used to complete the model (Niven, 2003). The model is based on four fundamental factors to find the relation between strategic goals and operational controls (Golpîra and Veysi, 2012). BSC eliminates information overload and forces the management team to illuminate the organizational strategy to a level of specificity at which its implementation can be tracked (Kaplan and Norton, 1992; Stewart, 2003), but the most important drawback of the BSC is its poorly identification of metrics (Stewart, 2003).

DEA introduced by Charnes and Cooper (1978), often evaluates the decision making units (DMUs) from the best possible relative efficiency (Wang and Luo, 2006). Entani et al. (2002) and Wang et al. (2007) acquire the model to look at both the optimistic and pessimistic points, until Wang and Luo (2006) propose their model based on the relative closeness (RC) index to the ideal DMU (IDMU). Desheng (2006) and Chen (2012) propose the corrective notes on the Wang and Luo (2006) model and its application but in the field of ranking. Golpîra, (2012a) applies this version of DEA for formulating the problem of project monitoring and achieve correct comprehensive project success measurement. He focuses on it only for ranking alternatives to achieve weight factors for activities in projects. Golpîra, (2012b) employs the same concept combined with the BSC model in order to assess the organizations. We use this approach not only for evaluating sub-organizations, but for clustering. Coelli et al. (2005) advocated 11 major drawbacks that one may encounter in conducting the DEA. He advised that the exclusion of an important input or output can result in biases which are emphasized by Chen et al. (2008). In other words, the main drawback of the DEA is its weakness on identifying Input and output factors. It is noteworthy that Banker et al. (2004) use the combination of DEA and BSC to evaluate the trade-offs among different performance indexes. Chen and Chen (2007) use it to assess the performance of a semiconductor industry. Chiang and Lin (2009) apply it to assess the performance in two distinct industries. Min et al. (2008) try it in Korean hotels and Macedo et al. (2009) apply it in banking. Amado et al. (2012) apply DEA to assess performance of DMUs in only one company. It is clear that the focus of these scholars is on the performance assessment; however, we use this combination to introduce a new powerful method for clustering. Besides, Cooper et al. (2000) proposed the generally accepted principle to ensure satisfactory discrimination of the DEA method which demands:

$$n \geq \max\{m \times s, 3(m+s)\} \tag{1}$$

where n is the number of DMUs, m and s are the number of inputs and outputs. However, such conditions may not met in many applications.

BSC literature shows that the strategy map of organizations should contains at least two or three indexes for each level of the factors which is consequently introduces at least 8 factors as the outputs. Optimistically, with considering only two inputs, the methods may contain more than 30 DMUs to make a clear satisfying result. This makes the traditional methods to be complex and impractical. It is the superiority of the proposed method that is not be limited by this principle and may be used for ranking and clustering the DMUs with any number of outputs or inputs. So, in this paper, a hybrid method is proposed that handle the advantages of BSC and DEA all together and encounter the disadvantage of the DEA by the relative advantages of the BSC and TOPSIS. In other words, The BSC method is used to determine two or three most important factors in any field of its four basic fundamental factors. The factors are then used as the input data for the DEA method to make ranking and clustering in any organizations with and number of sub-organizations.

Proposed method

Suppose n DMUs, each consumes m inputs, denoted by $x_{ij}(i=1,...,m, j=1,...,n)$, to produce outputs denoted by $y_{rj}(i=1,...,s, j=1,...,n)$. A virtual DMU which uses the least inputs, $x_i^{\min}(i=1,...,m)$, to produce the most outputs, $y_r^{\max}(r=1,...,s)$, and a DMU, which consume the most inputs, $x_i^{\max}(i=1,...,m)$, to generate the least outputs, $y_r^{\min}(r=1,...,s)$ can be defined as ideal decision making unit (IDMU) and anti ideal decision making unit (ADMU) respectively. To completing the model, the LP model shown in Equations (2) and (3) must be solved for all DMU_s such as DMU_0 to calculate the $\theta_{j0}^*, \varphi_{j0}^*$, where $j0$ is the DMU under evaluation (denoted by DMU0), u_r, v_i are decision variables, ε is the non-Archimedean infinitesimal, θ_{IDMU}^* is the optimum efficiency of IDMU that may calculated by Equation (4) and φ_{ADMU}^* is the worst efficiency of the ADMU that may calculated by Equation (5). It is obvious that the relative closeness index of DMU0 to IDMU is defined by Equation (6). It is clear that the bigger the RC_{j0} value is the-better-the-performance of DMU_0.

$$
\begin{aligned}
Max \quad & \theta_{j0} = \sum_{r=1}^{s} u_r y_{rj0} \\
s.t. \quad & \sum_{i=1}^{m} v_i x_{ij0} = 1 \\
& \sum_{r=1}^{s} u_r y_j^{\max} - \sum_{i=1}^{m} v_i (\theta_{IDMU}^* x_i^{\min}) = 0 \\
& \sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0 \quad j = 1,\dots,n \\
& u_r, v_i \ge \varepsilon \quad \forall r, i
\end{aligned}
\tag{2}
$$

$$
\begin{aligned}
Min \quad & \phi_{j0} = \sum_{r=1}^{s} u_r y_{rj0} \\
s.t. \quad & \sum_{i=1}^{m} v_i x_{ij0} = 1 \\
& \sum_{r=1}^{s} u_r y_j^{\min} - \sum_{i=1}^{m} v_i (\phi_{IDMU}^{*} x_i^{\max}) = 0 \\
& \sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0 \quad j = 1, \ldots, n \\
& u_r, v_i \ge \varepsilon \quad \forall r, i
\end{aligned}
\tag{3}
$$

$$
\begin{aligned}
Max \quad & \theta_{IDMU} = \sum_{r=1}^{s} u_r y_r^{\max} \\
s.t. \quad & \sum_{i=1}^{m} v_i x_i^{\min} = 1 \\
& \sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0 \quad j = 1, \ldots, n \\
& u_r, v_i \ge \varepsilon \quad \forall r, i
\end{aligned}
\tag{4}
$$

$$
\begin{aligned}
Min \quad & \phi_{ADMU} = \sum_{r=1}^{s} u_r y_r^{\min} \\
s.t. \quad & \sum_{i=1}^{m} v_i x_i^{\max} = 1 \\
& \sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0 \quad j = 1, \ldots, n \\
& u_r, v_i \ge \varepsilon \quad \forall r, i
\end{aligned}
\tag{5}
$$

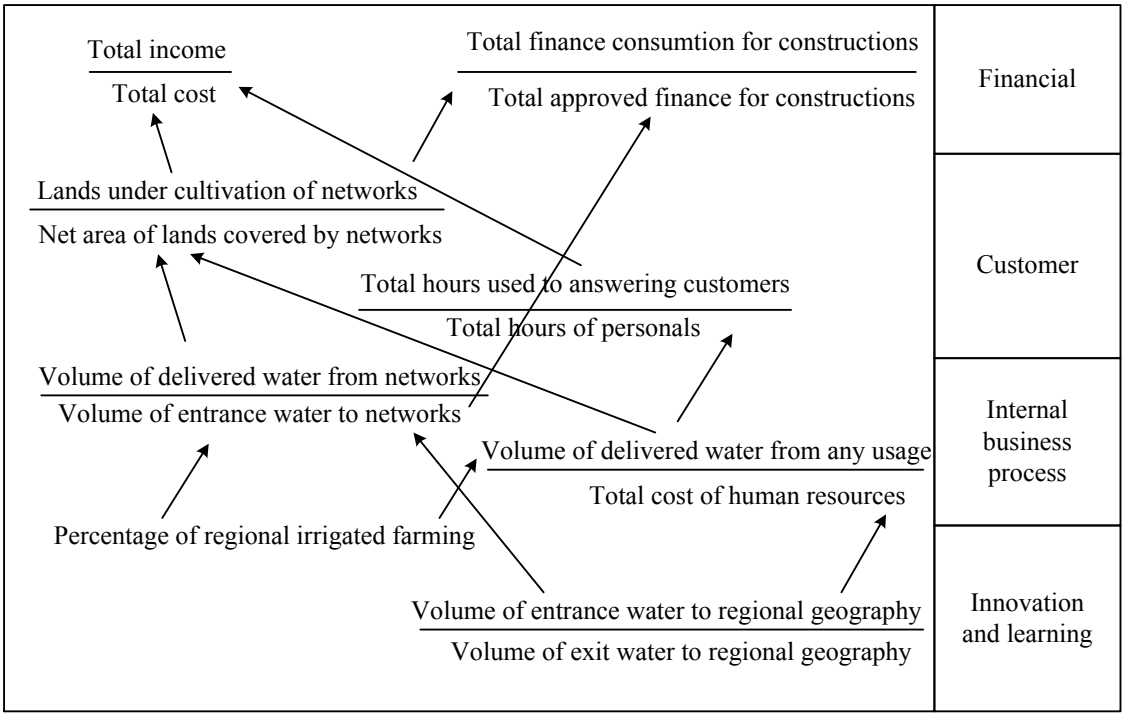
$$
RC_{j0} = \frac{\varphi_{j0}^{*} - \varphi_{ADMU}^{*}}{(\varphi_{j0}^{*} - \varphi_{ADMU}^{*}) + (\theta_{IDMU}^{*} - \theta_{j0}^{*})} \tag{6}
$$

The RC indexes are sorted in descending order and plotted in the way which is similar to the scree plot in the hierarchical clustering method. In this diagram, the sharp increase in RC illustrates a new cluster in DMU_s. As per validating the method, it is successfully installed in 10 sub organization of Kermanshah Regional Water Organization Company which is illustrated in the last section.

Empirical study

The data for this study are taken in from the Kermanshah Regional Water Organization, Iran. The data included 53 creditable performance indexes that factor analysing in SPSS

software classifies them into four levels of factors. Data are classified as: (1) 10 financial indexes, (2) 7 internal business process indexes, (3) 7 customer Indexes, (4) 24 innovation and learning indexes. Indexes are given to experts to give a privilege to them according to organizational predefined strategies. Consequently, "five point Likert" and "factor analysis" methods are used to prove the classification. Then the most important indexes in each four levels are chosen. After linking the factors in BSC procedure, the strategic map is given as shown in Fig. 1. These indexes are used as the outputs for the DEA method. Seven inputs which are strongly related to these outputs are also selected and the real data are collected from the 10 sub-organization of the Kermanshah Water Regional Organization which are illustrated in Table 1. Finally, DEA is used to rank these sub-organizations using factors which are indicated on the strategy map. The results are illustrated in Table 2.



Source: author's construction based on (Golpîra and Veysi, 2012)

Fig. 1. **Strategy map of Kermanshah Regional Water Organization**

What is indicated in column five (RC) of Table 2 shows the difference of the sub-organizations. So managers not only can clearly recognize the differences between their organizations to others, but also the related distances can show the intensity of these differences. This information helps the manager to have a better view to perceive the position of his/her organization and enhance an ability to compare it with other similar ones in terms of the organizational strategic goals that may be changed and updated over its life cycle. This ranking is based on the other similar organizations that make it possible and acceptable for any others.

Table 1

Inputs and outputs data for 10 sub-organization of Kermanshah Water Regional Organization

	DMU	X_1	X_2	X_3	X_4	X_5	X_6	X_7	
1	DMU_1	46963	54	990	169934.1	75357	273600	16	
2	DMU_2	37570.4	9	99	118953.87	52749.9	164160	16	
3	DMU_3	16437.05	12.6	264	101960.46	45214.2	68400	14	
4	DMU_4	16437.05	32.4	330	33986.82	33910.65	54720	14	
5	DMU_5	18785.2	7.92	231	254901.15	22607.1	76608	14	
6	DMU_6	28177.8	6.48	198	169934.1	33910.65	109440	16	
7	DMU_7	37570.4	14.04	264	339868.2	15071.4	191520	16	
8	DMU_8	11740.75	16.74	330	254901.15	36171.36	54720	14	
9	DMU_9	7044.45	13.68	429	169934.1	37678.5	41040	12	
10	DMU_{10}	14088.9	13.14	165	84967.05	16578.54	27360	14	
	Max	46963	54	990	339868.2	75357	273600	16	
	Min	7044.45	6.48	99	33986.82	15071.4	27360	12	
	DMU	**Y_1**	**Y_2**	**Y_3**	**Y_4**	**Y_5**	**Y_6**	**Y_7**	**Y_8**
1	DMU_1	3	0.148148148	0.007595767	9.185965736	0.34	0.508632244	0.86	16
2	DMU_2	0.75	0.333333333	0.005086451	6.450145506	0.2	0.537696944	0.56	16
3	DMU_3	0.4	0.047619048	0.00356536	9.505477587	0.23	0.406905795	0.57	14
4	DMU_4	0.333333333	0.032716049	0.00604561	2.376369397	0.19	0.565146938	0.39	14
5	DMU_5	0.514705882	0.116161616	0.0042048	7.311905836	0.26	0.339088163	0.56	14
6	DMU_6	0.384615385	0.114197531	0.002351071	4.558749455	0.39	0.429511673	0.67	16
7	DMU_7	0.133333333	0.196581197	0.006103741	10.04864774	0.23	1.449601895	0.56	16
8	DMU_8	0.609756098	0.05734767	0.006076614	9.820710263	0.19	0.635790305	0.48	14
9	DMU_9	0.928571429	0.097953216	0.00795747	3.830045914	0.18	0.345869926	0.56	12
10	DMU_{10}	0.304878049	0.04718417	0.004702141	4.616946257	0.25	0.439273302	0.45	14
	Max	3	0.333333333	0.00795747	10.04864774	0.39	1.449601895	0.86	16
	Min	0.133333333	0.032716049	0.002351071	2.376369397	0.18	0.339088163	0.39	12

Source: author's calculations based on Fig. 1 on the Kermanshah Water Organization real data

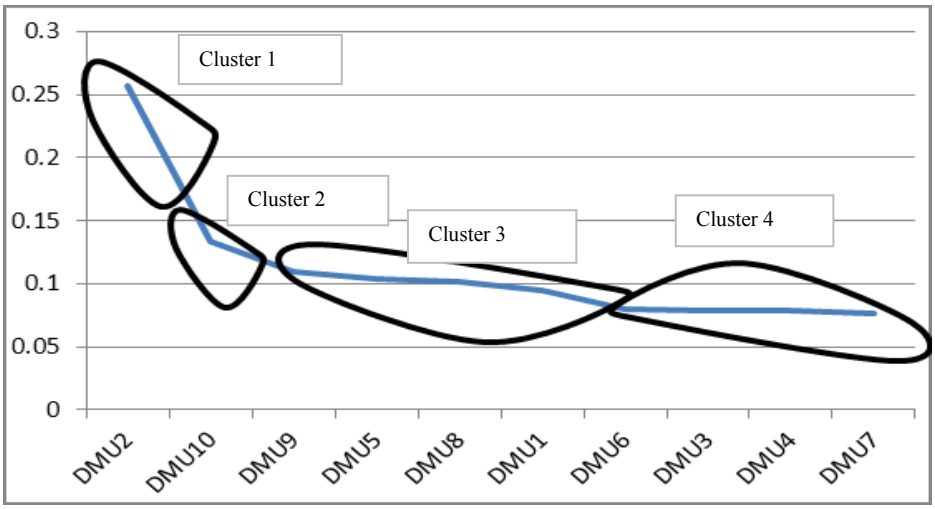
Table 2

DEA Results

	DMU	φ*(ADMU)	Θ*(IDMU)	RC	rank
1	DMU_1	1.16903	1	0.0953237213371733	6
2	DMU_2	3.573291	0.95	0.256965674488989	1
3	DMU_3	1	0.6497418	0.0786201569817434	8
4	DMU_4	1	0.5973795	0.0782527880957957	9
5	DMU_5	1.308757	0.7616327	0.104458622564129	4
6	DMU_6	1.018273	0.5963	0.0797457146743756	7
7	DMU_7	1	0.4182025	0.0770212647288676	10
8	DMU_8	1.257319	0.8997455	0.101623935288267	5
9	DMU_9	1.346556	1	0.109727723753503	3
10	DMU_{10}	1.647861	1	0.133152584206886	2
11	IDMU	-	10.92647	-	-
12	ADMU	0.1231	-	-	-
$\varepsilon = 1 \times 10^{-6}$					

Source: author's calculations based on Table 1

As per completing the proposed clustering procedure the scree diagram is plotted in Fig. 2. One can see that the diagram has sharp increasing shape in some points which produces 4 partitions. The clustering is graphically obvious but the hierarchical clustering method is used to define the number of clusters and this number of clustering is used as the input of the hard C-means method to have a clear predefined valid clustering. This process is done by using SPSS software which its results are shown in Table 3. The results show that the optimal number of clusters is 4 clusters which are used to have final clustering by using hard C-means method. The results are shown in Table 4, Table 5 and Table 6. The results are clearly emphasizing on what is achieved in the proposed method.



Source: author's construction based on Table 1

Fig. 2. **Final clustering results**

Table 3

Hierarchical clustering results

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	8	9	0.000	0	0	2
2	7	8	0.000	0	1	3
3	7	10	0.000	2	0	7
4	4	5	0.000	0	0	5
5	3	4	0.000	0	4	6
6	3	6	0.000	5	0	7
*7	3	7	0.001	6	3	8
8	2	3	0.002	0	7	9
9	1	2	0.026	0	8	0

Source: author's calculations based on Table 1

Table 4

Hard C-means cluster membership

Case Number	VAR00001	Cluster	Distance
1	DMU2	1	0.000
2	DMU10	2	0.000
3	DMU9	3	0.007
4	DMU5	3	0.002
5	DMU8	3	0.001
6	DMU1	3	0.007
7	DMU6	4	0.001
8	DMU3	4	0.000
9	DMU4	4	0.000
10	DMU7	4	0.001

Source: author's calculations based on Fig. 2 and Table 3

Table 5

Hard C-means final clustering centers results

	Cluster			
	1	2	3	4
VAR00002	0.256966	0.133153	0.102784	0.078410

Source: author's calculations based on Fig. 2 and Table 3

Table 6

ANOVA results

	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
VAR00002	0.009	3	0.000	6	470.700	0.000

Source: author's calculations based on Fig. 2 and Table 3

Conclusion

This study introduces a new comprehensive clustering system based on DEA and BSC methods. The basic BSC is used to define the important factors in organizational performance which leads the system having valid and strategic-based measurement factors. These factors are used as the outputs of the DEA method and trying the relative inputs with no limitations. The Wang and Luo (2006) DEA method is subsequently used to define the RC indexes for all of the DMUs and finally the DMUs are graphically classified by using the scree plot and focusing upon sharpness of the diagram. The results are exactly and clearly validated by using

two well-known traditional clustering methods. The salient superiority of the system is its ability to encounter with clustering problems without any limitation of number of inputs/outputs or the number of DMUs. The other superiority of the system is its comprehensiveness and practical characteristics. The simple graphical process is the other advantage of the method that makes it understandable and acceptable in addition to its capability to be used as the ranking, benchmarking and clustering method synchronously. The numerical results are clearly validating the method and make it practical.

Bibliography

Amado, C.A.F., Santos S.P., Marques P.M., 2012. *Integrating the Data Envelopment Analysis and the Balanced Scorecard approaches for enhanced performance assessment*, Omega 40, pp. 390-403.

Banker RD, Chang H., Janakiraman SN, Konstans C. A., 2004. *Balanced Scorecard analysis of performance metrics*. European Journal of Operational Research, 154, pp. 423-436.

Barney J., 1996. *Gaining and Sustaining Competitive Advantage*. (4th ed.) Upper Saddle River: Prentice Hall, 2010.

Bentes AV, Carneiro J., DaSilva J.F., Kimura H., 2011. *Multidimensional assessment of organizational performance: Integrating BSC and AHP.* J. Bus. Res., doi: 10.1016/ j. jbusres. 2011.10.039.

Chakravarthy B., 1986. *Measuring strategic performance.* Strategic Management J., 7, pp. 437-458.

Charnes, A., Cooper, W. W., & Rhodes E., 1978. *Measuring the efficiency of decision making units*. European Journal of Operation Research, 2, pp. 529-444.

Chen J.X., 2012. *A comment on DEA efficiency assessment using ideal and anti-ideal decision making units*. Applied Mathematics and Computation, 219, pp. 583-591.

Chen T-y Chen L., 2007. *DEA performance evaluation based on BSC indicators incorporated: the case of semiconductor industry*. International Journal of Productivity and Performance Management, 56, pp. 335-357.

Chen T-y, Chen C-B, Peng S-Y, 2008. *Firm operation performance analysis using data envelopment analysis and Balanced Scorecard: a case study of a credit cooperative bank*. International Journal of Productivity and Performance Management 57, pp. 523-539.

Chiang C-Y, Lin B., 2009. A*n integration of Balanced Scorecards and data envelopment analysis for firm's benchmarking management*. Total Quality Management, 20, pp. 1153-1172.

Cobbole I. and Lawrie G., 2002. *The development of the balanced scorecard as a strategic management tool.* Proceeding of International Conference on Performance Measurement and Management, pp. 17-19.

Coelli, T., Rao D. P., & Batteese G. (2005). *An introduction to efficiency and productivity analysis*. London, Kluwer Academic Publishers.

Cooper, W. W., Seiford, L. M. & Tone, K., 2000. *Data Envelopment Analysis: A Comprehensive Text with Models- Applications, References and DEA-Solver Software*. Kluwer Academic Publishers, Boston.

Dsheng W., 2006. *A note on DEA efficiency assessment using ideal point: An improvement of Wang and Luo's model*. pplied Mathematics and Computation, 183, pp. 819-830.

Entani T., Maeda Y., & Tanaka H., 2002. *Dual models of interval DEA and its extension to interval data*. European Journal of Operational Research, 136, pp. 32- 45.

Golpîra, H., 2012a. *Real project success measurement by using data envelopment analysis.* 1st International Scientific Conference on Project Management in the Baltic Countries.

Golpîra H. and Veysi B., 2012. *Flexible balanced Scorecard for nonprofit organizations*. Advances in Industrial Engineering, Information and Water Resources, pp. 139-146.

Golpîra, H., 2012b. *A new method to organizational ranking: Integrating BSC and DEA*. International Journal of Reasearch in Industrial Engineering, pp. 39-47.

Goudarzi, M.M.R., Ansari J.M.R., 2012. *Clustering decision making units (DMUs) using full dimensional effect factors (FDEFs) of PPS with BCC Technology*. Applied Mathematic Science, 6, pp. 1431-1452.

Hartigan J.A., 1975. *Clustering Algorithms*. Wily, New York.

Jain, A. K., Duin, R. P. W., Mao, J., 2000. *Statistical pattern recognition: A review*. IEEE Transactions on Pattern Analysis and Machine Intelligence 22, pp. 4-37.

Johnson H.T., and Kaplan, R.S., 1987. *Relevance Lost.* Harvard Business Press.

Kaplan R., Norton D., 1996. *The Balanced Scorecard: Translating Strategy into Action*. Boston: Harvard Business Press.

Kaplan R.S. and Norton D.P. X., 1992. *The balanced scorecard-measures that drive performance*. Harvard Business Review.

Krishnapuram, R., Keller, J. M., 1993. *A possibilistic approach to clustering*. IEEE Transactions on Fuzzy Systems, 1, pp. 98-110.

Macedo MA, Barbosa AC, Cavalcante GT., 2009. *Performance of bank branches in Brazil: applying data envelopment analysis (DEA) to indicators related to the BSC perspectives*. E&G Revista Economiae Gestao, 19, pp. 65-84.

Min H, Min H, Joo S-J., 2008. *A data envelopment analysis based Balanced Scorecard for measuring the comparative efficiency of Korean luxury hotels*. International Journal of Quality & Reliability Management, 25, pp. 349-365.

Mooi E. and Sarstedt M., 2011. *A Concise Guide to Market Research*. DOI 10.1007/ 978-3-642-12541-6_9, # Springer-Verlag Berlin Heidelberg.

Niven P.R., 2003. *Balanced Scorecard Step-By-Step for Government and Nonprofit Agencies*. John Wiley & Sons, 87 p.

Po R.W., Guh Y.Y., Yang M.S., 2009. *A new clustering approach using data envelopment analysis*. European Journal of Operational Research 199, pp. 276-284.

Ross T.J., 2004. *Fuzzy logic with engineering applications*. (2nd ed.), Wily, New York.

Stewart R.A., 2003. *Lifecycle management of information technology (IT) projects in construction*, Griffith University.

Venkatraman N., Ramanujam V., 1986. *Measurement of business performance in strategy research: a comparison of approaches*. Acad. Manage Rev., 11, pp. 801-814.

Wang Y.M., and Luo Y., 2006. *DEA efficiency assessment using ideal and anti-ideal decision making units.* Applied Mathematics and Computation, 173, pp. 902-915.

Wang Y.M., Greatbanks R., & Yang J.B., 2007. *Measuring the efficiency of decision making units using interval efficiencies*. European Journal of Operation Research.

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ON STOCHASTIC TIME-COST-QUALITY TRADE-OFF IN PROJECT SCHEDULING

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Abstract

In this paper, the quality parameter is embedded in the traditional time-cost trade-off problem under some environmental uncertainty in order to develop a time-cost-quality trade-off problem (TCQTP) in a multi-phase project. To do this, we propose a new approach based on goal programming and robust optimization formulation to deal with the problem. To the best of our knowledge, this problem has not been extensively treated in the literature yet. Computational results which are presented in the following sections show the applicability and usefulness of the method.

Key words: *Time cost, quality trade-off, Stochastic optimization, Uncertainty*

JEL code: C61

Introduction

Time, cost and quality are usually three interdependent crucial objectives which are often randomly traded off in project practices in the absence of effective tools.

In a project scheduling, it is by and large taken to shorten duration of some activities through consuming extra budget in order to achieve shorter project completion time. This approach that can be taken under either some pre-defined budget or a threshold of project completion time, is known as time-cost trade-off problem (TCTP). This problem leads to a counterbalance between the project completion time and its' total cost. According to (Salmasnia et al., 2012), some TCTP studies can be classified regarding to some modelling factors such as: 1) stochastic or deterministic environment that forces the network to be CPM (Hazır et al., 2010a), PERT ((Abbasi and Mukattash, 2001; Foldes and Soumis, 1993; Mokhtari et al., 2010) or GERT (Arisawa and Elmaghraby, 1972); 2) cost function behaviour that can be discrete (Bregman, 2009), Linear continuous (Mitchell and Klastorin, 2007), non-linear convex (Berman, 1964) and linear-piecewise; 3) controllable variable in cost function which can be in the modes of activities with allocated budget (Abbasi and Mukattash, 2001) or resources (Sunde and Lichtenberg, 1995); 4) response variable in cost function which can be activity costs (Sunde and Lichtenberg, 1995) or its' durations (Godinho and Costa, 2007); 5) type of distribution function of cost and duration which can be Beta (Abbasi and Mukattash, 2001), Normal (Golenko-Ginzburg and Gonik, 1998) Exponential and Erlang (Azaron and

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Tavakkoli-Moghaddam, 2006); 6) objective function which can be maximizing project completion probability in a predefined deadline with limited budget (Abbasi and Mukattash, 2001), minimizing direct cost to obtain a pre-defined threshold of mean completion time (Foldes and Soumis, 1993), minimizing direct cost to reach a predefined threshold of project completion probability in a deadline (Mokhtari et al., 2010), minimizing the total cost, including direct and indirect approaches (Gutjahr et al., 2000), minimizing mean of project completion time and minimizing variance of completion time and cost (Azaron and Tavakkoli-Moghaddam, 2006) and minimizing mean of project completion time and minimizing mean of total project cost (Godinho and Costa, 2007); and 7) the solution approaches that contains exact approaches (Arisawa and Elmaghraby, 1972; Azaron and Tavakkoli-Moghaddam, 2006; Gutjahr et al., 2000), Heuristic approaches (Bregman, 2009; Foldes and Soumis, 1993) and meta-heuristic approaches (Aghaie and Mokhtari, 2009).

The above researches consider only two dimensions of the projects that are time and cost, but the other critical project dimension – quality – is completely missed. Babu and Suresh (1996) suggest that project quality may be affected by project crashing and develop linear programming models to study the time-cost-quality trade-off (TCQTP). Khang and Myint (1999) describe their attempt to apply the method to an actual cement factory construction project in Thailand. El-Rayes and Kandil (2005) design a model as a multi-objective genetic algorithm to transform the traditional TCTP to an advanced three-dimensional TCQTP. Iranmanesh et al. (2008) propose a discrete multi-mode model of TCQTP to deal with the problem. Pour et al. (2012) propose fuzzy logic theory to consider affecting uncertainty in project quality for discrete TCQTP. Zheng (2014) studies the fuzzy time-cost-quality trade-off problem for construction project and establishes a decision making model with multiple modes under resource-constrained environment. Golpîra and Hejazi (2014) propose a scenario based stochastic TCQTP over a multi-objective approach under this assumption that the probability of each scenario is available.

In this paper, we formulate a TCQTP based on scenario based stochastic optimization for multi-phase project scheduling problem that is, a well-known optimization attitude under uncertainty. SP applies probabilistic models to deal with uncertain data in terms of probability distributions. When accurate distributional information is available, stochastic programming has the advantage of incorporating this available distributional data; however, stochastic programming models are usually computationally more demanding (Hazır et al., 2010b). To do this, we use a goal programming approach in order to deal with the budget constraint. Our research and Golpîra and Hejazi (2014) address a TCQTP through the same methodology; however the approaches and the contributions of these papers are quite different. Golpîra and Hejazi (2014) introduce a stochastic approach and their model is not addresses the uncertainty of all the project costs unless the costs related directly to the duration of activities. But in this research, we use the approach that is introduced by Mulvey et al. (1995) in new point of view that uses a goal programming idea to obtain stochastic modelling. To the best our knowledge, this paper is the first research to introduce this approach. The remainder of this paper is organized as follows: Section 2 defines the proposed TCQTP. Section 3 presents an illustrative example to investigate the effectiveness of the developed method. Finally, the concluding remarks are reported in Section 4.

Problem statement

A scenario based stochastic multi-objective modelling for TCTP is as follows:

$$Minimiz\ \mathrm{z} = \left(\sum_{s=1}^{S}\sum_{i=1}^{I} p_s\left(d_{si}^{+}+d_{si}^{-}\right)\right)+\left(\left(\sum_{p=1}^{P} p_s\sum_{s=1}^{S} a_{sp}x_{sp}\right)+\delta\left(\sum_{s=1}^{S} p_s\left(\Omega_s^{+}+\Omega_s^{-}\right)\right)\right) \quad (1)$$

$$s.t: \quad \sum_{p=1}^{P} x_{sp} - d_{si}^{+} + d_{si}^{-} = T_s \quad ,s=1,...,S,\ i=1,...,I \quad (2)$$

$$\sum_{p=1}^{P} c_{sp}x_{sp} - d_{si}^{+} + d_{si}^{-} = TC_s \quad ,s=1,...,S,\ i=1,...,I \quad (3)$$

$$\sum_{p=1}^{P} l_{sp}x_{sp} - d_{si}^{+} + d_{si}^{-} = Q_s \quad ,s=1,...,S,\ i=1,...,I \quad (4)$$

$$\sum_{p=1}^{P} a_{sp}x_{sp} - p_s\sum_{p=1}^{P}\sum_{s=1}^{S} a_{sp}x_{sp} = \Omega_s^{+} - \Omega_s^{-} \quad ,\mathrm{s}=1,...,S \quad (5)$$

$$x_{sp} \geq 1, \quad s=1,...,S,\ i=1,...,I \quad (6)$$

$$d_{si}^{+}, d_{si}^{-} \geq 0, \quad s=1,...,S,\ i=1,...,I \quad (7)$$

$$\Omega_s^{+}, \Omega_s^{-} \geq 0, \quad s=1,...,S. \quad (8)$$

The index s is the scenario number, i is the constraint number and p is the project phase number. p_s is the probability of the scenarios and d_{si}^{+}, d_{si}^{-} are respectively the under-achievement and over-achievement of the i^{th} goal of the scenario set. x_{sp} is the duration of phase p over scenario s.

Constraint (1) represents the total cost of the project that is contains the expected amount of the deviational variables in the first term, and the human resource cost variability and model infeasibility penalty in the last term. Constraint (2) denotes the total estimated time of the project. T_s in this constraint, is the total time of the project over scenario s. Constraint (3) reveals the relation between total cost of the project and the duration of the phases of the project. The parameter TC_s in this constraint is the total cost of the project over scenario s except the costs of human resources. Constraint (4) explains the linkage between phase's duration and the quality that must be achieved. Q_s in this constraint is total quality achieved over scenario s. δ is the penalty that is assigned to control the deviation which may be accrued in constraint (5). This constraint contains the cost of human resources and the parameter a_{sp} is the per-unit

human resource for phase p over scenario s of the project. Constraints (6)-(8) reveal the positivity of the variables. The two additional variables, Ω_s^+, Ω_s^- are interpreted as the amount by which the expected value of the human resource costs is less or more than the exact one according to the scenarios, respectively.

Simulation and results

To illustrate the usefulness and practicability of the proposed approach, an empirical case is studied. A real project containing three phases- planning, scheduling and controlling- is given as a case. The data for this study are collected in winter 2013 in Kurdistan that is previously addressed by Golpîra and Hejazi (2014). The data of the problem are illustrated in Table 1 and Table 2.

Table 1

Problem data of each scenario over each scenario

Phases	Probability of Scenarios	Scenario	Human and material resource monthly cost			Other monthly costs	Monthly cost of quality
1	0.40	1	29	26	27	20	30
		2	20	27	23	26	5
		3	15	27	15	30	20
2	0.35	1	19	10	13	20	24
		2	17	21	19	18	4
		3	10	21	21	25	16
3	0.25	1	15	13	22	18	22.5
		2	21	10	19	20	3.75
		3	17	16	14	40	15

Source: author's calculations based on Golpîra and Hejazi (2014)

Table 2

Problem data of the total project

Scenario	Total cost of the project	Timetable of the project	Total cost of quality of the project
1	1000	36	3.5
2	800	30	3
3	750	24	4

Source: author's calculations based on Golpîra and Hejazi (2014)

The problem is a linear stochastic goal programming which is simply solvable by Lingo software. The results are shown in Table 3. In this table symbol k is assigned to enumerate the number simulations.

Table 3

Solution data about the empirical exam

kth*simulation*	$\delta = 0$			$\delta = 1$		
	3	**2**	**1**	**3**	**2**	**1**
d_{11}^{+}	0	0	0	0	0	0
d_{11}^{-}	2.2	2.2	2.2	14.54	20.38	2.2
d_{12}^{+}	0	0	0	0	0	0
d_{12}^{-}	0	0	0	370.4	545.66	0
d_{13}^{+}	0	0	0	0	0	0
d_{13}^{-}	1.68	1.68	1.68	2.29	2.58	1.68
d_{21}^{+}	2.48	9.85	9.85	2.48	9.85	9.46
d_{21}^{-}	0	0	0	0	0	0
d_{22}^{+}	0	0	0	0	0	0
d_{22}^{-}	0	0	0	0	0	7.76
d_{23}^{+}	0	0	0	0	0	0
d_{23}^{-}	0.88	1.17	1.17	0.88	1.17	1.19
d_{31}^{+}	0	0	0	0	6.48	4.97
d_{31}^{-}	4.2	4.2	4.2	4.03	0	0
d_{32}^{+}	0	0	0	0	0	0
d_{32}^{-}	0	0	0	0	0	0
d_{33}^{+}	0	0	0	0	0	0
d_{33}^{-}	2.63	2.63	2.63	2.62	2.37	0
x_{11}	1	1	1	1	1	1
x_{12}	1	1	1	1	1	1
x_{13}	31.8	31.8	31.8	19.45	13.61	31.8
x_{21}	1	37.85	37.85	1	37.85	37. 46
x_{22}	1	1	1	1	1	1

k^{th} *simulation*	$\delta = 0$			$\delta = 1$		
	3	**2**	**1**	**3**	**2**	**1**
x_{23}	30.48	1	1	30.48	1	1
x_{31}	1	1	1	1.29	20.43	7.62
x_{32}	1	1	1	1	1	12.06
x_{33}	17.8	17.8	17.8	17.66	9.05	9.28
Q_1^+	111.67	322.83	57.43	0	0	0
Q_1^-	0	0	0	0	0	0
Q_2^+	0	0	62.48	0	0	0
Q_2^-	73.53	168.26	0	0	0	0
Q_3^+	0	0	0	0	0	0
Q_3^-	75.73	280.96	179.36	0	0	0
Objective	**418.7664**	**595.8841**	**476.6866**	**498.5399**	**654.0337**	**536.244**

Source: author's calculations based on Table 1 and Table 2

As one can see, the penalty coefficient δ which is assigned to control the human recourse cost variability is designed to be 0 or 1. If the δ is 0, the value of the variables Q_1 , Q_2 , Q_3 allowed to be nonzero as the human and material resource variability. But if the δ is 1, the value of the variables Q_1 , Q_2 , Q_3 are zero. In other words, it forces the variability of the human and material resource costs to be zero. On the other hand, if the manager wants to have a less duration, he/she can chose the scenario 1 that forces the project quality to be less than what expected, but makes the total costs to have no change in $\delta = 0$, and the human and material resource cost is forced to be more than its expected value. But it changes the total costs to be more than what expected, if the value of the δ is fixed on 1. So, the manager enforced to have more human and material resource costs to reach the better level of quality and project completion time. In scenario 2, if the value of the δ is 1, the manager encountered with extended project time and more cost of quality with no change in the human and resource cots and total costs. So, if the manager wants to have a fixed value of costs, he/she may encounter with some loss in quality and have extended project time. In scenario 3, all of the parameters are not worst in comparison with their expected values. In other words, if the manager selects the scenario 3, the trade-off is not needed and the project may be finished exactly.

Conclusion

In this paper, we consider the time-cost-quality trade-off problem in the field of project management under stochastic manner to handle the uncertainty of the real world project environment. The scenario approach is employed to deal with the problem. The results illustrate

that the model exactly helps the decision maker to have some alternatives and in this decision making helps him/her to make better optimal trade-offs among all the critical factors of the project. In addition to handling uncertainty, the variety of scenarios that can be considered, numerous constraints that may be indicated in the model and its simplicity and solvability are making the model more flexible and practical in real worlds.

Bibliography

Abbasi, G.Y., Mukattash, A.M., 2001. Crashing PERT networks using mathematical programming. International Journal of Project Management 19, pp. 181-188.

Aghaie, A., Mokhtari, H., 2009. Ant colony optimization algorithm for stochastic project crashing problem in PERT networks using MC simulation. The International Journal of Advanced Manufacturing Technology 45, pp. 1051-1067.

Arisawa, S., Elmaghraby, S.E., 1972. Optimal time-cost trade-offs in GERT networks. Management Science 18, pp. 589-599.

Azaron, A., Tavakkoli-Moghaddam, R., 2006. A multi-objective resource allocation problem in dynamic PERT networks. Applied Mathematics and Computation 181, pp. 163-174.

Babu, A., Suresh, N., 1996. Project management with time, cost, and quality considerations. European Journal of Operational Research 88, pp. 320-327.

Berman, E.B., 1964. Resource allocation in a PERT network under continuous activity time-cost functions. Management Science 10, pp. 734-745.

Bregman, R.L., 2009. A heuristic procedure for solving the dynamic probabilistic project expediting problem. European Journal of Operational Research 192, pp. 125-137.

El-Rayes, K., Kandil, A., 2005. Time-cost-quality trade-off analysis for highway construction. Journal of construction Engineering and Management 131, pp. 477-486.

Foldes, S., Soumis, F., 1993. PERT and crashing revisited: Mathematical generalizations. European Journal of Operational Research 64, pp. 286-294.

Godinho, P.C., Costa, J.P., 2007. A stochastic multimode model for time–cost tradeoffs under management flexibility. OR Spectrum 29, pp. 311-334.

Golenko-Ginzburg, D., Gonik, A., 1998. A heuristic for network project scheduling with random activity durations depending on the resource allocation. International Journal of Production Economics 55, pp. 149-162.

Golpîra, H., Hejazi, S., 2014. A Scenario Based Stochastic Multi-Objective Modeling for Time-Cost-Quality Trade-Off Problem, International Scientific Conference on Project Management in the Baltic Countries Riga, University of Latvia.

Hazır, Ö., Haouari, M., Erel, E., 2010a. Discrete time/cost trade-off problem: A decomposition-based solution algorithm for the budget version. Computers & Operations Research 37, pp. 649-655.

Gutjahr, W.J., Strauss, C., Wagner, E., 2000. A stochastic branch-and-bound approach to activity crashing in project management. INFORMS Journal on Computing 12, pp. 125-135.

Hazır, Ö., Haouari, M., Erel, E., 2010b. Robust scheduling and robustness measures for the discrete time/cost trade-off problem. European Journal of Operational Research 207, pp. 633-643.

Iranmanesh, H., Skandari, M., Allahverdiloo, M., 2008. Finding Pareto optimal front for the multi-mode time, cost quality trade-off in project scheduling, Proceedings of World Academy of Science, Engineering and Technology. Citeseer, pp. 1307-6884.

Khang, D.B., Myint, Y.M., 1999. Time, cost and quality trade-off in project management: a case study. International Journal of Project Management 17, pp. 249-256.

Mitchell, G., Klastorin, T., 2007. An effective methodology for the stochastic project compression problem. IIE Transactions 39, pp. 957-969.

Mokhtari, H., Aghaie, A., Rahimi, J., Mozdgir, A., 2010. Project time–cost trade-off scheduling: a hybrid optimization approach. The International Journal of Advanced Manufacturing Technology 50, pp. 811-822.

Mulvey, J.M., Vanderbei, R.J., Zenios, S.A., 1995. Robust optimization of large-scale systems. Operations research 43, pp. 264-281.

Pour, N.S., Modarres, M., Tavakkoli-Moghaddam, R., 2012. Time-Cost-Quality Trade-off in Project Scheduling with Linguistic Variables. World Applied Sciences Journal 18, pp. 404-413.

Salmasnia, A., Mokhtari, H., Abadi, I.N.K., 2012. A robust scheduling of projects with time, cost, and quality considerations. The International Journal of Advanced Manufacturing Technology 60, pp. 631-642.

Sunde, L., Lichtenberg, S., 1995. Net-present-value cost/time tradeoff. International Journal of Project Management 13, pp. 45-49.

Zheng, H., 2014. The Fuzzy Time-Cost-Quality-Environment Trade-off Analysis of Resource-Constrained Multi-mode Construction Systems for Large-Scale Hydroelectric Projects, Proceedings of the Seventh International Conference on Management Science and Engineering Management. Springer, pp. 425-438.

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QUANTITATIVE APPROACH FOR PROJECT MANAGEMENT STANDARDS EVALUATION, BASED ON EFQM CRITERIA

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Abstract

This research, employs the fuzzy technique of order performance by similarity to ideal solution (FTOPSIS) to evaluate some well-known project management standards (PMSs). The method is founded on the indexes presented by the European foundation for quality management model (EFQM) to deliver a new theoretical account to compare standards as a new comprehensive method. To do this end, a brief recap on some of the PMSs is introduced based on their frameworks, concepts and vital regions. The crucial indexes are extracted based on the EFQM model areas and because of the multiplicity of the criteria, the TOPSIS is employed to assess the standards. Moreover, fuzzy logic is applied to encounter with the vagueness of judgment about the coverage level of each PMS in each of the nine basic criteria of the EFQM model in order to assess them. Computational results which are presented in the following sections show the applicability and usefulness of the method.

Key words: *Project management standards, EFQM, FTOPSIS, Standards evaluation*

JEL code: L15

Introduction

While most of the project management standards (PMSs) can be tailored for a specific environment, still there can be conditions that indorse one over another for a certain case. Crawford (2000) addresses an outline of the PMSs and guides for PM knowledge and performance (Crawford L., 2000). Ahlemann et al. (2009) introduce an empirical study on the PMSs applicability in German and Swiss enterprises and point out the prospects, the benefits and the major differences among them (Ahlemann, et al., 2009). Ilieş et al. (2010) introduce the best practices recently used in PM, focusing on two of the most used frameworks – PMBOK (Project Management Body of Knowledge) and PCM (project cycle management) Guidelines. They reveal that the PMBOK is appropriate in all types of organizations, from all over the world, but the PCM is well-adapted to the European commission's development policy (Ilieş et al., 2003). Buttrick (2012) compares the PRINCE 2, the ISO 21500 and the BS 6079 comprehensively and lays stress on their weakness in fully covering the scope of the standards (Buttrick, R., 2012). In addition, numerous efforts are done to map some of these standards to each other, but there is no comprehensive contribution to compare them efficiently in previous researches. That is, what we want to do in this paper. Ahlemann et al. (2009) present that establishing consistent communication in a project and better process quality leads it to be better done (Ahlemann, et al., 2009). Bayo-Moriones et al. (2011) reveal that assessments based on the

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European foundation for quality management model (EFQM) are gaining ground in improvement processes (Bayo-Moriones et al., 2011).

While PMSs are in different categories, the main purpose of this paper is to explore the coverage level of each PMS in each of the nine basic criteria of the EFQM model. Furthermore, a new framework to evaluate the related standards based on the EFQM model is introduced. To do this end, the basis of the PMSs and EFQM model are carried out from literature.

The paper contributes to the recent literature in several ways. First, it provides a good survey in the field of PMSs. Secondly, to the best our knowledge; this is the first paper to reflect the comparative evaluating of the PMSs and makes a new framework available to assess the related comparable standards based on fuzzy logic and EFQM model. Finally, the coverage level of the standards could make the organizations to be able to have a better decision making according to their condition and level of performance in each of the basic criteria of the EFQM model which make the decision to be more reliable and organizational process oriented.

In the paper the EFQM framework and evaluating area and criteria are employed for evaluating 13 well-known PMSs to have an effective assessment of them to make a comprehensive comparison among them. In this way, the fuzzy technique of order performance by similarity to ideal solution (FTOPSIS) is employed to work with the vagueness of judgment about the coverage level of each PMS in each of the nine basic criteria of the EFQM model and evaluate them. The paper is structured as follows. The following section introduces the proposed method after a brief study on the project management standards, section 3 sets out and discusses the results achieved in the model and section 4 makes the conclusion, discusses the method limitations and proposes some future researches potentials.

Project management standards

Standardization of PM frameworks began in 1980 and continued in the USA, Britannia, Japan, Australia, South Africa, New Zealand, China and India. Table 1 illustrates 13 well-known PMSs and their basic properties. It is noteworthy that the mentioned years in Table 1 demonstrate the establishing date of each PMS.

Table 1

Project management standards

No.	Date	Standard name	Utilization	Standard category
1.	1987	PMBOK: Project Management Body of Knowledge	Project Management Institute (PMI), USA, International	General management skills
2.	1988	APMBOK: Association for Project Management Body of Knowledge	United Kingdom, National	General management skills
3.	1996	BS6079: British Standard Guide to Project Management	United Kingdom, National	Both operational and strategic project management

No.	Date	Standard name	Utilization	Standard category
4.	1997	ISO 10006 Guidelines to Quality in Project Management	Swiss, International	Quality management tool rather than a project management standard
5.	Start at 1989, first issue in 1996	PRINCE 2	Central Computer and Telecommunications Agency (CCTA), UK Government standard for IT project management, Europe	IT project management
6.	2002	PMMM: Project Management Maturity Model	Crown Copyright product of the Office of Government Commerce (UK), National	Public and private sector project management
7.	2001	P2M: Project & Program Management	Japan, National	To manage individual and multiple projects
8.	1998	OPM3: Organizational Project Management Maturity Model	Project Management Institute (PMI), USA, International	Global standard for organizational project management
9.	1996	ANCSPM: African National Competency Standards for Project	South Africa, National	Global standard for project management
10.	Start at: 1993. First issue in 1998	AIPM: Australian Institute of Project Management	Australia, National	General management skills as a global standard
11.	1996	NOSPM: National Occupational Standards for Project Management	National and Scottish Vocational Qualifications	Both operational and strategic project management
12.	1999	IPMA (ICB): International Project Management Association (Competence Baseline)	Switzerland, National	Global project management standard
13.	2002	PMCDF: Project Manager Competency Development Framework	Project Management Institute (PMI), USA, UK, South Africa, Australia, International	Use in professional development of project managers rather than for use in selection or performance evaluation

Source: author's calculations based on (Caupin et al. 1998; Crawford L., 2000; Organizational project management … 2003; National Occupational Standards …, 2003; Gvozdenovic et al., 2006; Project Management – some …, 2007; Gvozdenovicet al. 2008; Eberle et al., 2011; Buttrick, R., 2012)

The PMBOK is a completely new document and the first available body of knowledge of PM. It added contract/procurement management and risk management to the previous six

primary criteria of its older version reported from 1983 as: scope, cost, time, quality, human resources and communications (Dinsmore P., and Cabanis- Brewin J., 2006). The APMBOK embraces practices and knowledge that could apply to various projects and/or part of the time which is much more comprehensive approach. The 4th edition of APMBOK, from 2000, contains 7 main headings, with 42 areas. The BS6079-1:2010 aims to help organizations gain a desired outcome of a project efficiently. It likewise aspires to chip in to the learning within projects and thus continually improve the organization's PM proficiency. The philosophies provided in this standard are as relevant to small systems/projects. The standard pays attention to the management challenges encountered in different project environments and proposes possible approaches based on four guidelines as: (1) guide to PM, (2) PM vocabulary, (3) guide to the management of business related project risk and (4) guide to PM in the construction industry (Browne R.H., 2003). One of the most important differences between this standard and the other ones except, ISO 10006 is that it is not used as the knowledge base or standard for professional certification programs (Crawford L., 2000).

The ISO 10006 delivers guidelines for quality in PM, so Crawford (2000) introduces it as a quality management rather than a PM standard and it is applicable to projects of varying complexity, size and length. Its main purpose is to construct and maintain quality in projects through a systematic procedure that guarantees: (1) stated and implied needs of customers are understood and met; (2) interested stakeholders' needs are understood and evaluated and (3) The organization's quality policy is incorporated into the management of projects (Crawford L., 2000). The PRINCE 2 is first published in 1996 and has grown to become a de facto 'standard' as a PM method recently – in the UK and more than 150 countries worldwide. The scope of the PRINCE 2 and BS 6079 is most closely aligned. The benefits of using this standard are as follows. (1) using the standard improves a project performance in both the public and private sectors that leads the country enhances its benefits as a whole, (2) very little alternative 'open copyright' method is existing for organizations to draw on, (3) its scope considers all the processes needed to direct, manage and undertake a project, (4) its philosophies is of high quality, in general, reflecting good practice, (5) its training is very easy, (5) There is a growing requirement for 'accreditation' to be proven in a supplier/contractor context (Buttrick, R., 2012).

The PMMM follows the Software Engineering Institute's (SEI) Capability Maturity Model's (CMM) five evolutionary maturity levels, and examines the maturity development across nine knowledge criteria in the PMBOK. It integrates both the PMBOK Guide and CMM, respectively, to provide a comprehensive, straightforward, and easy-to-follow plan for advancing organizational PM maturity (Crowford, J.K., 2006). The P2M is proposed as a guide to standard Japanese PM to enhance awareness about the breakthroughs and practical capabilities which are vital for a knowledge-intensive information society. It is organized to recognize three kinds of projects consisting of concept development (scheme model), implementation (system model) and operates (service model) and to generate diversified, creative and synergistic business models (Ohara S., 2005).

The OPM3 suggests the key to organizational PM maturity with three elements as: (1) knowledge elements (learn about hundreds of organizational PM best practices), (2) assessment element (evaluate an organization's current capability and identify areas in need of improvement), (3) improvement element (Use the completed assessment to map out the steps needed to achieve performance improvement goals). It has a wide range of benefits to organizations, senior management, and those engaged in PM activities as follows: (1) reinforces the link between

strategic planning and execution, (2) recognizes the best practices that support the employment of organizational strategy through successful projects (3) recognizes the "precise capabilities" that recognizes the "best practices", and the dependencies among those "capabilities" and "best practices" (Crawford L., 2000). The ANCSPM is structurally similar to the AIPM, but it has only one level of performance. In addition, it introduces the computer and English skill as the two additional abilities of a project manager. The AIPM includes the following components: (1) units of competency: the significant major functions of the profession, (2) elements of competency: the building blocks of each unit of competency, (3) performance criteria: the type of performance in the workplace that would establish adequate evidence of personal competence, (4) range indicators: define the situations in which the performance criteria would be applied. The standard incorporated the nine knowledge areas of the PMBOK directly into the knowledge part of their qualification program (Gvozdenovic et al., 2006).

The NOSPM has been written as 51 separate units of competence, each relating to a distinct functional area. It covers the full range of PM functions including the strategic and the operational ones between them. It is fully well-matched with the APMBOK and has been established through consideration of previously defined PMSs (National Occupational Standards …2003). The IPMA is the other international organization which is operating as a PM development association in addition to PMI. The IPMA competence baseline (ICB) is its well-known PMS. There are 28 main and 14 additional elements of PM knowledge recognized from an analysis of the four national documents. PMBOK and ICB are differing under many aspects. PMI has its roots in North America, whereas IPMA is well spread in Europe. One can see the comprehensive comparison between these two associations' standards in (Eberle et al., 2011). The PMCDF is proposed to cover a range of competencies needed by project managers and to apply widely, regardless of the nature, type, size or complexity of the projects being managed. The broad nature of the standard is essential to guarantee that PM competency in individuals is transferable across industries and those industries and organizations can use the PMCDF to construct industry and organization competency models (Project manager competency …, 2007).

The proposed method

The TOPSIS method, recognized as a classical multi attribute decision making (MADM) method, was first introduced by Hwang and Yoon (1981). The basic principle of the method is based on the notion that each alternative should have the shortest distance from the positive ideal and the largest distance from the negative one (Hwang, C.L., and Yoon, K., 1981). The overall importance of each alternative depends on criteria often exposed by a fuzzy number that makes the decision making close to reality. The processed method based on the FTOPSIS model is shown as follows (Golpîra H., 2012):

(1) Constructing fuzzy decision matrix (see Eq. (1)).

$$D = \begin{bmatrix} \tilde{Y}_{11} & \cdots & \tilde{Y}_{1n} \\ \vdots & \ddots & \vdots \\ \tilde{Y}_{P1} & \cdots & \tilde{Y}_{Pn} \end{bmatrix} \quad (1)$$

Where $\widetilde{Y}_{pj}$ is the fuzzy rating of alternative (in this paper alternative means standard) p related to *j*th criteria (in this paper the criteria means the areas defined by the EFQM method) which is in this study defined by a fuzzy triangular number.

(2) Normalizing the fuzzy decision matrix denoted by $\widetilde{T}$ in Eq. (2).

$$\widetilde{T} = [\widetilde{t}_{pn}]_{p\times n} \quad p = 1,2,...,P \text{ and } j = 1,2,...,n \tag{2}$$

(3) Calculating fuzzy weighted decision matrix as shown in Eq. (3).

$$V = \begin{bmatrix} \widetilde{v}_{11} & \cdots & \widetilde{v}_{1n} \\ \vdots & \ddots & \vdots \\ \widetilde{v}_{P1} & \cdots & \widetilde{v}_{Pn} \end{bmatrix} = \begin{bmatrix} w_1\widetilde{t}_{11} & \cdots & w_n\widetilde{t}_{1n} \\ \vdots & \ddots & \vdots \\ w_1\widetilde{t}_{P1} & \cdots & w_n\widetilde{t}_{Pn} \end{bmatrix} \tag{3}$$

at which w is obtained from the EFQM criteria weights.

(4) Defining fuzzy negative $\widetilde{v}_j^- = (0,0,0)$ and fuzzy positive ideals $\widetilde{v}_j^+ = (1,1,1)$.

(5) Calculating the distance of each alternative (standard) from fuzzy negative and fuzzy positive ideals by Eq. (4) and Eq. (5).

$$d_p^- = \sum_{j=1}^{n} d(\widetilde{v}_{pj}, \widetilde{v}_j^-), p = 1,2,...,P \tag{4}$$

$$d_p^+ = \sum_{j=1}^{n} d(\widetilde{v}_{pj}, \widetilde{v}_j^+), p = 1,2,...,P \tag{5}$$

(6) Calculating the closeness coefficients by using Eq. (6).

$$C_p = \frac{d_p^-}{d_p^+ - d_p^-} \tag{6}$$

Simulation and results

To establish the method, the EFQM evaluating criteria are widely utilized for assessing these 13 well-known PMSs to have an effective assessment to create a comprehensive comparison among them. In this manner, the FTOPSIS is used to assess the standards in its multi-criteria decision making arena. In the FTOPSIS method, the only subjective input needed is criteria weights which are in this study obtained from the nine basic criteria weights of the EFQM method. The measures are examined and the judgment about the reporting level of them in the area of each EFQMs sub-criteria are taken out and gathered using linguistic variables in the orbit of "very low", "low", "median", "high" and "very high" point of coverage which the terminations are presented in Table 2. The linguistic variables are translated into the triangular fuzzy numbers, using Table 3. The coverage level of each standard according to each criterion is calculated from the geometric mean of the fuzzy scores under that criterion – sub-criteria – for that specific standard. The criteria crisp weights are multiplied to the criteria scores of each

stock to create the fuzzy weighted decision matrix as the step (3) of the FTOPSIS method defined in subdivision 2.2. The remaining steps of the FTOPSIS method are followed accordingly. The results are shown in Table 4.

According to results in Table 4 one can witness that the standard 2 – PMBOK – is the best standard in covering the EFQMs criteria. Yet, that is the standard 8 – OPM3 – that introduced as the best standard in tracking the "result" field of the EFQM method and the PMBOK achieved the second position. Evaluating the other standards is successfully illustrated in each of the two main areas of the EFQM model and the entire evaluation is either obtained in the final column of the mesa. Moreover, Table 2 can help the organizations/projects and their handlers to get a more reliable decision choosing an appropriate measure to ensure their success.

Table 2

Expert judgment about coverage level of EFQM model criteria by PMSs

Criteria	Sub-criteria	Standards												
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Leadership	a1	L	M	VL	VL	M	M	L	VL	M	M	M	M	M
	b1	L	M	VL	M	M	M	L	M	M	M	M	M	L
	c1	M	M	VL	L	M	M	L	L	L	L	L	L	L
	d1	L	M	L	M	M	M	L	M	L	L	L	L	L
	e1	L	M	L	L	M	M	L	L	L	H	M	L	L
Policy & Strategy	a2	M	H	M	M	M	VL	L	M	L	VL	VL	VL	VL
	b2	M	M	M	M	L	M	L	M	L	VL	VL	VL	VL
	c2	M	M	M	M	L	M	L	M	L	VL	VL	VL	VL
	d2	M	H	M	M	L	VL	L	M	L	VL	VL	VL	VL
Human resources	a3	H	H	L	M	M	M	M	M	M	M	M	M	M
	b3	H	H	L	H	M	VL	L	H	VL	VL	VL	VL	VL
	c3	H	H	L	H	M	VL	L	H	M	VL	VL	VL	VL
	d3	VL	VL	L	H	M	VL	L	VL	VL	VL	VL	VL	VL
	e3	VL	VL	L	H	M	VL	L	M	VL	VL	VL	VL	VL
Companies & references	a4	H	H	L	L	M	L	L	L	L	VL	VL	VL	VL
	b4	L	H	L	L	M	M	L	M	L	VL	VL	VL	VL
	c4	L	H	L	L	L	L	L	L	VL	VL	VL	VL	VL
	d4	L	H	L	L	L	M	L	M	VL	VL	VL	VL	VL
	e4	L	H	L	L	M	M	M	M	VL	VL	VL	VL	VL
Processes	a5	H	H	M	M	M	L	VL	M	VL	VL	VL	VL	VL
	b5	L	H	M	M	M	M	VL	M	VL	VL	VL	VL	VL
	c5	L	M	L	M	L	L	VL	M	VL	VL	VL	VL	VL
	d5	H	M	L	M	M	M	VL	H	VL	VL	VL	VL	VL
	e5	L	M	L	M	L	L	L	H	VL	VL	VL	VL	VL
Customers results	a6	VL	M	VL	VL	VL	VL	VL	H	VL	VL	VL	VL	VL
	b6	VL	M	VL	VL	VL	VL	VL	H	VL	VL	VL	VL	VL
Population results	a7	M	M	L	M	L	VL	VL	L	M	M	L	L	L
	b7	M	M	L	M	L	VL	VL	L	M	M	M	M	M
Society results	a8	VL	VL	VL	VL	VL	VL	VL	L	VL	VL	VL	VL	VL
	b8	VL	VL	VL	VL	L	L	L	L	VL	VL	VL	VL	VL
Key results of performance	a9	M	M	M	M	L	L	VL	L	VL	VL	VL	VL	VL
	b9	M	M	M	M	L	L	VL	M	VL	VL	VL	VL	VL

Source: author's calculations based on Table 1

Table 3

Reference table of transforming linguistic variables to fuzzy numbers

Linguistic	Scale of fuzzy number
Very low	(0.00, 0.10, 0.25)
Low	(0.15, 0.30, 0.45)
Media	(0.35, 0.50, 0.65)
High	(0.55, 0.70, 0.85)
Very high	(0.75, 0.90, 1.00)

Source: author's calculations based on (Golpîra, 2012)

Table 4

Results of method simulation

No.	Score of the standard in the field of results	Score of the standard in the field of enablers	Total score	Level of the standard in the field of results	Level of the standard in the field of enablers	Total assessment
1.	0.081387166	0.080972151	0.081156688	3	5	4
2.	0.117320253	0.110415074	0.113483802	2	1	1
3.	0.072836127	0.069276286	0.070860301	4	7	6
4.	0.081387166	0.093105719	0.087892518	3	2	3
5.	0.060441317	0.089507414	0.076555458	5	3	5
6.	0.052887042	0.072604494	0.063826529	7	6	7
7.	0.040319081	0.058428736	0.050360734	9	8	9
8.	0.125191032	0.087941123	0.104475969	1	4	2
9.	0.054540264	0.050111159	0.052081126	6	9	8
10.	0.054540264	0.043972977	0.04867362	6	10	10
11.	0.049685252	0.042888845	0.045912503	8	11	11
12.	0.049685252	0.038522245	0.043483424	8	12	12
13.	0.049685252	0.037543634	0.042940323	8	13	13

Source: author's calculations based on Table 2 and Table 3

Discussion, conclusion, limitations and future researches potentials

In this paper the usefulness of the FTOPSIS method based on the EFQM methods' criteria and sub-criteria in society to assess the PMSs is examined. The results which are

indicated in Table 4 lay stress on the superiority of the PMBOK which is illustrated by some other previous researches. This main result proves the validity of the method. The comprehensive review of the PMSs which its results are shown in Table 2 helps the managers to have a quick exact view of the standards to make a better selection among the standards. Moreover, amalgamating of the EFQM as the excellence method and the PMSs in such a modular mathematical manner is a new approach that establishes consistent communication in a project and better process quality to lead it to be better done. Every bit in other empirical studies, the findings and implications of this field should be read with care, due to their limitations. First, in establishing the comparison between the standards, the related literature is widely applied and an expert's idea about the applicability and drawbacks of them is not used. Second, the method is prepared by the crisp weights of each criteria belongs to the EFQM method. Thus, a logical extension would be to use fuzzy weights for the indexes. Thirdly, the method uses a FTOPSIS method to evaluate the standards. One can use the other MADM methods to make a comparison.

Bibliography

Ahlemann F., Teuteberg F., Vogelsang K., 2009. Project management standards – Diffusion and application in Germany and Switzerland. International Journal of Project Management, 27 (3), pp. 292-303. [Online] Available at: http://education.huji.ac.il/adamnir/papers/paper12.pdf.

Bayo-Moriones A., Dıaz-de-Cerio J.M., Escamilla-de-Leon S.A., Selvam R.M., 2011. *The impact of ISO9000 and EFQM on the use of flexible work practices*. International Journal of Production Economics, 130, pp. 33-42.

Buttrick, R., 2012. *PRINCE2 and the National and International Standards*. [Online] Available at: http://www.best-management-practice.com/gempdf/PRINCE2_National_Standards.pdf.

Caupin G., Knopfel H., Morris, P.W.G., Motzel E., Pannenbacker O., 1998. *ICB IPMA Competence Baseline.* International Project Management Association, Zurich.

Browne R.H. 2003, *British standard*. [Online] Available at: http://www.bsonline.techindex.co.uk.

Crowford, J.K., 2006. *Project management maturity model, second edition (PM solutions research)*, Auerbach Publications.

Crawford L., 2000. *Global body of project management knowledge and standards*. Morris (Wiley), pp. 1153-1193.

Dinsmore P., Cabanis- Brewin J., 2006. *The AMA Handbook of Project Management*. Amacom, USA.

Eberle A., Meyer H., Rosen D., 2011. *A comparison of PMI and IPMA approaches*. Projekt Management Aktuell, pp. 31-34.

Golpîra H., 2012. *Making comparison between fuzzy and non-fuzzy MCDM to calculate weight factors of project activities*. J. of Industrial Management, Islamic Azad University of Sanandaj, pp. 23-34.

Hwang, C.L., Yoon, K., 1981. *Multiple attribute decision making: methods and applications*. Springer, Berlin, Heidelberg.

Ilieş L., Crişan E., Mureşan I.N., 2010. *Best practices in project management*. Review of International Comparative Management, 11(1), pp. 43-51.

Gvozdenovic T., Miljanovic M., Aleksandar J., Crnogorcic Z., 2008. *Bodies of knowledge in project management and project quality management*. International Journal for Quality research, 2(1), pp. 69-76.

None to Claim Their Bones, 2003. *Organizational project management maturity model (OPM3) knowledge foundation*. Project management Institute Inc. Pennsylvania, USA. [Online] Available at: http://www.pmigno.org/pmigno/2008/2008-10-pds-presentations/milt-jones-opm3.pdf.

None to Claim Their Bones, 2007. Project Management – some reflections on the management of projects in the Australian public Sector. Australian Institute of Project Management. [Online] Available at: http://www.anao.gov.au/~/media/Uploads/Documents/speech_to_aipm_9_oct.pdf.

None to Claim Their Bones, 2003. *National Occupational Standards for Project Management*. [Online] Available at: http://www.ehu.es/Degypi/OTmec/resources/Project_Management_Standards2.pdf.

Ohara, S., 2005. Booklet on P2M. Project Management Association of Japan. [Online] Available at: http://www.maxwideman.com/papers/managing2007/managing2007.pdf.

None to Claim Their Bones, 2007. *Project manager competency development framework*. 2nd edition, Project Management Institute.

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VIRTUALITY IN HYBRID CONSTRUCTION PROJECT TEAMS: CAUSES, MODERATORS AND EFFECTS

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Abstract

Organisations within the construction industry almost entirely have to deal with hybrid teams in which the regular pattern of interactions is a combination of face-to-face and virtual communications. Evidence has demonstrated that major aspects of hybrid team operations are affected by virtuality i.e. the extents to which teams are shifted towards working virtually as opposed to act as purely collocated teams. Nevertheless, the nature of factors associated with virtuality in construction project teams has remained elusive. As one of the first inquiries on this topic, here an attempt is made to explore the major causes and the main effects of virtuality in hybrid construction project teams through a qualitative approach. To this end, a priori list of factors is developed drawing upon existing literature on virtuality from a multidisciplinary perspective. Correspondingly, the array of factors is subjected to the scrutiny of 17 experts with experiences of hybrid team working in the construction context through semi-structured interviews. Following the analysis of qualitative data by Nvivo 10 primary causes and effects of virtuality for hybrid construction project teams are presented. This paper concludes with putting forward the main lessons learned and future areas of research on virtuality in hybrid teams for the construction context.

Key words: *Virtuality, Virtual teams, Hybrid teams, Construction industry, Project teams*

JEL code: O33

Introduction

A contemporary construction project team is defined by Baiden and Price (2011, 14 p.) as "…a collaborative venture that involves a number of different organisations brought together to form "the construction project team.". In this respect, virtual teams have largely replaced face-to-face teams in many organisations (Peñarroja *et al.*, 2013; Gibson *et al.*, 2014). As stated by Lu *et al.* (2006, 4 p.), working virtually in teams is regarded as "…the rule rather than the exception…". Likewise, construction project teams are increasingly operating as partially virtual teams i.e. hybrid teams for delivering projects due to the impacts of globalisation (Ramalingam *et al.*, 2014). Even more, evidence e.g. (Chen & Messner, 2010) has demonstrated that in view of the conditions governing today's business environment, adopting hybrid teaming has become mandated for construction organisations. This in turn requires acquiring a deep

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appreciation of the inherent attributes and the nature of major aspects associated with hybrid team working (Nayak & Taylor, 2009) through the lenses of virtuality level in teams (Hosseini & Chileshe, 2013). That is, virtuality is a crucial aspect of hybrid teaming operations, which affects members' interactions and effectiveness as put by Peñarroja *et al.* (2013). Nevertheless, the review of literature reveals an absence of studies on causes and effects of virtuality within the construction context. This identifies a critical gap in the body of knowledge as pointed out by previous studies e.g. (Hosseini & Chileshe, 2013; Gibson *et al.*, 2014; Merschbrock & Munkvold, 2014).

The main thrust of the present study is to map out the major causes and effects of virtuality in hybrid construction projects teams. It is put forth that the findings of the present study facilitates future investigators in evaluating virtuality of teams alongside outlining the effects of virtuality and the major outcomes associated with virtuality on the effectiveness of teams. On a practical level, the present study provides an illuminating insight into the managerial aspects of hybrid construction projects teams inasmuch as the findings could be translated into the basis for development of policies by construction project managers in order to efficiently design and enhance the effectiveness of their hybrid teams.

Literature review

Different approaches have been deployed for defining virtual teams. These comprise the dichotomy approach and the virtuality approach in consistency with the classification proposed by Peñarroja *et al.* (2013). In this respect, dichotomy approach entails pigeonholing all virtual teams into a single category in order to contrast them with conventional (i.e. face-to-face) teams through relying on the unique attributes of virtual working. The studies implementing this approach have classified a team in a dichotomous manner, namely, either virtual or face-to-face, as described in the literature e.g. (Martins & Schilpzand, 2011; Peñarroja *et al.*, 2013). One popular dichotomous definition was the one presented by Lipnack and Stamps (1997) according to which virtual teams were defined as people who interact for the completion of interdependent tasks guided by a common purpose, working remotely, in different time zones and organisations with links strengthened by information communication technology.

Nonetheless, contemporary teams do not operate purely face-to-face or fully virtual (Hosseini *et al.*, 2015). As asserted by Webster and Staples (2006, 189 p.), "the distinction between traditional and virtual teams is no longer needed, as all types of teams in organisations today are characterized by degrees of virtuality". That is, even in supposedly face-to-face operations in teams, members widely communicate via technology, thus investigators have reached a consensus on the necessity of defining teams based on their level of virtuality in lieu of using a dichotomy to differentiate between different teams (Hosseini *et al.*, 2015). In essence, most of organisations have to deal with teams "…that have some face-to-face interaction along with a healthy dose of virtual interaction" termed by Schroeder (2013, 1 p.) as *hybrid teams*.

Causes of virtuality

To define virtuality in hybrid teams, researchers have attempted to identify the main constructs or dimensions acting as the causes of virtuality. Causes of virtuality are defined as the

factors that shift a hybrid team arrangement towards purely virtual team working (as one extreme on the virtuality continuum) whereas the opposite extreme represents conventional collocated team working purely in face-to-face arrangements (Hosseini *et al.*, 2015). As salient examples of studies allocated to determining the causes of virtuality, Kirkman *et al.* (2004) proposed a three dimensional basis to define virtuality contributors comprising (1) proportion of the time that team members operated virtually, (2) the location of members and (3) the proportion of time members devote to their virtual team as opposed to other inter- or intra-organisational commitments. Gibson and Gibbs (2006), suggested that major contributors to virtuality comprise (1) spatial distance, (2) dynamic structure, (3) nationality diversity of members and (4) dependency on communication technology.

Other studies such as Schweitzer and Duxbury (2010) used purely objective measures calculated by mathematical equations to define the causes of virtuality. In this spirit, Schweitzer and Duxbury (2010) conceptualised virtuality as a three-dimensional construct comprising (1) the proportion of time that members of a team spend working virtually, (2) the proportion of members working virtually, and (3) the degree of separation between members of a team. In contrast to the aforementioned study, Siebdrat, Hoegl, and Ernst (2014) questioned the reliability of such objective dimensions and argued that that dimensions such as dispersion between human beings could not be linked directly and linearly with physical distance or the number of available hours for working synchronously.

In essence, review of literature reveals that findings of previous studies are contradictory and confusing, hence the body of knowledge on causes of virtuality suffers from confusion and the area has remained in need of conducting further research to map out the main causes of virtuality as acknowledged by Gibson *et al.* (2014).

Effects of virtuality

Evidence has shown that increasing virtuality in hybrid teams influences effectiveness aspects of teams (Lu *et al.*, 2006). Consequently, indicators of effectiveness in hybrid teams are affected by virtuality level (Schweitzer & Duxbury, 2010). Increasing the level of virtuality in teams would detrimentally affect the level of trust (Chudoba *et al.*, 2005; Ahuja, 2010; Peñarroja *et al.*, 2013). Besides, teams with higher levels of virtuality become less effective in terms of communications and data exchange (Martins, Gilson, & Maynard, 2004; Lu *et al.*, 2006; Peñarroja *et al.*, 2013). Additionally, increasing virtuality results in reducing performance in teams (Schweitzer & Duxbury, 2010; Arling & Subramani, 2011). This adversely impacts team output products in teams with higher virtuality (Ahuja, 2010; Ferreira, Lima, & da Costa, 2012). Furthermore, lower levels of team participation and coordination in teams in which virtuality is increased were observed by previous studies e.g. (Ahuja, 2010; Schweitzer & Duxbury, 2010; Arling & Subramani, 2011).

Differing with the studies arguing that increasing virtuality ends up in lower effectiveness as discussed above, a number of investigators have argued that teams with higher virtuality are more effective. For example, Martins *et al.* (2004) and Arling and Subramani (2011) maintained that by increasing virtuality, team effectiveness could be enhanced in certain cases. By the same token, Ortiz de Guinea, Webster, and Staples (2012) argued that effects of virtuality in hybrid teams are case-specific and observations indicating negative effects could not be generalised to all circumstances. Likewise, Griffith, Sawyer, and Neale (2003) asserted that virtuality assists

the exchange of knowledge in hybrid teams. Even more, Gibson and Cohen (2003, 8 p.) postulated that "The greater the degree of virtuality and differences, the higher the potential benefit is."

As discussed above, critical appraisal of the existing literature brings to light that investigators have acquired knowledge on potential effects of virtuality on team effectiveness, yet views on the topic are rather contradictory and confusing.

In essence, there is a clear need to investigate the causes and effects of virtuality on hybrid teams to address the outlined gaps in the literature as described above. Furthermore, review of literature did not spot any comprehensive study exploring the links between virtuality and hybrid teams in the construction context as previously indicated by Hosseini and Chileshe (2013). Thus, a special need to investigate the impacts of virtuality on construction projects teams is indicated in order to address the outlined gaps in the construction industry literature as described next.

Research Methods

Deploying a qualitative approach for data collection becomes relevant in light of the novelty of the topic in the construction context. In this respect, conducting interviews is one of the most effective methods for elucidating experiences and practices of experts in their natural context as a qualitative data collection technique (Punch, 2005). To select the interviewees, a list of 64 potential respondents was identified through websites of companies and social networks such as LinkedIn. Invitations were sent to, and eventually 21 experts agreed. As such, interviewees were selected on account of the willingness of experts to partake in interviews. Deploying such an approach enhances the richness of data due to the strong motive of respondents to contribute to the research study as acknowledged by Simms and Rogers (2006).

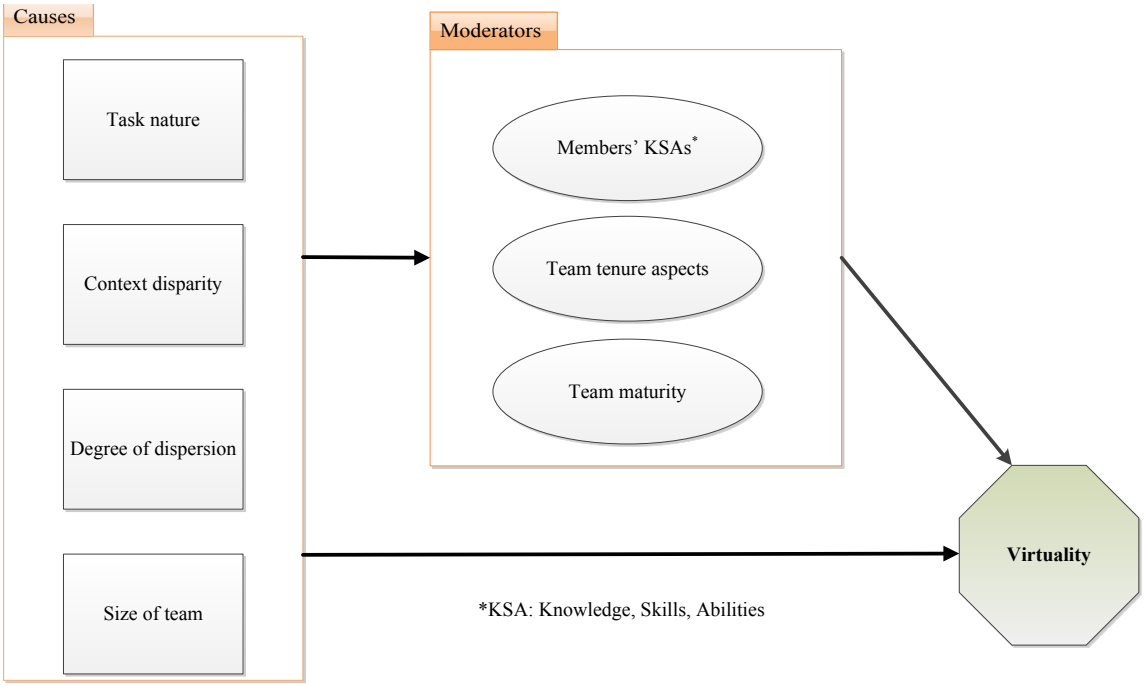
The number of respondents that should be interviewed was determined by considering the concept of *saturation* in qualitative studies. This refers to the point after which "no new information is being added to coding categories (data saturation) or to the emerging theories (theoretical saturation) through adding further cases to the analysis" (Bazeley, 2013, 50 p.). This resulted in conducting interviews with 17 respondents (i.e. saturation point was reached after the 14th interview). Respondents had an experience range of 6-11 years close exposure to hybrid teams in the construction context, thus were regarded as an experienced group of experts for the purpose of the present study. As acknowledged by Bazeley (2013), using a qualitative package such as Nvivo in lieu of analysing on paper provides a great level of flexibility to split, merge, recode and rearrange coded material for analysing qualitative data. Accordingly, Nvivo 10 was deployed for analysing interview transcripts.

Results and Discussions

As the outcome of analysing the transcripts of interviews, four main categories of factors as major causes of virtuality and three factors as the mediators of these causes in hybrid teams emerged. Additionally, eight factors were identified by interviewees as the primary effects of virtuality in hybrid teams as described next.

Major causes

The major causes of virtuality in hybrid construction project teams as perceived by the interviewees are illustrated in Figure 1. In this respect, interviewees were of the view that some aspects of team working act as the moderators of the causes of virtuality in hybrid teams as explained below. That is, causes of virtuality can increase virtuality only in settings in which certain contextual characteristics of teams exist and the relationship between causes of virtuality and virtuality does not hold under different settings. This points to the moderating effects of such contextual factors according to the definition for moderators as put forward by the seminal study by (Baron, Kenny, & Reis, 1986).



Source: author's construction based on analyses of interview transcripts

Fig. 1. **Causes and Moderators of virtuality**

It came to light that the *degree of dispersion as perceived by team members is* a major contributor to virtuality in hybrid construction project teams. According to the data, 16 out of 17 interviewees referred to perception of dispersion in hybrid teams 86 times as a factor which makes them perceive hybrid teams as more virtual. Degrees of dispersion as termed by O'Leary and Cummings (2007) refers to the disparity perceived by members due to the combined effects of geographic distance among team members, temporal distance (i.e. disparity of time zones) and configuration of hybrid teams (namely layout of teams).This could be explained in view of the impacts of these features in losing the big picture of the project as one interviewee put '*isolated members of hybrid teams will lose the bigger picture of the project'*

Interviews data pointed to the fact that *context disparity* (in various features) among team members increases virtuality. This was in line with observations by Chudoba *et al.* (2005) indicating that due to context disparity team members might follow opposing priorities and have different perceptions about the level of importance associated with different issues. Interviewees were in agreement that increasing context disparity leads to higher levels of virtuality. They generally believed that context disparity occurs when team members follow different working routines, implement different technology, use dissimilar technical codes, come from different organisations and are from different disciplines.

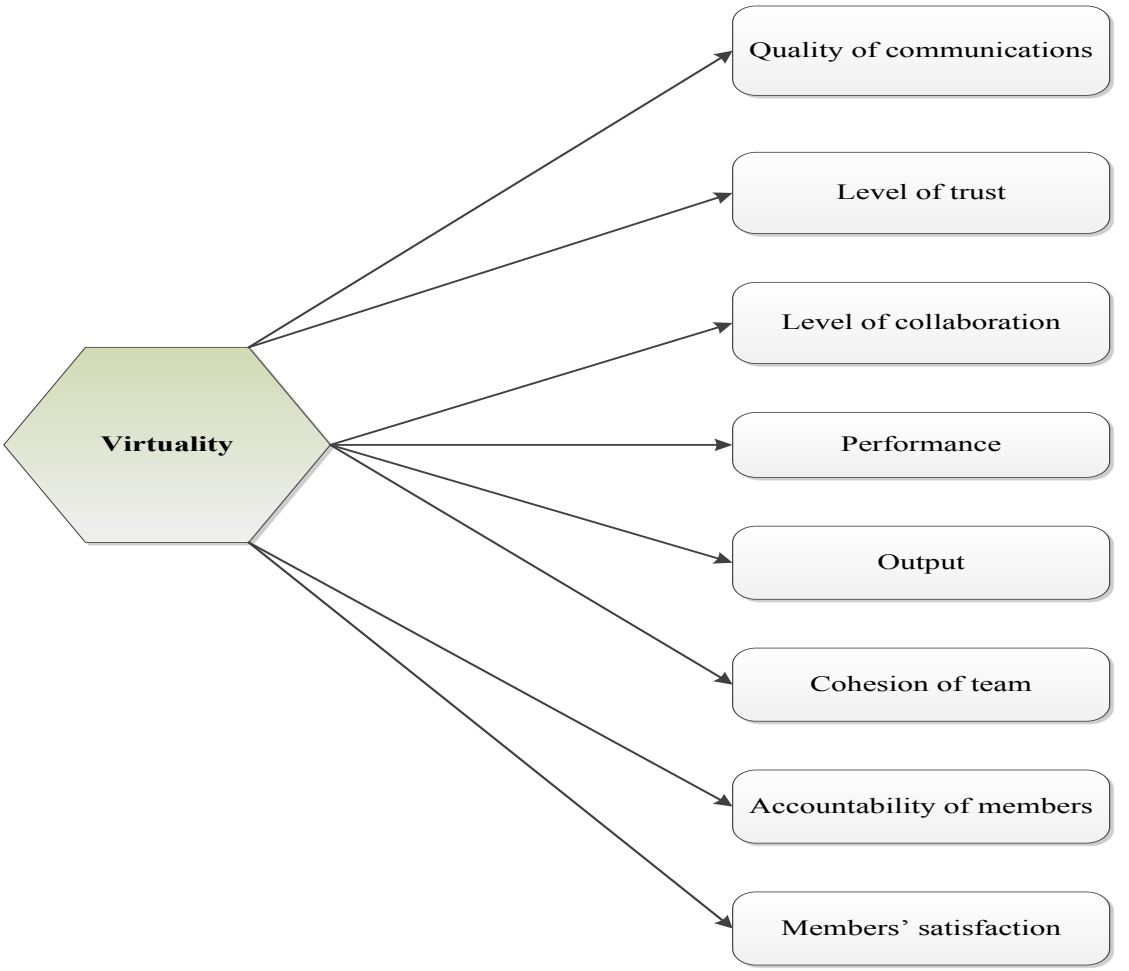
As illustrated in Figure 1, analyses of the data showed that the *nature of tasks* assigned to a team is a determinant of virtuality in the team. Likewise, Martins *et al.* (2004, 808 p.) asserted "a team's extent of virtualness may vary depending on the nature of the task.".

It was revealed through analysis of interviews that the number of members in a construction project team (i.e. *size of a team*) contributes to virtuality. This was consistent with findings of the study by Martins *et al.* (2004) denoting that a larger number of members in a hybrid team arrangement is a contributor to the level of virtuality.

Interviewees were in agreement that *team maturity in handling supply chain relationships is a moderator of virtuality in hybrid construction project teams*. According to Meng, Sun, and Jones (2011) maturity in supply chain relationships should be assessed considering eight major business processes. These are comprised of procurement, objectives, trust, collaboration, communication, problem solving, risk allocation and continuous improvement. Interviewees indicated that *members' knowledge, skills and abilities (KSAs) are among the moderators to causes of virtuality in hybrid construction project teams.* Additionally, interviewees had widespread agreement that hybrid construction project teams with a history of cooperation among members, namely teams in which members have previously worked together on other projects, perceive virtuality at lower levels. Thus, virtuality can become moderated in terms of forging relationships, making collaboration work, predictability and timeliness of completion of assigned tasks if team members have a previous history of working relationships. As such, the contextual features of teams moderate the causes of virtuality in teams.

Primary effects

The primary effects of virtuality as perceived by the interviewees emerged through analyses of interview transcripts are illustrated in Figure 2. In essence, virtuality is a fundamental feature, which influences every aspect of hybrid teaming (Mesmer-Magnus *et al.*, 2011). Particularly, virtuality is tightly associated with virtual teaming effectiveness and output as postulated by Peñarroja *et al.* (2013). One such impact includes the effects of virtuality on *quality of communications* according to the wide-spread agreement among interviewees. That is, Hybrid team working for the most part is contingent upon information exchange via the Internet (Hosseini *et al.*, 2013). On the other hand, maintaining the quality of information on the Internet is of paramount importance because poor quality information is the source of low productivity and serious risks as asserted by Bovee, Srivastava, and Mak (2003). Thus, the effects of virtuality on quality of communication is of utmost importance for construction projects teams as indicated in previous studies and acknowledged by the interviewees.



Source: author's construction based on analyses of interview transcripts

Fig. 2. **Effects of virtuality**

According to Ferris *et al.* (2008, 229 p.), "accountability is critical to the success of organisations and the ability to establish its antecedents and outcomes should be of utmost importance". Yet, interviewees were of the view that level of *accountability* of team members in hybrid team working is reduced significantly. Lack of accountability in hybrid team arrangements was put by one interviewee as *'...it can take a long time specifically if it is complex and if that party is elsewhere that accountability is further reduced because when you are closer your shouting is more effective.'*

Trust also turned out to be an issue as one impact of virtuality on hybrid construction projects teams. Similarly, lack of trust in hybrid arrangements was discussed in great length by Hosseini and Chileshe (2013) for the construction industry. Such an insight was reaffirmed by the interviewees as one of them said *'when you are engaged with someone in technical work and you cannot see them face to face it becomes a bit nerve-racking.'*

According to van Gassel, Láscaris-Comneno, and Maas (2014, 85 p.) collaboration is "a creative process undertaken by two or more interested individuals, sharing their collective skills, expertise, understanding and knowledge (information) in an atmosphere of openness, honesty, trust, and mutual respect, to jointly deliver the best solution that meets their common goal.". This was stated by almost all interviewees that under the effects of virtuality the level of collaboration in hybrid teams is adversely affected. Such an effect was described by one interviewee as *'...you will get into your own silo and you never know what is going on around you…'*.

In their authoritative work, Mathieu *et al.* (2008, 412 p.) argued that a team effectiveness framework should include "…*performance* (e.g., quality and quantity) and members' *affective reactions* (e.g., satisfaction, commitment, viability)."Analysis of interviews showed that virtuality in teams impacts major aspects of effectiveness in teams including performance, output and members satisfaction. This resonates with the contention of Schweitzer and Duxbury (2010) arguing that indicators of effectiveness in hybrid teams are associated with the virtuality level of teams. This was reaffirmed by the interviewees and one of them went on to say *'generally the outcome is always better if you employ local people.'* Additionally, most of interviewees expressed their views about lack of satisfaction with hybrid team working and regarded hybrid team arrangement as the last resort. As an example one interviewee said '…*the problem is that such issues happen and you should deal with such negative outcomes and results of such issues instead of putting in effort to fix the issues and problems…'*.

Conclusion

Through a qualitative approach, four main causes of increased virtuality in hybrid construction project teams came to light. The present study contributes that three main moderators of causes of virtuality are in existence. To the best of the authors' knowledge, prior studies devoted to virtuality have overlooked the effects of moderators of virtuality in hybrid teams. Thus, the findings of the present study provide a novel insight for considering virtuality in hybrid teams. It was also observed that virtuality adversely affects the major features of effectiveness in teams. In fact, deploying hybrid team arrangements was regarded by all interviewees as an obligation to make delivering projects possible when no viable option is available. As such, the findings from the construction context contradicts the views of investigators such as Gibson and Cohen (2003) who supported the positive effects of virtuality in hybrid teams.

The factors as identified could contribute to the field by outlining the main causes and effects of virtuality in hybrid construction projects teams. However, the findings should be considered in light of the limitations of the present study. That is, all interviewees came from the Australian construction industry, thus the findings for other contexts and countries should be treated with caution. Nevertheless, the study opens the door for future research on the topic. The fertile grounds for future research could be suggested as investigating the mechanism and the nature of effects of virtuality on effectiveness of teams as the most important feature of team working affected by virtuality. In addition, conducting quantitative studies to evaluate the relative importance of each of the causes and moderators in altering the level of virtuality in hybrid teams provide another fertile ground for inquiries on the topic.

Bibliography

Ahuja, J., 2010. "A study of virtuality impact on team performance", The IUP Journal of Management Research, Vol. 9, No. 5, pp. 27-56.

Arling, P. A., & Subramani, M., 2011. "The effect of virtuality on individual network centrality and performance in on–going, distributed teams", International Journal of Internet and Enterprise Management, Vol. 7, No. 4, pp. 325-348.

Baiden, B. K., & Price, A. D. F., 2011. "The effect of integration on project delivery team effectiveness", International Journal of Project Management, Vol. 29, No. 2, pp. 129-136.

Baron, R. M., Kenny, D. A., & Reis, H. T., 1986. "The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations", Journal of Personality and Social Psychology, Vol. 51, No. 6, pp. 1173-1182.

Bazeley, P., 2013. Qualitative data analysis : practical strategies. Thousand Oaks, Calif.: SAGE.

Bovee, M., Srivastava, R. P., & Mak, B., 2003. "A conceptual framework and belief-function approach to assessing overall information quality", International journal of intelligent systems, Vol. 18, No. 1, pp. 51-74.

Chen, C., & Messner, J. I., 2010. "A Recommended Practices System for a Global Virtual Engineering Team", Architectural Engineering and Design Management, Vol. 6, No. 3, pp. 207-221.

Chudoba, K. M., Wynn, E., Lu, M., & Watson-Manheim, M. B., 2005. "How virtual are we? Measuring virtuality and understanding its impact in a global organization", Information Systems Journal, Vol. 15, No. 4, pp. 279-306.

Ferreira, P. G. S., Lima, E. P. d., & da Costa, S. E. G., 2012. "Perception of virtual team's performance: A multinational exercise", International Journal of Production Economics, Vol. 140, No. 1, pp. 416-430.

Ferris, G. R., Perryman, A. A., Frink, D. D., Royle, M. T., Hochwarter, W. A., Hall, A. T., & Ranft, A. L., 2008. Meso-level theory of accountability in organizations. In J. J. Martocchio (Ed.), Research in personnel and human resources management (Vol. 27, pp. 177-245): Emerald Group Publishing Limited.

Gibson, C. B., & Cohen, S. G., 2003. Virtual Teams That Work : Creating Conditions for Virtual Team Effectiveness. San Fransisco, CA: Jossey-Bass.

Gibson, C. B., & Gibbs, J. L., 2006. "Unpacking the Concept of Virtuality: The Effects of Geographic Dispersion, Electronic Dependence, Dynamic Structure, and National Diversity on Team Innovation", Administrative Science Quarterly, Vol. 51, No. 3, pp. 451-495.

Gibson, C. B., Huang, L., Kirkman, B. L., & Shapiro, D. L., 2014. "Where Global and Virtual Meet: The Value of Examining the Intersection of These Elements in Twenty-First-Century Teams", Annual Review of Organizational Psychology and Organizational Behavior, Vol. 1, No. 1, pp. 217-244.

Griffith, T. L., Sawyer, J. E., & Neale, M. A., 2003. "Virtualness and Knowledge in Teams: Managing the Love Triangle of Organizations, Individuals, and Information Technology", MIS quarterly, Vol. 27, No. 2, pp. 265-287.

Hosseini, M. R., & Chileshe, N., 2013. "Global Virtual Engineering Teams (GVETs): A fertile ground for research in Australian construction projects context ", International Journal of Project Management, Vol. 31, No. 8, pp. 1101-1117.

Hosseini, M. R., Zuo, J., Chileshe, N., & Baroudi, B., 2013. "A conceptual meta-framework for managing multicultural global virtual teams", International journal of networking and virtual organisations, Vol. 12, No. 4, pp. 310-330.

Hosseini, M. R., Zuo, J., Chileshe, N., & Baroudi, B., 2015. "Evaluating virtuality in teams: a conceptual model", Technology Analysis & Strategic Management , Vol. 27, No. 4, pp. 385-404.

Kirkman, B. L., Rosen, B., Tesluk, P. E., & Gibson, C. B., 2004. "The impact of team empowerment on virtual team performance: The moderating role of face-to-face interaction", The Academy of Management Journal, Vol. 47, No. 2, pp. 175-192.

Lipnack, J., & Stamps, J., 1997. Virtual teams: reaching across space, time, and organizations with technology. New York: Wiley.

Lu, M., Watson-Manheim, M. B., Chudoba, K. M., & Wynn, E., 2006. "Virtuality and team performance: Understanding the impact of variety of practices", Journal of Global Information Technology Management, Vol. 9, No. 1, pp. 4-23.

Martins, L. L., Gilson, L. L., & Maynard, M. T., 2004. "Virtual teams: What do we know and where do we go from here?", Journal of Management, Vol. 30, No. 6, pp. 805-835.

Martins, L. L., & Schilpzand, M. C., 2011. Global Virtual Teams: Key Developments, Research Gaps, and Future Directions. In A. Joshi, H. Liao & J. J. Martocchio (Eds.), Research in personnel and human resources management (Vol. 30). Bingley : Biggleswade: Emerald Group Publishing Limited.

Mathieu, J., Maynard, M. T., Rapp, T., & Gilson, L., 2008. "Team effectiveness 1997-2007: A review of recent advancements and a glimpse into the future", Journal of Management, Vol. 34, No. 3, pp. 410-476.

Meng, X., Sun, M., & Jones, M., 2011. "Maturity Model for Supply Chain Relationships in Construction", Journal of Management in Engineering, Vol. 27, No. 2, pp. 97-105.

Merschbrock, C., & Munkvold, B. E., 2014. Succeeding with Building Information Modeling: A Case Study of BIM Diffusion in a Healthcare Construction Project. Paper presented at the 47th Hawaii International Conference on System Sciences (HICSS), 6-9 Jan, Hawaii.

Mesmer-Magnus, J. R., DeChurch, L. A., Jimenez-Rodriguez, M., Wildman, J., & Shuffler, M., 2011. "A meta-analytic investigation of virtuality and information sharing in teams", Organizational Behavior and Human Decision Processes, Vol. 115, No. 2, pp. 214-225.

Nayak, N. V., & Taylor, J. E., 2009. "Offshore outsourcing in global design networks", Journal of Management in Engineering, Vol. 25, No. 4, pp. 177-184.

O'Leary, M. B., & Cummings, J. N., 2007. "The spatial, temporal, and configurational characteristics of geographic dispersion in teams", MIS quarterly, Vol. 31, No. 3, pp. 433-452.

Ortiz de Guinea, A., Webster, J., & Staples, D. S., 2012. "A meta-analysis of the consequences of virtualness on team functioning", Information & Management, Vol. 49, No. 6, pp. 301-308.

Peñarroja, V., Orengo, V., Zornoza, A., & Hernández, A., 2013. "The effects of virtuality level on task-related collaborative behaviors: The mediating role of team trust", Computers in Human Behavior, Vol. 29, No. 3, pp. 967-974.

Punch, K. F., 2005. Introduction to social research: Quantitative and qualitative approaches. Thousand Oaks, Calif.: Sage Publications Ltd.

Ramalingam, S., Lobo, S., Mahalingam, A., & Whyte, J., 2014. "Achieving reliability in transnational work on complex projects: new directions for research", Engineering Project Organization Journal, Vol. 4, No. 4, pp. 193-208.

Schroeder, K. A., 2013. A Mixed Method Study of the Accelerators and Decelerators of Global Hybrid Team Effectiveness. (Unpublished PhD), Benedictine University.

Schweitzer, L., & Duxbury, L., 2010. "Conceptualizing and measuring the virtuality of teams", Information Systems Journal, Vol. 20, No. 3, pp. 267-295.

Siebdrat, F., Hoegl, M., & Ernst, H., 2014. "Subjective Distance and Team Collaboration in Distributed Teams", Journal of Product Innovation Management, Vol. 31, No. 4, pp. 765-779.

Simms, C., & Rogers, B., 2006. "The significance of flexibility in improving return on property investment: the UK perspective", Facilities, Vol. 24, No. 3/4, pp. 106-119.

van Gassel, F., Láscaris-Comneno, T., & Maas, G., 2014. "The conditions for successful automated collaboration in construction", Automation in Construction, Vol. 39, pp. 85-92.

Webster, J., & Staples, D. S., 2006. "Comparing virtual teams to traditional teams: An identification of new research opportunities", Research in personnel and human resources management, Vol. 25, pp. 181-215.

Project Management Development – Practice and Perspectives
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IDEA AND PROJECT MANAGEMENT IN A SMALL TOWN IN FINLAND

Dr. Raimo Hälinen, Finland[1]

Abstract

Currently municipal organizations are applying project-based working method in Finland. The needs of suitable tools and applications are recognized. However, the main issue is how to acquire needed knowledge and skills to start working effectively utilizing project-based methods. Before deciding which kind of project management software to use, we need to understand and motivate staff that the members of the organization must accept working method. The good practice is to organize project-management portfolio project taking by potential users to project group participating to define requirements and functionalities.

The research problem is how to apply action design research method (ADR) to requirements and definition process in the project management portfolio project. The aim of the research is to show that the selected method is usable, and it produces commitment members of staff. The preliminary results show that members of the staff are willing to use the project management portfolio after participating requirement's process. The role of the project office is a solution to guarantee that all proposed projects would be estimated using by the criteria. The criteria are based on the strategy of the town and definition of the enterprise architecture. The higher managements are still asking the utility of project management portfolio. The reason is that they need adequate information of the projects, and that information should be available in the graphical format (dashboards).

The idea and project-management portfolio project started in December 2013, and the first version of the tool was accepted in April 2014. The delivery process is continuing, and to update current version to new one and to develop defined dashboard for the management.

The role of researcher in the project is to operate as a project manager and consultant. The first interest of the researcher's point of view was to apply the selected research method to project-management portfolio project and explore the research method's usefulness in the real business case. The second interest is to study how we can optimize planned delivery time and how to motivate staff to use actively the project-management portfolio in every day.

From the organization point of view, the objective is to collect project ideas and evaluate these before starting projects in the project-management portfolio and achieves better management of the projects in different departments. For example, it is typical in municipal organizations that in every unit plan and manage their own projects, and the knowledge is not shared.

Key words: *Research method, project-management portfolio, project office, requirement*

JEL code: D23

Introduction

A typical idea and project management process includes collection of evaluated ideas after that, if accepted, start a project. This essay explores and identifies how we can implement idea and project management application to the town. The available solution is modified town's needs taken the specified requirements and features into account based on proposed offer and

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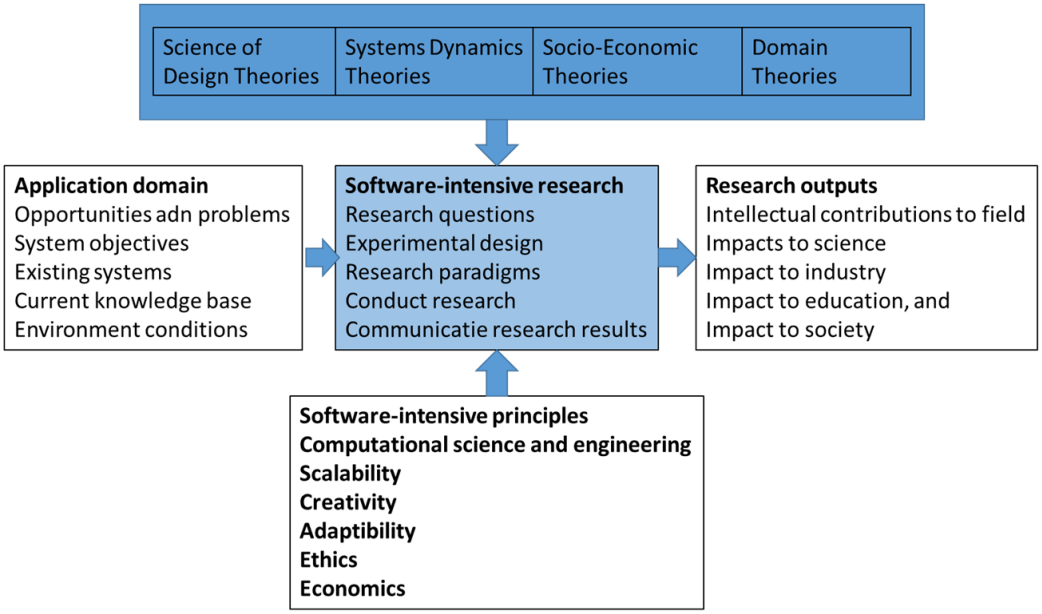
consultancy. The idea and project-management portfolio project started in December 2013and the first version of the portfolio was implemented to test usage in February. The production usage was accepted in April 2014. Currently, idea and project management portfolio's new version release is modified to test usage in January 2015. The need to implement the updated release is based on the new interface, navigation solution, and developed dashboards.

The research problem is to identify idea and project management portfolio's requirement and features together with members of the staff and project team. The purpose is to implement solution that fulfills the specified need for different service sectors and companies in the city. The research method is action design research method (ADR). The main aim of the research is to show how well the selected method serves as a research guide.

Literature review

In the section, I will explore existing literature in design research domain and project management theory. The purpose is to explore selected sources, which I believe the essays reveal some ideas that should be considered before and during to develop modern and usable idea and project management solution (IT-artifact).

Hevner and Chatterjee (2010) discussed the field of software-intensive systems and proposed the terms that can be utilized for software-development processes. The software-intensive system (SIS) includes two critical interfaces: 1) human layer, and 2) software layer. It is also essential to recognize platform layer. In figure 2 is described the research framework that is possible to utilize developing e.g. idea and project management application.



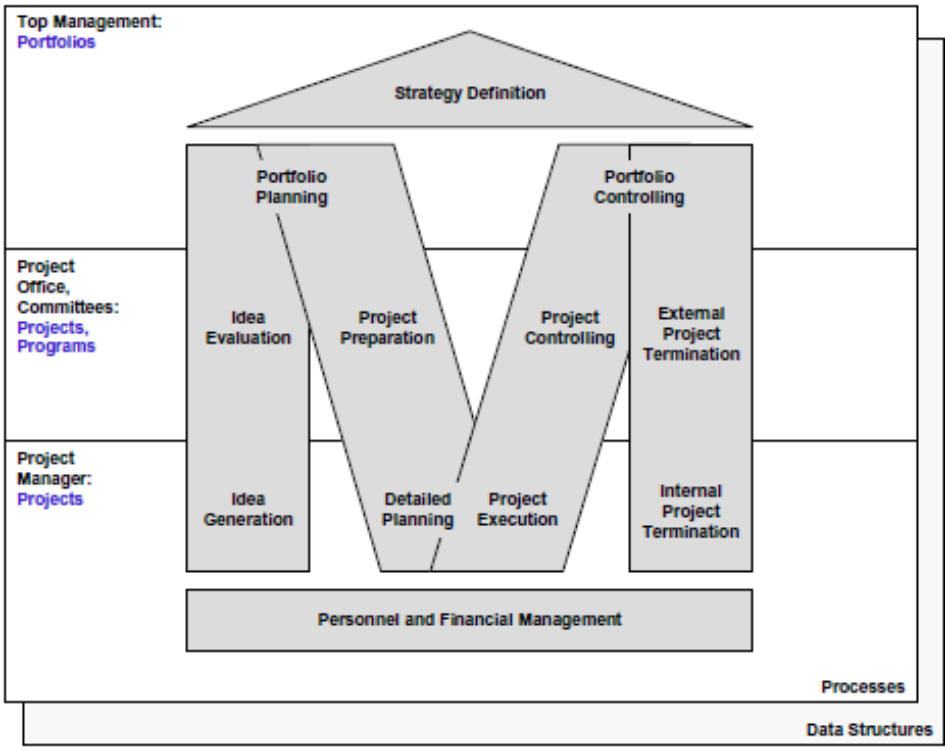
Source: modified by Hevner and Chatterjee (2010, 71 p.)

Fig. 1. **Software-intensive research framework**

De Reyck et al. (2005) identified three pre-conditions for project portfolio management. 1) Organization strategy, 2) Business leader's involvement, and 3) Team skills. It is accepted currently that organization strategy must be defined and revealed to all staff members that they adopt project portfolio management. Leader's involvement is needed and support for project team's work. According to De Reyck et al. (2005, 526 p.), the key elements for project portfolio management are a) centralized view of the project portfolio, b) financial analysis, c) risk analysis, d) interdependencies, e) prioritization, alignment and selection, f) constraints, g) dynamic re-assessment of portfolio, and h) need for specialized software.

The essential questions are how we can adopt project portfolio management in a way that all ideas and projects based on the suggested ideas can be successful. Meskendahl (2010) proposed the following elements. 1) Project's success is depending between the project balance, strategic fit, and synergies. 2) Project portfolio includes consistency, formalization, and diligence. 3) Strategic orientation needs analytical posture, risk-taking, and aggressive approach.

Ahlemann (2009) proposed the reference model for project management information systems. The reference model includes idea evaluation, project preparation and project management modules. The model integrates top management's strategic view, project office, and project manager's work nicely together. In figure 1 is described the reference model. The organizational hierarchical levels: strategic, tactical, and operative are visible, so the idea and project phases are integrated.



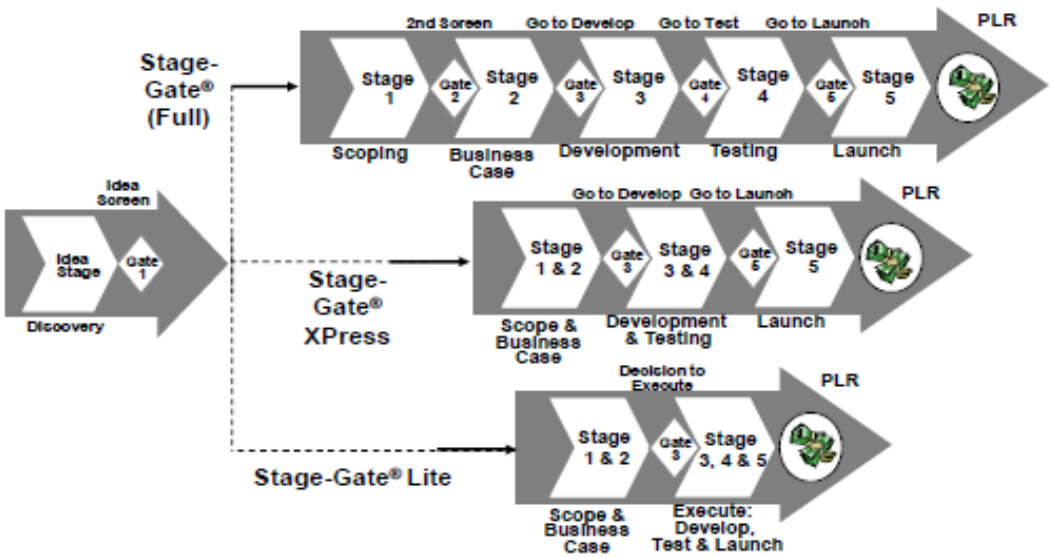
Source: Ahlemann (2009)

Fig. 2. **The Ahlemann's reference model**

Ahlemann (2009, p. 20) specified information systems as socioeconomic systems consist on hardware, software and organizational system. Ahlemann analysed 28 commercial project management systems in order to develop his reference model. Alter's (2013) work system framework includes part of the similar components. However, Alter's work system is much more systematically specified. Alter's (2013, 7 p.) work system framework takes infrastructure, environment, participant, information, technologies, process and activities, product and services, customers and strategies into account, but tactical and operative levels are missing. Alter defines three strategies, namely enterprise, department, and work system.

According to Cooper (2008, 7 p.), the stage-gate is a macro process, and project management is the micro process. The traditional stage-gate model is not flexible enough to apple in idea and project management process. Hence, we should recognize that the stage-gate model is not suitable for all development processes. Cooper (2008, 13 p.) proposed the next-generation stage-gate that takes different kinds of projects into account. In the figure 3, three different stage-gate processes are described. The first is the traditional waterfall model. The second is suitable for moderate risk projects, e.g. for extension and modification project. The third can be used to minor modification projects, when we do modifications, for example, user interface during to delivering idea and project management solution to the new customer.

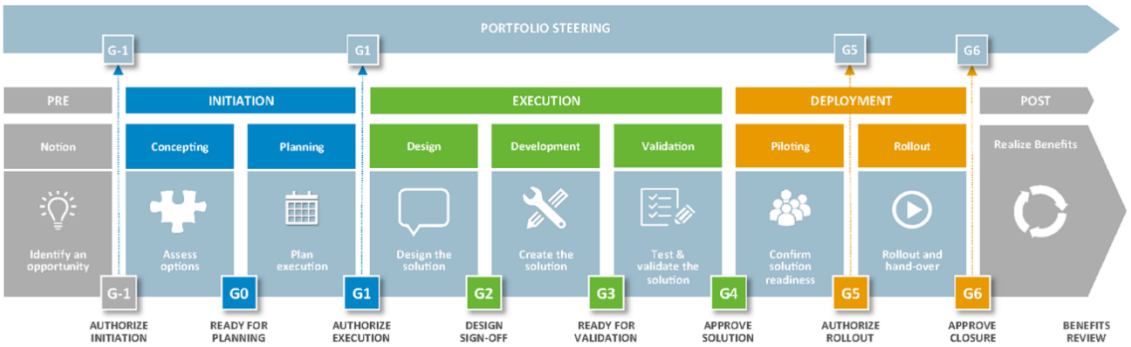
Today more and more software-development processes are planned using by an agile method, e.g. Scrum and Spiral method. Customer centric planning and development processes need continuous discussion with customers and rivals. Hence, we have recognized the increasing demand for idea and project management application that supports company's innovation processes. An answer is to apply agile process such as Kanban tools integrated to stage-gate process. Cooper's new stage-gate model's lite process can utilize Kanban board. (Kanban is written both versions, the first letter capital and small. I use systematically Kanban.) Anderson (2003) created Kanban method and published updated the book 2010.



Source: Cooper, 2008, 13 p.

Fig. 3. **New stage-gate model for different projects**

ICT-forum (2014) proposed a new project model, and it will be published in November 2015 in ICT Standard for Management v3. The idea selection process is added to the gate G-1.



Source: ICT Forum 2014

Fig. 4. **ICT-forum's new project management model**

The model includes the following phases: 1) pre as idea screening, 2) initiation, 3) execution, 4) deployment, and 5) post. The first phase, pre may need more steps to clarify, how idea selection and evaluation should be carried out. To my mind, it is important to integrate idea selection to the organization's strategy and enterprise architecture in order to be successful decide projects based on evaluated idea.

Docherty (2006) proposed open innovation model, which is possible to add project management model to clarify idea gathering and evaluating processes. The model includes 1) Fuzzy Front-End phase, 2) Development, and 3) Commercialization phase. Chesbrough (2003) first presented the open innovation model. Similar idea is also Apilo and Taskinen (2006) suggested in their research paper (in Finnish). Innovation process starts with recognizing potential products, gathering ideas, screening ideas and evaluating ideas before starting the project.

Floyd (2013) described Microsoft's best practices for innovation. The framework consists of the 5E's, which are 1) Envision, 2) Engage, 3) Evolve, 4) Evaluate, and 5) Execute. The first sub-process suggest that organization has defined program strategy and the brainstorming activity means to collect ideas. The second sub-process includes gathering ideas and idea development activities. The third sub-process include only defining proposals. The forth sub-process consists of two activities team evaluation and approval. The fifth sub-process is a last sub-process and it starts a project.

Summary of literature review

In this section, I explored firstly design science research theory and framework. The objective is to integrate idea and project management portfolio's development to the theoretical basis. I selected purposefully Hevner and Chatterjee's (2010) framework as a starting point. Hevner and Chatterjee's framework illustrate properly the problem classes that must be taken into account. According to Järvinen (2011, 10 p.), the research approach can be done using by Järvinen & Järvinen's taxonomy. The research stressing for utility and innovations sub-category

is suitable for developing the idea and project management application. During the development process, we must be evaluate the artefact based on the requirements and defined features.

De Reyck et al. (2005) and Meskendahl (2010) revealed the important issues for successfully proceed idea and project management development projects. Ahlemann's (2009) preference model for project management solutions describes nicely the whole phenomena. The organization's strategy, tactical and operative levels integrate idea and project management project to organization's functions and emphasize a need to work together. Collaboration between all members of staff and management is essential.

I selected Cooper's (2008) new stage-gate model to illustrate how we can see the idea and project management projects in macro model's viewpoint. The model makes it possible to utilize the traditional waterfall method and different kinds of agile methods depending on the projects in question.

ICT forum's new project management model is still under construction. However, the comparison with Cooper's new project management model reveals that ICT forum's needs modification in order to be suitable for agile projects.

Research method

The section discusses about research method. I will explore, why action design research method (ADR) can serve as a research approach in idea and project management portfolio project. The offered solution to the town is modifiable, since it includes two main modules. The first module is idea management, and the second is a project management portfolio. The first meeting we decided to integrate both modules to the idea and project management solution. In order to specify requirements and features, we created the team to define needed solution. The researcher's role in the team was the project manager.

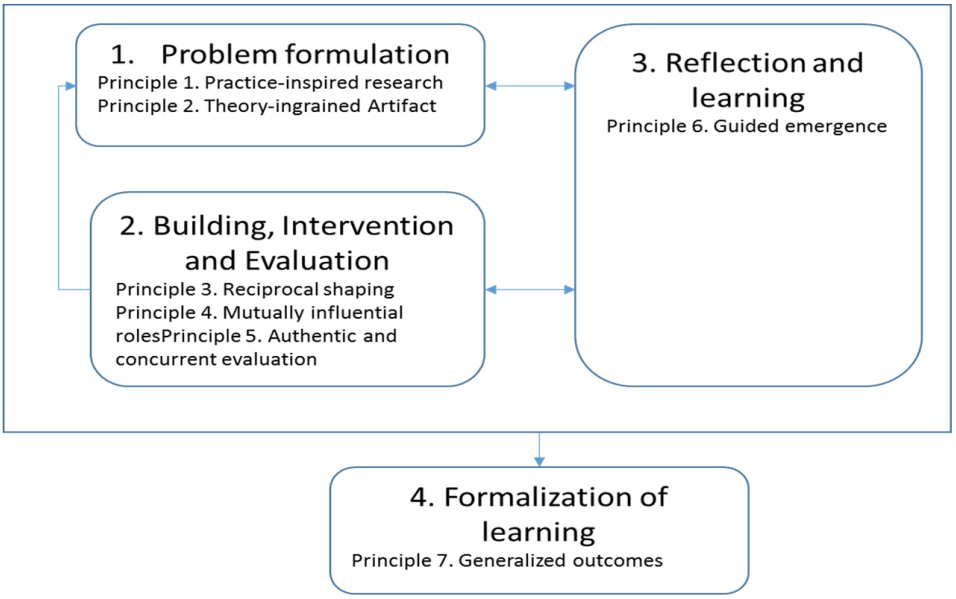
According to Susman and Evered (1978), action research method consists of diagnosis, action planning, action taking, evaluating, and specifying learning. Basic assumption is that researchers and members of client organization are working together to solve the problem. Davidson et al. (2004, p.69) proposed five principles for canonical action research (CAR). 1) the principle of the researcher-client agreement, 2) the principle of the cyclical process model, 3) the principle of theory, 4) the principle of change through action, and 5) the principle of learning through reflection.

Sein et al. (2011) emphasized that the core of the information systems discipline is the IT artifact following Orlikowski and Iacano's (2001) suggestions. However, researchers argue that a combination of action research and design research in information systems discipline offers a more realistic and pragmatic approach to develop and modify IT artifact. The research problem's formulation can be either practice-inspired or theory-integrated. Figure 5 present Sein et al.'s research method.

According to Goldkuhl (2013), comparison action research and design research using by practice research as a lens offers some guide for carrying out research projects. The different objective of the specific problem and problem of general class of the problem is essential to keep in mind. This essay's purpose is to find the solution to the actual problem, so the consideration about class of problems is not important.

Building and modifying idea and project management application includes both building new properties and modifying existing features. Building and modification are done using by

ADR-team suggestions. The suggestions are needed requirements and properties. The selected research approach is in the case practice-inspired, since the purpose is to develop the desired idea and project management application for the customer's use. Sein et al. (2011) considered building, intervention, and evaluation can be either IT-dominant or organization-dominant. In the IT-dominant process, the purpose is to develop an innovative technological application. Organization-dominant process tries to achieve an artifact, which is defined to the specific context. They see the research design continuum in which the one end is IT-dominant process and to the other end is the organization-dominant process. Sein et al. (2011, 42 p.) emphasize continual evaluation during the whole design process.



Source: Sein et al. 2011

Fig. 5. **Action design research model**

For the researcher point of view, the interesting question is, how well the ADR-method serves as a project's framework. The action research cyclical process means that we must to discuss closely with members of the ADR-team in order to achieve the desired features and properties. Understanding between researchers, members of the customer, and software developers are essential to recognize.

Idea and project management case

In this section, I will describe Idea and project management portfolio project that started November 2013 after a short negotiation with representatives of the company and IT-manager and project manager of the town. During the process, I played as the project manager and researcher. In the town's organization worked already the project manager, and he was

responsible to arrange needed meetings with other members of organization. At the beginning, we decided to take participants in all sectors to the ADR-team (Education, Social and health care, Construction, IT, and Administration). Members of the ADR-team were between nine and twelve depending of the meeting.

At the first half-day meeting, the purpose was to analyze and define metadata for databases. The meaning and content of information were written to the excel-worksheets. It was clear that idea and project management portfolio will be defined in Finnish and Swedish language. The second half-day meeting both idea (candidate) and project data accepted in order to start building and modifying the process. The main results from the requirement meetings were desired requirements and properties for the sectors.

ADR-team's working process in described in figure 6. After the requirements' meetings, we developed a test version (alpha version). Participants of the ARD-team tested alpha version. The test period started from the beginning of January 2014. During the test period, we collected comments and desired properties. The beta version was modified after the first test-period. The second test-period started from the beginning of February 2014. The purpose of the pilot use included planned testing data, and the test was carried out in the planned time. The result from the test was gathered to the excel-worksheet. The planned test revealed some errors and it produced some desired features. In my mind, the planned test carried out using by detailed test-material properly showed that it is important to plan test-process before and manages it.

Practitioners and end users participated to the ADR-team and their roles were essential to requirements definitions and creating desired features of the application (IT-artifact). The user interfaces and tables of database are possible to create and modify utilizing proper data and knowledge.

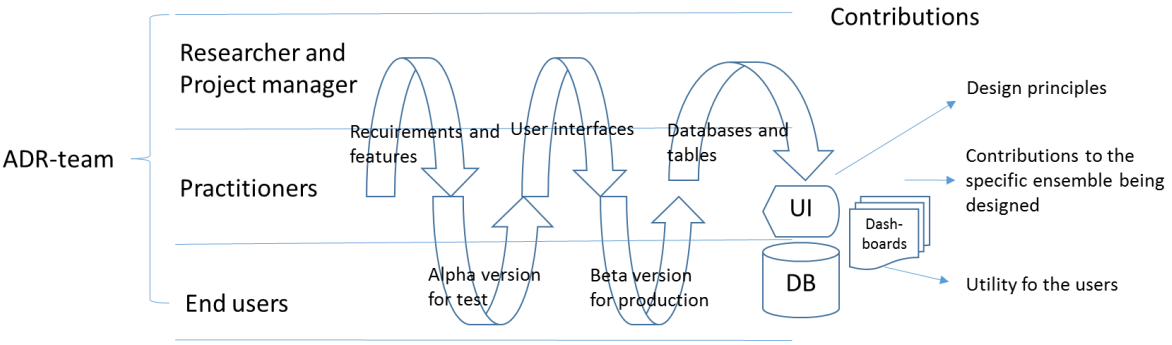


Fig. 6. **Development process of idea and project management portfolio**

Idea and Project management solution

Idea and project management portfolio implementation in this section is presented. I will describe the artifact and its properties. The version's description is based on the new release. The reason to use this version is that it is modern and more up to dated solution, and I suppose it is more interesting for readers. The current version development started about one year ago. The design and developed modules are based on customer researches and visual designers' suggestions.

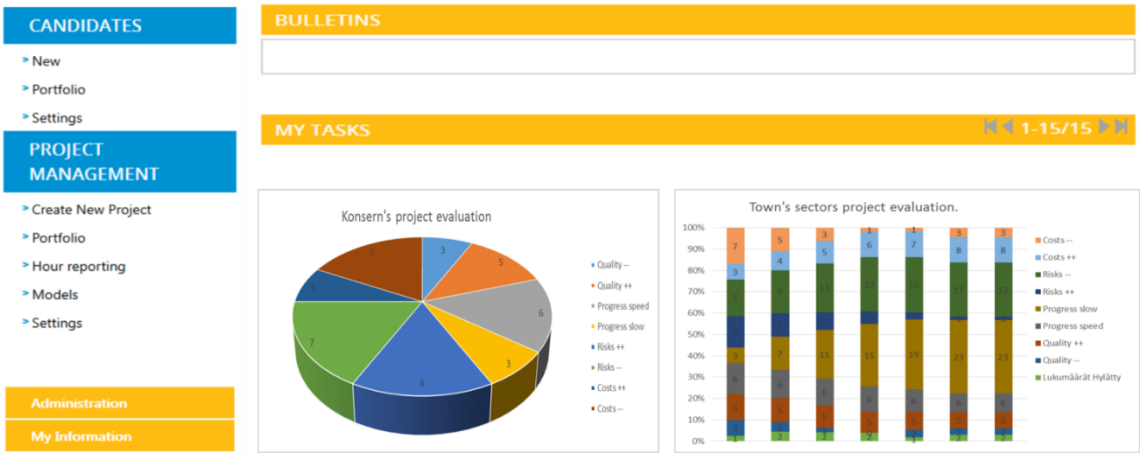


Fig. 7. **Top-management user interface for idea and project management portfolio**

In figure x, it presents the top-management's user interface. The interface includes the idea process (Customer selected the name candidates, since it more specifically explains the purpose). The idea candidates are proposals created by staff members and process includes evaluation process based on strategy and enterprise architecture specifications. One or more candidates can be selected for as a project's source.

Top-management need is to see how different projects are going on. The question is, if it is needed to go to specific project's data to explore possible problems and to see, if there must be make decisions to go or to kill the project in question. The top-management information is essentially depending on the work of project managers. They have to continually update and report to the idea and project management portfolio's database actual data and possible problems that need decision-making.

Discussions and Conclusions

The practical objective of the project is to develop useful idea and project management portfolio to the customer. The research main aim is to demonstrate how well the selected research method action design research method is for requirements and properties definition work together members of the town, developers and project people.

The practical objective was achieved and idea and project management portfolio is in use. During the feedback discussions, the IT-manager and project manager proposed if it possible to modify current version to the new release and add some desired dashboard to the platform. The new release is currently in test use.

The research objective, the demonstration of the ADR-method creating by ARD-team at beginning is very good choice. The members of the team were motivated to work and their knowledge of the practice is important. It is also essential to remember that the strategy and principle of enterprise architecture are defined and project-working method is learned.

Bibliography

Ahlemann F., 2009. Towards a conceptual reference model for project management information systems, International Journal of Project Management, Vol. 29, pp. 19-30.

Anderson, David, September 2003. *Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results*. Prentice Hall.

Apilo T. And Taskinen T., 2006. Innovaatioiden johtaminen, VTT Tiedotteita 2330, Espoo.

Alter S., 2013. Work System Theory: Overview of Core Concepts, Extensions, and Challenges for the Future, Journal of Association of Information Systems 14, Issue 2, pp. 72-121.

Chesbrough H., 2003. Open innovation: The new imperative for creating and profiling from technology, Harward Business School Press.

Cooper R.G., 2008. Perspective: The Stage-Gate Idea-to-Launch Process – Update, What's New and NexGen Systems, Journal of Product6 Innovation Management, Vol. 25, No. 3, pp. 213-232.

Davidson R.M., Martinsons M.G. and Kock N., 2004. Principles of canonical action research, Information Systems Journal, No. 14, pp. 65-86.

De Reyck B., Grushka-Cockayne Y., Lockett M., Calderini S.R., Moura M. and Sloper A., 2005. The impact of project portfolio management on information technology project, International Journal of Project Management, Vol. 23, pp. 524-537.

Dogherty M., 2006. Primer on "open innovation:" principle and practice, pdma vision, pp. 13-17.

Floyd S., 2013. Best Practices for Innovation: Microsoft Innovation Management Framework. [Online] Available at: http://download.microsoft.com/.../Microsoft%20Innovation% [Accessed 5 February 2015].

Goldkuhl, 2013. Action research vs. Design research: using practice research as a lens for comparison and integration. [Online] Available at: http://liu.diva-portal.org/smash/get/diva2:688095/FULLTEXT01.pdf [Accessed 6 February 2015].

Hevner A. and Chatterjee S., 2010. Design Research in Information Systems, Theory and Practice, Integrated Series in Information Systems 22, Springer.

Hughes B. and Cotterell M., 2009. Software Project Management, Fifth Edition, McGraw-Hill Higher Education, Berkshire.

ICT Forum, 2014. New Best Practices for Succesful Project Management. [Online] Available at: https://www.ictstandard.org/publications_and_tools [Accessed 6 February 2015].

Iivari J., 2005. Information Systems as a Design Science, Some Concerns, Information Systems Development: Advances in Theory, Practice and Education, Edited by Vasilecas O. et al., Springer.

Iivari J. and Venable J., 2009. Action Research and Design Science Research – seemingly similar but decisively dissimilar, 17th European Conference on Information Systems, ECIS2009-0242.R1, Verona.

Järvinen P., 2012. On Research Methods, Opinpajan kirja, Tampere.

Meskendahl S., 2010. The influence of business strategy on project portfolio management and its success – A conceptual framework, International Journal of Project Management, Vol. 28, pp. 807-817.

Sein M. K., O. Henfridsson, S. Purao, M. Rossi and R. Lindgren, 2011. Action design research, MIS Quarterly 35, No 1, 37-56.

Susman G.I. and Evered R.D., 1978. An Assessment of the Scientific Merits of Action Research, Administrative Science Quarterly, Vol. 23, No. 4, pp. 582-603.

Sjöström J. and Donnellan B., 2012. Design Research Practice: A Product Semantics Interpretation, International workshop on IT Artefact Design & Workpractice Intervention, Barcelona.

Thakurta R., 2011. Influence of Process Models on Requirement Volality, and Strategies for its Management – An Empirical Investigation, Clei Electronic Journal, Vol. 14, No. 2, Paper 3.

Weißbach R., 2013. How Business Departments Manage the Requirements Engineering Process in Small and Medium Enterprises, Issues in Information Science and Information Technology, Vol. 10, pp. 539-549.

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FROM "IT PROJECT MANAGEMENT" M.SC. DEGREE PROGRAM TOWARDS E-LEADERSHIP EDUCATIONAL OFFERS – CURRICULA ANALYSIS

Valentina Ivanova, New Bulgarian University, Bulgaria[1]

Abstract

"LEAD – e-Leadership Skills: for Small and Medium Sized Enterprises" develops targeted actions for start-ups and fast growing SMEs to provide them with relevant e-leadership skills. The focus of this initiative supported by the European Commission is on e-leadership, defined as leadership which both relies on information and communication technologies (ICT) and aims to accomplish goals that involve ICT. Effective organizations are demanding e-leaders who are both business and ICT-savvy. E-Leadership skills enable people with very strong ICT skills to lead qualified staff from ICT and other disciplines towards identifying and designing business models and exploiting key innovation opportunities. E-Leadership is successful where an organization is making best use of new developments in ICT, where leading edge ICT is driving innovation and delivering value to their organizations (Empirica, e-Leadership Skills for SMEs, 2014).

In this article a brief overview of the LEAD initiative is presented as contributing to the "Grand Coalition for Digital Jobs" and to the follow up of the European Commission's Communication on "e-Skills for the 21st Century" which presents an European Union long term e-skills agenda, of "The Digital Agenda for Europe" and of the Communication "Towards a Job-rich Recovery". Recent research on demand for e-leadership knowledge and skills is presented. SMEs' e-leadership requirement elicitation activities in Bulgaria are discussed and the results of in depth interviews with start-ups, leading and fast growing SMEs are presented. A method for identifying curricula improvement opportunities based on e-CF, CEN ICT profiles, labor market based competence requirements for ICT project managers, PMBOK® Guide knowledge areas, and e-leadership curricula profiles is suggested. A sample M.Sc. degree programme "IT Project Management" is analysed. Based on the results of the analysis and the elicit SMEs' e-leadership requirements curricula improvement opportunities are identified and SME targeted e-leadership courses, trainings, and workshops are suggested.

Key words: *IT Project Management, e-CF competence framework, CEN ICT profiles, e-Leadership, Education in e-Leadership*.

JEL codes: I210, I230, J24

Introduction

"LEAD – e-Leadership Skills: for Small and Medium Sized Enterprises (SMEs)" develops targeted actions for start-ups and fast growing SMEs to provide them with relevant e-leadership skills. The focus of this initiative, supported by the European Commission, is on e-leadership, defined as leadership which both relies on information and communication technologies (ICT) and aims to accomplish goals that involve ICT (empirica, e-Leadership Skills for SMEs, 2014). Effective organizations are demanding e-leaders who are both business

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and ICT-savvy. e-Leadership skills enable people with very strong ICT skills to lead qualified staff from ICT and other disciplines towards identifying and designing business models and exploiting key innovation opportunities. e-Leadership is successful where an organization is making best use of new developments in ICT, where leading edge ICT is driving innovation and delivering value to their organizations (empirica, e-Leadership Skills for SMEs, 2014).

The challenge to universities is to prepare appropriate educational content and e-leadership curricula, and to offer innovative course formats in order to answer the demand for SMEs e-leaders (Ivanova, V., Arenas, A., 2014).

1. Demand for e-Leadership

The ICT workforce in Europe in 2011 amounted to 6.67 million, which is 3.1% of the overall workforce. It has been growing over the past decades and will continue to grow in the future. From 2000 to 2010 the ICT workforce grew at an average annual rate of 4.26%. Even at times of economic and financial crisis which Europe is undergoing since late 2008, growth remained at 2.65%.

There seems to be a significant demand for e-leaders. Of the approximately 255 000 ICT vacancies for the EU-27 in 2012, we find 76 000 vacancies requiring "ICT management and business architecture" skills. Furthermore, the gap is disproportionately affecting SMEs: 70% of vacancies can be found in SMEs, which demand ICT skills in much greater numbers than large enterprises (empirica, e-Skills for Competiveness and Innovation, 2013).

During 2012, empirica, IDC and INSEAD worked together on a study for the European Commission's Directorate General Enterprise and Industry. The objective of the study titled "e-Skills for Competitiveness and Innovation: Vision, Roadmap and Foresight Scenarios" was to develop a vision for Europe's e-skills for competitiveness and innovation, and to examine ways to face current and future challenges. A particular focus of the study was on e-leadership skills. The resulting analysis, roadmap and scenarios focus on how Europe can seize opportunities in innovation, new technologies and emerging forms of organization and production, while maintaining its priority on inclusive growth. To estimate the demand for e-leaders, the research team assumed that some organizations need more e-leaders than others, depending on two dimension

- The size of an organization: In terms of number of full-time equivalents (FTEs), large (250-99 FTEs) or very large firms (1000+ FTEs) will have a greater need and capacity to distribute key responsibilities across more individuals than a micro firm (1-9 FTEs) or a small firm (10-49 FTEs).
- The ICT-Intensity of a sector: This is the degree to which organizations rely on technology for their business operations, innovations and the provisioning of their services and products. The demand for e-leaders is greater for organizations in the ICT sector than for organizations in non-ICT sectors, because the ICT sector needs e-leaders for internal operations, innovation and for external provisioning of services. Within non-ICT, there are high ICT intensity sectors and low ICT intensity sectors.

Based on these factors, organizations were assigned into one of three different groups. Within each of the three groups, demand was estimated (empirica, e-Skills for Jobs in Europe, 2013).

Table 1

Estimated Demand of e-Leaders

Type of Firm & Sector	Size of Firm	Estimated Demand of e-Leadership per Enterprise	Number of Enterprises	Estimated TOTAL Demand for e-Leaders by Firm Type
ICT Sector	High Growth SMEs	1	15 000	15 000
	Medium	4	6 500	26 000
	Large & Very Large	8	1 400	11 000
High ICT Intensity Sectors	High Growth SMEs	1	30 000	30 000
	Medium	2	60 000	120 000
	Large & Very Large	5	29 000	145 000
Low ICT Intensity Sectors	High Growth SMEs	1	25 000	25 000
	Medium	1	227 000	227 000
	Large & Very Large	2	42 000	84 000
TOTAL ESTIMATED DEMAND of e-LEADERS			**436 000**	**680 000**

Source: author's construction based on (Empirica, e-Skills for Jobs in Europe, 2013)

Demand of e-leaders is growing throughout European industry. Recent research has confirmed that the shortage of e-leadership skills across Europe is significant, calling for action.

2. SMEs' e-Leadership Requirements Elicitation Activities in Bulgaria

The "LEAD – e-Leadership Skills: for Small and Medium Sized Enterprises" study builds on previous work for the European Commission. A particular focus of the study are Small and Medium Sized Enterprises.

The selected SMEs' e-Leadership requirement elicitation technique was in-depth interviews with leading or fast growing SMEs and start-ups. Companies from five European countries were interviewed. In Bulgaria 50% of the interviewed companies are 'gazelles' with annual growth of more than 20% for the last two years, and 60% – won awards in the last three years. All the companies were established in the last 20 years. Among the founders of the companies are young entrepreneurs, NGOs, and multinational corporations. Some of the companies were significantly transformed in the last five years.

SMEs concentrate e-leadership responsibilities in the top-management personnel most often in a single chief officer that is both ICT-savvy and business-savvy.

The research revealed the preferred sources of advanced knowledge of Bulgarian SMEs:

- internal coaching and training;
- external trainings (one or two days);

- conferences;
- free online courses;
- recruitment of experts.

None of the interviewees mentioned universities as a lifelong learning knowledge provider. The challenge to universities is to prepare appropriate educational content and to offer innovative course formats in order to answer the demand for SMEs e-Leaders (Ivanova, V., Arenas, A., 2014).

3. Curricula Improvement Opportunities

The M.Sc. degree programmes must be:

- accredited by the national accreditation institutions for the corresponding qualifications

As additional criteria for identifying curricula improvement opportunities the author proposes:

- for compliance with the current industry demands:
  - national competence definitions and job profiles;
  - European competence definitions and job profiles;
  - world-wide recognized professional standards;
- for compliance with the forecasts of the industry demands of tomorrow:
  - research on sector trends and estimated future competence and job demands.

The curricula development is a continuous process taking into account the changes in national and European legislation, industry demands, good practices and standards, technological and academic research results and innovations, and trends and forecasts of the future development.

4. M.Sc. Degree Programme "IT Project Management"

The approach was used to evaluate and identify improvement opportunities for New Bulgarian University (NBU) Master of Science Degree programme "Information Technologies Project Management" (M.Sc. "IT PM"). The programme was started in 2009 aiming to enable experienced ICT developers, first- and second-level ICT managers to move to a higher management level.

The M.Sc. "IT PM" programme follows the standard NBU master degree scheme (course: 30 hours/3 credits).

- I semester: 15 credits from courses / 15 credits from projects;
- II semester: 15 credits from courses / 15 credits from projects;
- III semester: 15 credits from courses / 15 credits from practice;
- IV semester: M.Sc. Thesis or State Exam – 15 credits.

Table 2

M.Sc. "IT PM" Course List

SEMESTER 1	SEMESTER 2	SEMESTER 3
IT Project Management – Part 1	Advanced IT Project Management	Modern Technologies for Managing IT Production
IT Project Management – Part 2	Architectures of Software Systems	Estimating Risk in IT Projects
Workshop on IT PM	IS Analysis and Design	Statistical Methods
Management of Financial Resources	Management of Human Resources	Marketing Management
Law Regulations of Projects	Software Testing and QA	Data Mining
Information Society Law	Software Estimation	Data Warehouse
Personal Software Process – Fundamentals	Personal Software Process – Advanced	Leading a Development Team

Source: author's construction based on (New Bulgarian University, 2015, Master Degree Programmes)

All courses and trainings related to the core content are named "IT Project Management" and they are mandatory for all students. To get the required minimum of credits the students must enrol and successfully complete five courses (three credits each) during the first, second and third semester. The M.Sc. programme offers seven courses per semester.

5. M.Sc. "IT Project Management" Programme Curricula Analysis and Improvements Opportunities

5.1. National Accreditation

European and national legislation proscribe National Accreditation Procedures. The European Association for Quality Assurance in Higher Education (ENQA) is an umbrella organization which represents quality assurance organizations from the European Higher Education Area (EHEA) member states. ENQA promotes European co-operation in the field of quality assurance in higher education and disseminates information and expertise among its members and towards stakeholders in order to develop and share good practice and to foster the European dimension of quality assurance (ENQA, 2014).

The Bulgarian National Evaluation and Accreditation Agency is a statutory body for evaluation, accreditation and monitoring of the quality in higher education institutions and scientific organizations in Bulgaria aiming at the enhancement of their teaching and research, as well as of their development as scientific, cultural, and innovative organizations. The Agency monitors the ability of institutions, their main units and branches to provide good quality of education and scientific research through an internal quality assurance system. Their mission is to encourage higher education institutions in assuring and enhancing the quality of education they offer by sustaining high academic standards and good education traditions in Bulgaria (NEAA, 2014). All e-Leadership educational programmes should be accredited by the national accreditation institutions.

The NBU M.Sc. "IT PM" programme is accredited by the Bulgarian National Evaluation and Accreditation Agency.

5.2. National Competence Profiles and Job Descriptions

In November 2014 Bulgarian Industrial Association – Union of the Bulgarian Business (BIA) introduced a sector oriented competence framework. The methodology used by BIA considers competence to be a set of knowledge, skills, attitudes and behaviours used to achieve results (performance levels) in a certain professional role or in a particular organisation. Acquiring a certain level of competence can be seen as an expression of the individual's ability to combine and integrate in their behaviour (independently, own know-how) the different elements of skills and knowledge, of professional and personal qualities, of past experience.



	Целеви профил	Профил на програмата	
	Целево ниво	Максимално ниво	Брой дисциплини
Знания			
Администрация и управление	3	4	9
Обслужване на клиенти	3	4	8
Комуникации	3	3	3
Компютри и Електроника	3	3	6
Математика	3	3	6
Персонал и човешки ресурси	3	3	1
Информационна сигурност	3	4	1
Умения			
Самоувереност	3	3	16
Комуникация	3	3	14
Въздействие/ влияние	3	3	6
Усъвършенстване на другите	3	3	5
Грижа за ред, качеството и точността	3	4	10
Решаване на проблеми	3	3	11
Планиране и организация	3	3	6
Боравене с информация и управление	3	3	5
Аналитично мислене	3	3	13
Чужди езици	3	4	6
Специфични технически умения	3	4	1
Основни компетенции			
Асертивност	3	3	6
Изграждане на взаимоотношения	3	3	2
Инициативност	3	4	3
Специфични компетенции			
Планиране на проект и продукт	4	4	12
Управление на връзки и комуникации	4	4	4
Управление на проект и портфолио	4	4	6
Управление на риска	4	4	7
Управленски компетенции			
Вземане на решения	3	4	7
Лидерство	3	4	2
Организиране	3	4	4
Планиране	3	4	8
Развитие на кора	3	3	3
Управление на екип	3	4	5

Source: author's construction based on (Ivanova, V. 2014, Piloting MyCompetence IS tool for M.Sc. "IT Project Management").

Fig. 1. **Mapping to BIA IT Project Manager (Project Manager) – NKPD code: 25125006 to M.Sc. "IT PM" Programme (NBU)**

The classification used in the development of sector models organises competencies in three groups: general, specific and managerial competencies. General competencies are relevant for all positions within the company and contribute to creating and fostering corporate culture. Specific competencies are necessary for the successful execution of activities related to specific work tasks. Each competency is described with the following characteristics: name; type (according to classification, according to NQF and according to the name of the cluster to which it belongs); sector definition; recommended level of demonstration; behavioural indicators; ways to acquire the competency; competence assessment tools. Behavioural indicators illustrate

how a competency is transformed from an abstract concept into specific, clear and tangible actions which describe the profile of a successful employee/worker employed at a particular position. The competencies are classified into three groups – general for the sector, job specific and managerial ones whenever the position requires such competences (Competence Assessment Information System, 2015).

An information system called "MyCompetence" was created within a project "Development of a Workforce Competence Assessment System by Sectors and Regions" carried out by the Bulgarian Industrial Association (BIA) in partnership with the Confederation of the Independent Trade Unions in Bulgaria (CITUB) and the Confederation of Labour "Podkrepa" and the financial assistance of the European Social Fund

A prototype tool for mapping BIA "MyCompetence" professional profiles to existing educational offers was developed. It supports universities, educational and training institutions.

NBU M.Sc. "IT PM" programme was mapped against the BIA profile "IT Project Manager (Project Manager) – NKPD code: 25125006". The programme curricula and educational methods cover the three competence groups: general, specific and managerial competencies. In all groups the educational offer of the "IT PM" M.Sc. programme exceeds today's requirements of the industry.

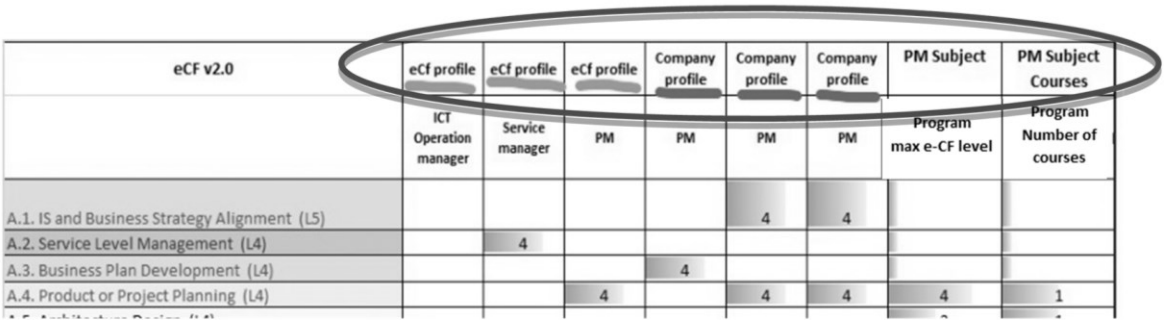
5.3. European Competence Definitions and Job Profiles

The European e-Competence Framework (e-CF) provides a reference of 40 competences as required and applied at the Information and Communication Technology (ICT) workplace, using a common language for competences, skills and proficiency levels that can be understood across Europe. As the first sector-specific implementation of the European Qualifications Framework (EQF), the e-CF fits for application by ICT service, demand and supply organizations, companies, for managers and HR departments, for education institutions and training bodies, including higher education, for market watchers and policy makers, public and private sectors (European e-Competence Framework, 2014).

The e-CF version 3.0 gives clear definitions and sound orientation to support decision-making in relation to the selection and recruitment of candidates, as well as the training and the assessment of ICT professionals. It enables the identification of skills and competences that may be required to successfully perform duties and fulfil responsibilities related to the ICT workplace. The widespread adoption of the e-CF by companies and organisations throughout Europe has started to increase the transparency, mobility and efficiency of ICT sector related human resources (European e-Competence Framework, 2014).

Previous research proposed the bidirectional mapping of e-CF version 3.0 definitions of skills and competences as a common language of describing skills and competences offered by higher education courses (Sharkov G., Asenova P., Ivanova V., 2014).

Master Degree Programmes are a set of courses. The tool for bidirectional mapping accumulates the e-CF skills and competences taught in all courses of a programme. The results could be used to identify gaps between standard CEN ICT profiles, industry recognized job profiles and the existing educational offers or to highlight overlapping content – similar skills and knowledge at similar levels that are offered by independent courses. The proposed method for programme evaluation provides scientific approach to programme curricula development based on the CEN e-CF profiles.



eCF v2.0	eCf profile	eCf profile	eCf profile	Company profile	Company profile	Company profile	PM Subject	PM Subject Courses
	ICT Operation manager	Service manager	PM	PM	PM	PM	Program max e-CF level	Program Number of courses
A.1. IS and Business Strategy Alignment (L5)					4	4		
A.2. Service Level Management (L4)		4						
A.3. Business Plan Development (L4)				4				
A.4. Product or Project Planning (L4)			4		4	4	4	1

Source: author's construction based on (Sharkov G., Asenova P., Ivanova V., 2014)

Fig. 2. **Bidirectional mapping of 3 e-CF (CEN ICT) profiles to three Industry profiles and M.Sc. "IT PM" Programme (NBU)**

The mapping to CEN ICT profiles revealed that the M.Sc. "IT PM" program covers the following CEN ICT profiles:

- Project Manager
- ICT Operations Manager
- Quality Assurance Manager
- Enterprise Architect

It was observed that the competences of the CEN ICT CIO profile are not fully covered, although the CIO profile is one of the managerial profiles defined by the standard. The competences that were not covered by the courses of the programme were related to:

- A.1. IS and Business Strategy Alignment
- E.8. Information Security Management.

The areas where existing curricula and target European competence definitions and job profiles do not overlap are identified as curricula improvement opportunities. Updates of the M.Sc. programme should take into account the research results from the SMEs e-Leadership requirement elicitation activities presented earlier in this article and to propose relevant educational formats of the new educational content.

A seminar training "Strategy Development for ICT Intensive Organizations" and a course on "Cyber Security and Resilient Business" were added to the M.Sc. "IT PM" programme and the requirement of CEN ICT CIO profile were met. The seminar trainings follow an innovative format of project work for M.Sc. "IT PM" programme. The seminar consists of three phases:

- building theoretical background;
- team project work;
- gamified learning during presentation, feedback and assessment stage.

"Cyber Security and Resilient Business" course was added to the M.Sc. "IT PM" programme in "hyper intensive" format – ten academic hours per day, three sequential academic days. Identifying the efficiency of the educational format addressing the educational and training needs of SMEs is work in progress.

5.4. World-Wide Recognized Professional Standards

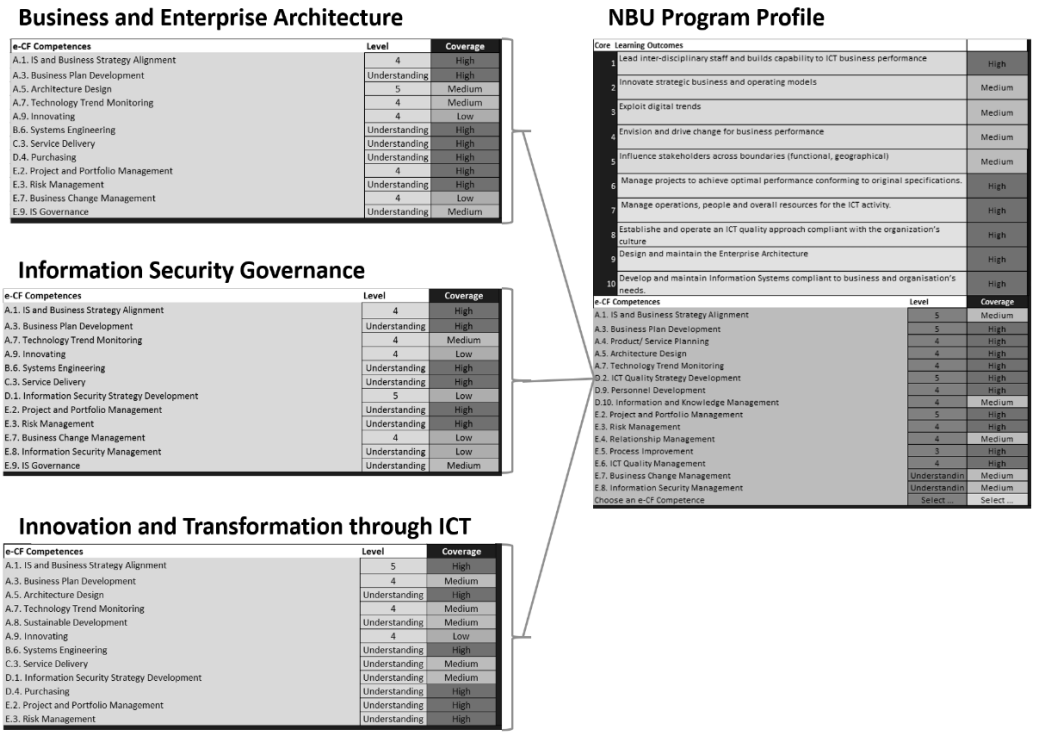
The PMBOK® Guide is the preeminent global standard for project management. It provides project managers with the fundamental practices needed to achieve organizational results and excellence in the practice of project management. (Project Management Institute, 2015).

The M.Sc. "IT PM" programme covers all PMBOK® Guide – Third Edition knowledge areas by design. The updates in PMBOK® Guide – Fourth and Fifth edition do not affect the programme scheme, only the content of the PMBOK® based courses – "IT PM" (Part 1 and Part 2), "Workshop on IT PM", and "Advanced IT Project Management".

5.5. Research on Sector Trends and Estimated Future Competence and Job Demand

CEN ICT management profiles define the competences required from the ICT leaders of today. World level educational offers should prepare e-Leaders – the leaders of tomorrow. The demand of e-Leaders was discussed earlier in this article. European Guidelines for New Curricula Fostering e-Leadership Skills define three initial e-Leadership curricula profiles (empirica, European Guidelines for New Curricula Fostering e-Leadership Skills, 2013):

- Business and Enterprise Architecture
- Innovation and Transformation through ICT
- Information Security Governance



Source: author's construction based on (Ivanova, V., 2014)

Fig. 3. **Mapping e-Leadership curricula profiles to M.Sc. "IT PM" Programme (NBU)**

The mapping approach is applied to e-Leadership curricula profiles. In addition to the improvement opportunities that are identified based on the non-intersecting or partial overlapping ICT skills and competences of the M.Sc. "IT PM" programme and e-Leadership curricula profiles, a mapping on a higher level is suggested by assessing the M.Sc. programme learning outcomes to the e-Leadership curricula expected learning outcomes.

The core e-Leadership curricula learning outcomes are:

- Lead inter-disciplinary staff and build capability to ICT business performance;
- Innovate strategic business and operating models;
- Exploit digital trends ;
- Envision and drive change for business performance;
- Influence stakeholders across boundaries (functional, geographical).

The e-Leadership curricula core learning outcomes could be classified to the top three level of Bloom's taxonomy – create, evaluate and analyze information and knowledge (Bloom, B. S., 1956). The M.Sc. "IT PM" programme scheme, course curricula, and individual and team projects fully covers only "Lead inter-disciplinary staff and build capability to ICT business performance". The rest of the e-Leadership core learning outcomes identify new curricula improvement opportunities. Their exploration in the context of SMEs e-Leadership requirements is work in progress.

Conclusion

The proposed systematic method based on mapping of existing M.Sc. programme curricula to standards of the national accreditation institutions for the corresponding qualifications, current industry demands specified by national competence definitions and job profiles, European competence definitions and job profiles, world-wide recognized professional standards, and the forecasts of the industry demands, based on research on sector trends and estimated future competence, and job demands could be used for identifying curricula improvement opportunities. For M.Sc. on "IT PM" mappings to labour market based competence requirements for ICT project managers, e-competence framework (e-CF), CEN ICT profiles, international standards such as PMBOK®, and forecasts for the e-leadership curricula profiles are suggested. The analysis of M.Sc. "IT Project Management" Programme at New Bulgarian University using the proposed method identified two different improvement opportunities – related to competences and related to the expected learning outcomes. The competence related issues can be solved by adding new courses and project work, while covering the expected learning outcomes requires further research that will lead the further curricula improvements. The development of M.Sc. programme curricula is a perpetual process, essential part of the M.Sc. programme quality assurance procedures and the programme life cycle.

Bibliography

Bloom, B. S.; Engelhart, M. D.; Furst, E. J.; Hill, W. H.; Krathwohl, D. R., 1956. *Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain.* New York: David McKay Company.

Competence Assessment Information System, 2015. *What is a competency?* [Online] Available at: http://en.mycompetence.bg/static/9 [Accessed 7 February 2015].

Empirica, 2013. *e-Leadership: e-Skills for Competitiveness and Innovation: Vision, Roadmap and Foresight Scenarios, Final Report*. [Online] Available at: http://eskills−vision.eu/fileadmin/eSkillsVision/documents/VISION%20Final%20Report.pdf [Accessed 4 November 2014].

Empirica, 2013. *European Guidelines for New Curricula Fostering e-Leadership Skills*. [Online] Available at: http://eskills2013.eu/fileadmin/monitor2013/Presentations/28_Robinson_GUIDE-.pdf [Accessed 4 November 2014].

Empirica, 2014. *e-Leadership Skills for SMEs*. [Online] Available at: http://www.eskills-lead.eu/home/ [Accessed 15 November 2014].

Empirica, 2014. *e-Skills for Jobs in Europe.* [Online] Available at: http://eskills−monitor2013.eu/fileadmin/monitor2013/documents/MONITOR_Final_Report.pdf [Accessed 4 November 2014].

European Association for Quality Assurance in Higher Education (ENQA), 2014. *About ENQA*. [Online] Available at: http://www.enqa.eu/ [Accessed 4 November 2014].

European e-Competence Framework, 2014. *The what, how and why guide to the e-CF*. [Online] Available at: http://www.ecompetences.eu/ [Accessed 4 November 2014].

Ivanova, V., 2014. *NBU M.Sc. Program "IT PM" Towards e-Leadership Program – Case Study*, Regional ICT Cluster Event: "New Curricula for e-Leadership", 20 May 2014, Sofia, Bulgaria, [Online] Available at: http://eskills-guide.eu/fileadmin/guide/documents/RCE_BG_presentations/09_Valentina_Ivanova_NBU.pdf [Accessed 7 February 2015].

Ivanova, V. 2014, *Piloting MyCompetence IS tool for M.Sc. "IT Project Management" Programme*, Presentation at National Round Table: "Education and Development by Employers Standards", 19-20 November 2014, Sofia, Bulgaria.

Ivanova, V., Arenas, A., 2014. *e-Leadership Skills for SMEs – Challenges to the Universities*. Proceedings of 8th International Scientific Conference on Economic and Social Development, 4th Eastern European ESD Conference: Building Resilient Economy, 19 December 2014, Zagreb, Croatia.

New Bulgarian University, 2015, *Master Degree Programmes*, [Online] Available at: http://ecatalog.nbu.bg/default.asp?V_Year=2015&PageShow=programpresent&P_Menu=generalinfo&Fac_ID=4&M_PHD=&P_ID=1767&TabIndex=1 [Accessed 20 March 2015].

Project Management Institute, 2015, *PMBOK® Guide*, [Online] Available at: http://www.pmi.org/PMBOK-Guide-and-Standards/pmbok-guide.aspx [Accessed 7 February 2015].

Republic of Bulgaria – Council of Ministers, National Evaluation and Accreditation Agency (NEAA), 2014. *NEAA website.* [Online] Available at: http://www.neaa.government.bg/en [Accessed 4 November 2014].

Sharkov G., Asenova P., Ivanova V., Gueorguiev I., Varbanov P., 2014. *Evaluation of ICT Curricula Using European e-Competence Framework*. Proceedings of: 10th Annual International Conference on Computer Science and Education in Computer Science, 4-7 July 2014, Albena, Bulgaria.

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THE IMPORTANCE OF PROJECT MANAGEMENT METHODOLOGIES AND TOOLS IN NON-GOVERNMENTAL ORGANIZATIONS. CASE OF LITHUANIA AND GERMANY

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Abstract

Certification bodies, the managerial and academic literature, and general practice indicate that organizations willing to succeed in managing projects need to be compliant with certain rules, practices and methodologies (Golini R., Kalchschmidt M., Landoni P., 2014).

The main aim of this research is to compare the level of awareness and application of PM methodologies and tools in NGOs of two socially, politically and economically distant countries – Lithuania and Germany. There was a scientific literature analysis made to define project management methodologies, its' benefits and current situation of PM challenges NGO sector has to face. Moreover, a survey of 100 NGOs project managers was held to assess the level of awareness and application of PM methodologies and tools in NGOs. There was also a correlation analysis made to appraise the determining factors of usage of PM methodology and software.

This research will contribute to NGOs' decision making process about application of PM methodologies and tools. Research results could be also used by PM consulting and Software companies, editors of PM guidelines.

Key words: *NGOs; project management; project management methodologies*

JEL code: L3

Introduction

There are thousands of Non-Governmental Organizations (NGOs) actively working in Lithuania and Germany. Their ability to fulfil society needs depends increasingly on project-based funding. Nevertheless, while the livelihoods of many people depend on NGOs' ability to deliver project results effectively and efficiently, project management (PM) is rarely identified as a strategic priority for these organizations (PM4NGOs, 2013). Despite the fact that there are PM tools and methodologies created and adapted exclusively for NGOs, there is still no significant evidence on wide application in this sector.

The NGO sector is extremely diverse, heterogeneous and populated by organizations with hugely varied size, scope, targets, structures and motivations. Therefore, they face a lot of challenges which, together with absence of proper PM methodology, usually cause poor project planning, scarcity of accountability and stakeholder involvement, complexity of inter-related tasks, superficial risk management strategies, unmotivated project team and eventually – bad quality, losses of time and money.

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This research seeks to analyse current NGOs' project management challenges, to introduce the reader with the variety of PM standards and tools, to prove the benefits of PM methodology and depict situation of the awareness and usage of different PM methodologies and tools in NGOs of Lithuania and Germany.

The research methods used in the article include the scientific literature review, survey based on questionnaire and correlation analysis.

Project management challenges in NGO sector

Project management consists of the knowledge, skills, methods, techniques, and tools used to plan and manage project work. It as well establishes a sound basis for effective planning, scheduling, resourcing, decision making, management, and plan revision (Richman, 2011).

Nowadays, NGOs, frequently due to the lack of private financial resources and support from the Government, tend to use project-based funding to fulfil society needs. NGO is a non-profit organization, independent from any governmental institution, based on voluntary activities in order to benefit community or it's certain groups, and its goals are not seeking for political power or exceptionally realization of religious goals (NGO Law Institute, 2014). Some of NGOs have hundreds of volunteers and are executing international development projects, building schools in Uganda, providing fresh water for a region of mountain villages while others, having only several members put their efforts on projects to fight for human or animal rights, to employ socially excluded groups, to integrate immigrants or disabled people to the society. Hereby, there is a variety of types of NGOs and there is a variety of challenges they face in everyday project management.

As Nwaiwu (2013) indicates, the most significant challenges are inadequate finances, lack of expertise (especially in risk and stakeholder management), stringent and multi-donor reporting requirements, and paucity of baseline data. In the earlier research, Diaz (2010) explains that insufficient infrastructure, limited resources, and a changing environment can also put a strain on NGOs project managers who need to deliver the project outcomes. A result of an unstable number of employees and uncertain financial situation is usually a poor, inconsistent project management discipline.

Hereby, it can be concluded that for NGOs, which do not have enough financial and human resources, a PM methodology could help to meet the challenges by improving communication among project team members, developing work performance, better controlling of resources and most importantly – by simplifying PM processes to reach project results in the most efficient way.

Benefits of Application of a Project Management Methodology

Project Management Methodology is a strictly defined combination of logically related practices, methods and processes that determine how best to plan, develop, control and deliver a project throughout the continuous implementation process until successful completion and termination. It is a scientifically-proven, systematic and disciplined approach to project design, execution and completion (McConnell, 2010).

The most widely used PM methodologies are the Project Management Body of Knowledge (PMBOK), IPMA Competence Baseline (ICB), ISO 9000 and PRINCE2. Furthermore, due to the specific needs of NGOs, there were Logical Framework (LogFRAME), PMDPro (developed by PM4NGO) and PM4DEV guidelines created. In 2003, the LOGICAL Frame Work, a requirement from many international fund agencies was one of the most used one in NGO sector. Later on, in 2007, the initiative of PM4NGOs was born. PM4NGOs is an organization devoted to training and disseminating project management knowledge among NGOs (Golini et al., 2014). After a few years, PM4DEV was introduced to society. Through the experience of project managers who have worked in international organizations for developing, the main objective of PM4DEV is to provide fundamental needs to the community involved in developing projects, offering them tools and processes to plan, execute, monitor and control the project in a more consistent and reliable manner (Golini et al., 2014). These authors made a comparative analysis of PMBOK, PM4DEV and PM4NGOs (see Table 1, Table 2). PMBOK does not consider Project Justification Management and Project Contract Management. On the contrary, it considers the Project Integration Management that is neglected by the other two.

Table 1

Comparison of processes of Project Management methodologies

	PMBOK® Guide	**PM4NGO**	**PM4DEV**
Process Integration Management	■		
Project Scope Management	■	■	■
Project Time Management	■	■	■
Project Cost Management	■	■	■
Project Quality Management	■		■
Project Human Resource Management	■		■
Project Stakeholders Management	■	■	■
Project Communication Management	■		■
Project Justification Management		■	
Project Risk Management	■	■	■
Project Procurement Management	■	■	
Project Contract Management			■

Source: Golini et al., The impact on international development projects of non-governmental organizations

In general, all the tools included in the PMBOK are also present in the other two guides (see Table 2). On the other hand, the PMBOK® Guide does not include the logical framework and problem tree, objectives tree, alternative tree (Golini et al., 2014).

As Wysocki (2004) remarks, project management methodologies that can be repeated are valuable to the organization. Repeatability creates standards, best practices, skill development, and a host of other benefits to the organization. Hereby, clear PM standards and formal methodology can be defined as a crucial project management success factor.

Table 2

Comparison of the tools of Project Management methodologies

	PMBOK® Guide	PM4NGO	PM4DEV
Project Charter			
WBS			
Critical Path Method			
Gantt Diagram			
Earned Value Management System			
Risk Analysis			
Logical Framework			
Stakeholders Analysis Matrix			
Problem tree, Objective tree, Alternative tree			

Source: Golini et al., The impact on international development projects of non-governmental organizations

Kerzner (2004) presented more arguments on benefits of a standard methodology. These benefits can be classified as short – term and long – term ones.

Short – term benefits are described as:

- Decreased cycle time and lower costs;
- Realistic plans with greater possibilities of meeting time frames;
- Better communications as to what is expected from groups and when;
- Feedback: lessons learned (Kerzner, 2004).

Long – term benefits are described as:

- Lower overall program risk;
- Better risk management, which leads to better decision-making;
- Greater customer satisfaction and trust;
- Continuous improvement made easier and quicker (Kerzner, 2004).

As Diaz (2010) suggests, the benefits from a standard project management methodology outweigh the effort organizations need to invest in order to implement one:

- Completing projects effectively and efficiently. Once the processes, procedures and templates are created, they can be used on all projects in the future, there is no need for reinventing them again;
- Better results through better planning. Using a methodology gives the project, the donor and the beneficiaries an opportunity to ensure there is a mutual understanding on what the project aims to achieve and this is also related with successful stakeholder management;
- Resolving problems more quickly. Proper management reduces the time project managers spend dealing with issues;
- Resolving future risk before the problems occur. The development of risk response plans helps to solve the problems before they appear;
- Improved financial management. Occurs as better estimating, more formal budgeting and better tracking of the project actual costs against the budget.

To conclude, there are a lot of benefits of application of PM methodology – it ensures that available resources are used in the most efficient and effective manner. Nevertheless, as Golini et al. (2014) state, despite the universalistic nature of project management methodologies, different industries show different approaches to project management and one of the most neglected sectors is the non-profit one as there is a little evidence that NGOs adopt any of project management standards.

Therefore, it is crucial to analyze, whether the NGO sector use PM methodologies, gain the advantages or not and which factors influence the current situation. The research is made to compare application of PM methodologies and tools in NGOs of two socially, politically and economically distant countries – Lithuania and Germany.

The awareness and usage of PM methodologies in Lithuania's and Germany's NGOs

In Lithuania, NGO sector is divided into three parts: associations, charity foundations and public institutions. There are around 24 thousands registered in the system and approximately 18 thousands actually working for the society well-being (NGO information and support center, 2013). Interestingly, there are less NGOs, operating in Germany – according to Germany's Federal Ministry for Economic Cooperation and Development, there are several thousand of NGOs working in the field of development – associations, action groups, federations, working groups, solidarity groups, twinning arrangements, foundations and development-policy networks.

The research seeks to compare application of PM methodologies and tools in NGOs of two socially, politically and economically distant countries – Lithuania and Germany.

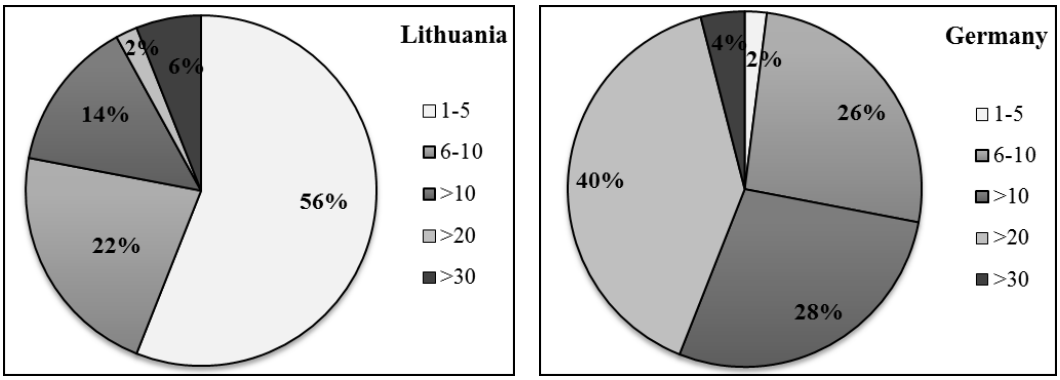
Sample and Data Collection

The target group for this study was 100 NGOs project managers from Lithuania and Germany. The online survey with multiple choices was performed in November 2014 – January 2015. To evaluate the level of awareness and application of PM methodologies and tools, there were questions formed accordingly: first group of questions assessed the size of an NGO in a matter of number of employees, average number and funding of executed projects per year; second group of questions were related with awareness and usage of PM methodology, different elements and software; the last questions were appointed for the analysis of the source project managers acquired their PM competences and challenges they face in everyday NGO's project management. There was also a correlation analysis made to appraise the determining factors of usage of PM methodology and software.

The Research Results

Study shows that the majority of NGOs in Lithuania are small-sized: 56% of them have only 1-5 permanent employees, 22% have 6-10 employees and the remaining ones permanently employ 10 or more workers. On the other hand, the presumption can be made that these organizations have plenty of volunteers to help and they are not counted as permanent

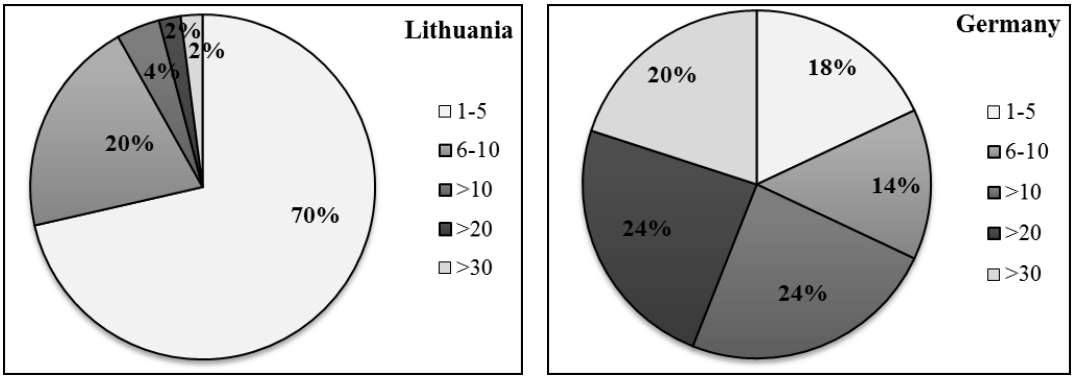
employees. While analyzing the situation in Germany, it can be stated that it differs – the greater number (40%) of NGOs has 20 and more employees, 28% of them work with the help of around 10-20 members and 26% have 6-10 workers.



Source: authors' survey data

Fig. 1. **The number of NGO's permanent employees**

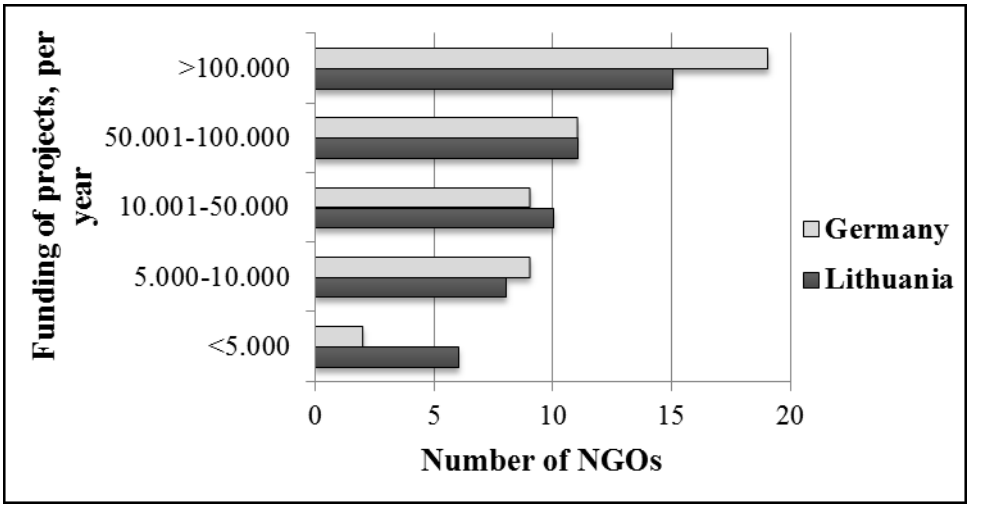
The major differences can also be seen in a comparison of a number of NGO's executed projects per year. In Lithuania, possibly, due to the low level of human resources, usually 1-5 projects are executed (70%) while in Germany the distribution can be noticed and the majority of NGOs execute around 10-30 projects per year (in sum, 48%).



Source: authors' survey data

Fig. 2. **The number of NGO's permanent employees**

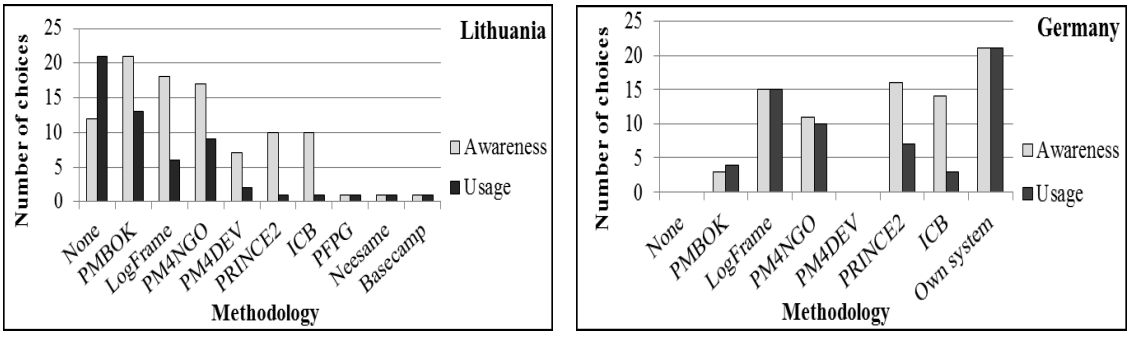
Despite the fact that Germany's NGOs on average execute bigger amount of projects per year, Figure 3 shows that the tendencies of funding for projects are similar – the majority of NGOs in both countries get more than 100.000 euros per year.



Source: authors' survey data

Fig. 3. **The average funding of NGO's projects (Eur)**

The results of the survey show significant disparity between Lithuania's and Germany's NGOs project managers' awareness and usage of PM methodologies (see Figure 4). Firstly, it can be seen that 12 (24%) Lithuania's NGOs project managers have not heard about any of listed PM methodologies and 21 (42%) of them do not use it constantly in every project management. On the contrary, all (100%) of Germany's NGOs project managers are awared of and use PM methodologies in their work. Secondly, it can be stated that in Lithuania, PMBOK, LogFrame and PM4NGOs are the most popular PM methodologies while in Germany own organizational PM system is usually created and used (21/42%). PM4NGOs and LogFrame are best known and used in both countries.



Source: authors' survey data

Fig. 4. **NGO's project manager awareness and usage of PM methodologies**

Further, the correlation analysis was made to check, whether the indicators as an amount of funding, executed projects and number of employees can make influence on usage of PM methodology (see Table 3).

Table 3

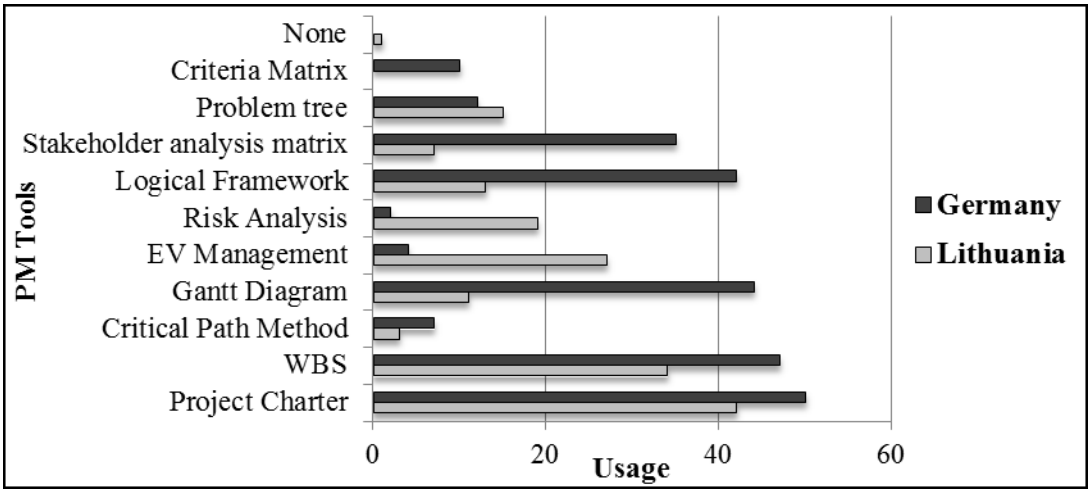
Influence of factors on usage of PM methodology

	Funding for projects, per year	Number of executed projects, per year	Number of employees	Usage of PM methodology
Funding for projects, per year	1			
Number of executed projects, per year	0.2855996	1		
Number of employees	0.4436621	0.421098764	1	
Usage of PM methodology	-0.0594022	**0.513942286**	0.05698	1

Source: authors' calculations based on survey data

According to Ratner (2008), the correlation coefficient is a measure of the strength of the straight-line or linear relationship between two variables. The correlation coefficient takes on values ranging between +1 and -1.

Values between 0.3 and 0.7 indicate a moderate positive linear relationship. As it can be seen from the Table 3, usage of PM methodology depends from the number of executed projects per year. If an NGO executes a lot of projects, they tend to use PM methods and tools.



Source: authors' survey data

Fig. 5. **The usage of PM tools in NGO's project management**

On the other hand, this study shows that the usage of PM elements also varies. In Lithuania's NGOs, where is a high level of ignorance on PM methodologies, the most frequent PM elements are project charter, work breakdown structure (WBS), earned value (EV) management, risk analysis and problem tree. In Germany's NGOs, project managers as well usually use project charter and WBS but other data also present high level of usage of Gantt Diagram, Logical framework and stakeholder analysis matrix (see Figure 5). These results further reflect the situation of the most important processes in NGOs project management (see Table 4).

Table 4

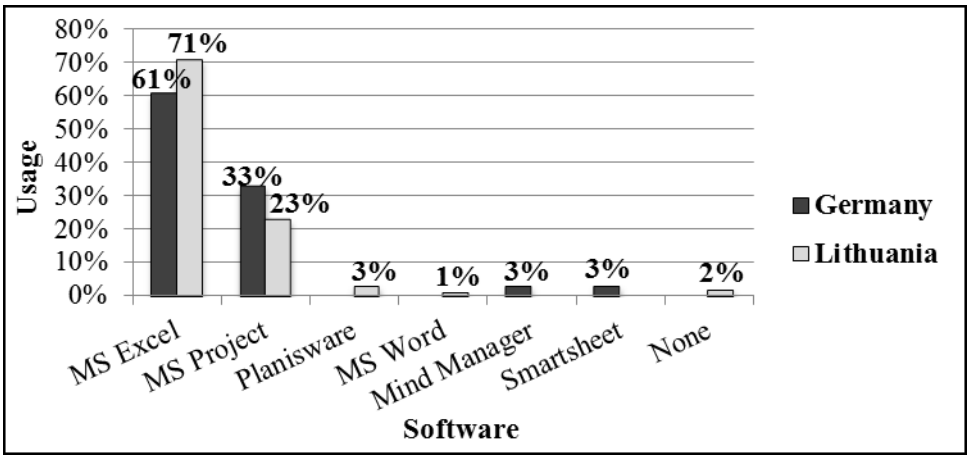
The comparison of the most important processes in NGOs project management

Priority	Lithuania	Germany
1.	Project Cost Management	Project Time Management
2.	Project Time Management	Project Cost Management
3.	Project Integration Management	Project Quality Management
4.	Project Human Resource Management	Project Human Resource Management
5.	Project Communication Management	Project Communication Management
6.	Project Procurement Management	Project Contract Management
7.	Project Quality Management	Project Stakeholders Management
8.	Project Contract Management	Project Procurement Management
9.	Project Scope Management	Project Justification Management
10.	Project Risk Management	Project Integration Management
11.	Project Justification Management	Project Scope Management
12.	Project Stakeholders Management	Project Risk Management

Source: authors' survey data

There is similar attention paid for project cost, time, human resource, communication and contract management both in Lithuania's and Germany's NGOs. That is why project charter and WBS are widely used PM elements. In Germany, project managers claim that stakeholder management is important and that is why stakeholder analysis matrix is usually used. In Lithuania, this process is not considered as important while Germany's NGOs project managers do not take risk management to an account (the lowest places in priority). These approaches can easily be called a huge mistake because the biggest challenges NGOs face (see Figure 8) are sensitive target group (part of stakeholders) and unstable financial situation (part of risks).

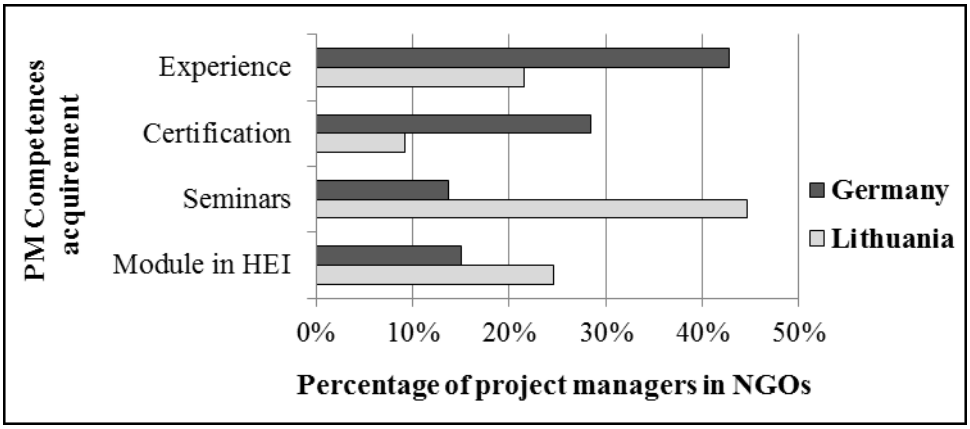
Both, in Germany and Lithuania, tendencies of usage of PM software are similar – the majority of NGOs project managers use MS Excel (accordingly, 61% and 71%), MS Project (accordingly 33% and 23%). Planisware, MS Word, Mind Manager, Smartsheet and no usage at all were also mentioned as alternatives (see Figure 6).



Source: authors' survey data

Fig. 6. **The usage of PM software in NGOs**

The vast majority of things and processes, related to project management in an organization, depends on the competences of it's project manager. Moreover, it is crucial to analyze, what is the source of these competencies and what influence it can make. The majority (43%) of Germany's NGOs project managers claim that their competences were formed and developed with their experience during the years while lithuanians (45%) choose to attend non formal PM seminars to deepen their knowledge. Courses for certified project managers were also mentioned as a source of competences – in Germany they are more popular (28%) than in Lithuania (9%). Lastly, module or a programme in higher education institution (HEI) is the second choice (25%) to develop PM skills for Lithuania's NGOs project managers whereas german project managers give it a third place (15%) of four.



Source: authors' survey data

Fig. 7. **The source of NGOs project managers competences**

The correlation analysis has shown that the source of PM competences acquirement can make an influence on application of PM standards and usage of PM software (see Table 5).

Table 5

Influence of source of competences on usage of PM methodology and software

	PM4NGOs	MS Project	Seminars
PM4NGOs	1		
MS Project	0.1281821	1	
Seminars	**0.5986946**	**0.3541125**	1

Source: authors' calculations based on survey data

Values between 0.3 and 0.7 indicate a moderate positive linear relationship. Due to this fact, it can be noted that project managers, who choose to attend non formal PM seminars usually use PM4NGOs as a guideline in their work. Furthermore, there is slight evidence that these project managers also use MS Project to control project activities.

Tables 6, 7 show that certified project managers tend to use PMBOK as a guideline and those, who had a PM module or a programme in a higher education institution, better know and apply PRINCE2.

Tables 6, 7

Influence of source of competences on usage of PM methodology

	PMBOK	Certification
PMBOK	1	
Certification	**0.4423622**	1

	PRINCE2	Module in HEI
PRINCE2	1	
Module in HEI	**0.4082487**	1

Source: authors' calculations based on survey data

Table 8

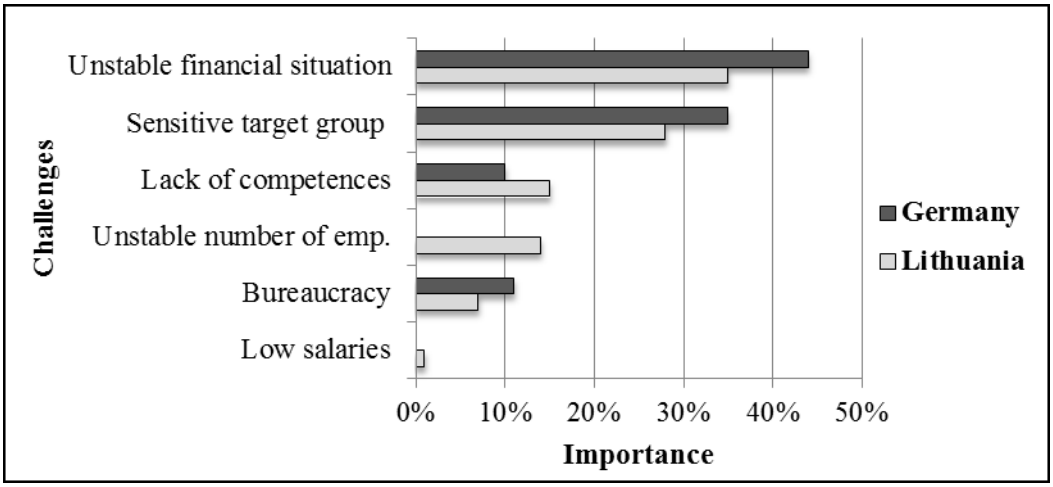
Influence of source of competences on usage of PM methodology and software (Lithuania)

	No usage of PM methodologies	No usage of PM Software	Experience
No usage of PM methodologies	1		
No usage of PM Software	0.0741688	1	
Experience	**0.3425109**	**0.3775721**	1

Source: Authors' calculations based on survey data

Table 8 depicts Lithuania's situation about influence of source of competences on usage of PM methodology and software. The analysis was done in this way because all project managers from Germany are applying PM methodologies and software. The results show that those Lithuania's NGOs project managers, who do not use external courses to develop their PM skills and rely on their internal experience, tend not to apply any of PM methodologies or software to facilitate PM processes.

Lastly, NGOs project management challenges were analyzed. Project managers were asked to point out challenges which, in their opinion, differ from other sectors (see Figure 8).



Source: authors' survey data

Fig. 8. **NGO's project management challenges**

It was indicated, that unstable financial situation and sensitive target group are the biggest problems for NGOs in Germany and Lithuania. Lack of competencies and high level of bureucracy were also mentioned as big challenges. Lithuania's NGOs project managers, differently from germans, noted that they face an issue related with unstable number of permanent employees and low salary.

Conclusions

1. Despite the fact that there are PM tools and methodologies created and adapted exclusively for NGOs, there is still no significant evidence on wide application in this sector.
2. For NGOs, which do not have enough financial and human resources, a PM methodology could help to meet the challenges by improving communication among project team members, developing work performance, better controlling of resources and most importantly – by simplifying PM processes to reach project results in the most efficient way.
3. Despite the fact that Germany's NGOs on average execute bigger amount of projects per year, the tendencies of funding for projects are similar – the majority of NGOs in both countries get more than 100.000 euros per year.

4. It can be seen that 12 (24%) Lithuania's NGOs project managers have not heard about any of PM methodologies and 21 (42%) of them do not use it constantly in every project management. On the contrary, all (100%) of Germany's NGOs project managers are aware of and use PM methodologies in their work. Also, it can be stated that in Lithuania, PMBOK, LogFrame and PM4NGOs are the most popular PM methodologies while in Germany own organizational PM system is usually created and used (21/42%).
5. There is similar attention paid for project cost, time, human resource, communication and contract management both in Lithuania's and Germany's NGOs. That is why project charter and WBS are widely used PM elements. In Germany, project managers claim that stakeholder management is important and that is why stakeholder analysis matrix is usually used. In Lithuania, this process is not considered as important while Germany's NGOs project managers do not take risk management to an account (the lowest places in priority). These approaches can easily be called a huge mistake because the biggest challenges NGOs face are sensitive target group (part of stakeholders) and unstable financial situation (part of risks).
6. It was indicated, that unstable financial situation and sensitive target group are the biggest problems for NGOs in Germany and Lithuania. Lack of competencies and high level of bureaucracy were also mentioned as big challenges. Lithuania's NGOs project managers, differently from Germans, noted that they as well face an issue related with unstable number of permanent employees and low salary.

Bibliography

Diaz, P.L., 2010. The Value of a Project Management Methodology. [Online] Available at: http://www.pm4dev.com/resources/pm4dev_journal.html [Accessed 22 January 2015].

Germany's Federal Ministry for Economic Cooperation and Development, 2015. NGO sector in Germany. [Online] Available at: http://www.bmz.de/en/ [Accessed 7 January 2015].

Golini R., Kalchschmidt M., Landoni P., 2014. The impact of International Development Projects By Non-Governmental Organizations. [Online] Available at: http://www.pmi.org/learning/id-projects-ngos-peculiarities-methodologies-6368 [Accessed 2 December 2014].

PM4NGOs, 2013. A Guide to the PMD Pro. Project Management for Development Professionals. [online]. Available at: http://www.pm4ngos.com/wp-content/uploads/2014/09/PMD_Pro_Guide_2nd_EN_US.pdf [Accessed 5 January 2014].

Kerzner H., 2004. Advanced project management. Best practises on implementation. Hoboken, NJ: Wiley, ISBN 0471472840.

McConnell E., 2010. Project Management Methodology: Definition, Types, Examples. [Online] Available at: http://www.mymanagementguide.com/basics/project-methodology-definition/ [Accessed 6 December 2014].

NGO information and support center, 2013. [Online] Available at: www.3sektorius.lt [Accessed 28 December 2014].

NGO Law Institute, 2014. [Online] Available at: http://www.nvoteise.lt/lt/node/211 [Accessed 13 December 2014].

Nwaiwu, B.C., 2013. Critical Management Challenges Facing NGOs – Examining the Impact of Legitimacy and Human Resource Issues on NGO Effectiveness. [Online] Available at: http://www.cedetf.org/uploads/publications [Accessed 28 December 2014].

Ratner, B., 2008. The Correlation Coefficient: Definition. [Online] Available at: http://www.dmstat1.com/res/TheCorrelationCoefficientDefined.html [Accessed 22 January 2015].

Richman L., 2011. Successful Project Management, 3d edition. ISBN-10: 0761214887.

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MOTIVATION FACTORS FOR EMPLOYEES FOR COMPETITIVENESS OF BIG COMPANY IN TELECOMMUNICATION INDUSTRY IN LATVIA

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Prof. Dr. Biruta Sloka, University of Latvia, Latvia

Abstract

Latvijas Mobilais Telefons (LMT) is the biggest telecommunication company in Latvia operating already more than 20 years. Telecommunication companies to be active and competitive have to pay attention to different sides of company management, including very important field – personnel management to have advanced and motivated specialists loyal to the company in long – term. Special importance it has for the telecommunication companies as they require high – qualified specialists with specific competencies. LMT has developed personnel policy and actively realises it since the start of LMT in 1992. LMT has been for many years among the most attractive employers in Latvia. LMT managed to have good specialists to perform work for success of the company. Regular attention to personnel views is paid in LMT. Annual surveys of personnel satisfactions on work conditions, on correspondence to professional development and individual personality development are analysed. To evaluate the motivation factors of personnel in LMT extensive survey on personnel motivation was conducted by Laura Keršule. Results of LMT employee survey with comparisons of other company employee views on work motivation factors are analysed in the current paper. In survey evaluation scale 1 – 7 was applied. Research methods: scientific publication analysis, in – depth interviews with project managers, survey of employees. For survey data analysis indicators of descriptive statistics: indicators of central tendency or location (arithmetic means, mode, median) and indicators of variability (variance, standard deviations, standard errors of means, range), cross-tabulations are applied, as well as multivariate data analysis (factor analysis) is performed.

Key words: *personnel management, telecommunications, project manager, project performance*

JEL codes: L96, M12, M5

Introduction

Motivation is key to the success of obtaining the benefit of skilled employees' performance in a team based environment. There have been continuing efforts among researchers in distinguishing the influential drivers of motivation and performance. Telecommunication industry is one of the most competitive in Latvia, but it is facing also big competition for skilled employees as well as pressure on material compensation. The aim of the study was to explore relationships between motivation factors and employee's feelings and evaluation of the company culture (activities style, colleague's behaviour, etc); examine factors that are associated with likelihood that employees will engage in effective and efficient business

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performance. Authors compared findings on factors associated with likelihood that employees will engage in effective and efficient business performance and analysed what are the relationships among – motivation and company culture in telecommunication and other industries in Latvia. There was performed survey of employees in telecommunication industry. Skills were evaluated in 7-point scale, where 1 – strongly disagree and 7 – strongly agree. For data analysis indicators of central tendency or location and indicators of variability were used, as well as cross-tabulations, multivariate analysis: factor analysis, correlation analysis are used.

Theoretical background

There are many findings in academic research related to job motivation and relation to company culture (activities style, colleague's behaviour, etc). To those aspects are several academic studies with useful practical findings for telecommunication companies. Martina Huermann (Huermann, 2010) has found interesting results on a longitudinal multi method case study of a company from the telecommunication industry – the company had developed into a project-oriented company during the 12 years (1997–2009). Martina Huermann has the development analysed and structured into phases with reflections of the limits of planning and managing change processes in practice. The development of the case study company analysed by Martina Huermann towards project-orientation was rather ad hoc than planned and structured. Martina Huermann findings indicate that in a project-oriented company human resource management also needs to change from an administration function to become a proactive business partner supporting project-oriented management. Interesting findings related to those topics are reflected also in Kang and his colleagues studies (Kang, *et al*, 2010), Stefan Seiler and his colleagues studies (Seiler, *et al*, 2012), Cliff Wymbs studies (Wymbs, 2004). Einar Iveroth from Uppsala University has examined those issues in the leading telecommunication companies and has concluded that practice-based culture can make global transformation projects easier to accomplish and that IT can reinforce such a culture (Iverith, 2012), Cinzia Batistella (Batisella, 2014), Summit Majumdar (Majumdar, 2010) have studied institutional changes, company size and wages in telecommunications sector. Human potential is boundless, but it requires motivation to excel (Schrader, 1972). The term "motivation" has several definitions. According to Jenkins et al (1982), "motivation is intangible: a hypothetical construct that is used to explain human behaviour." Further, they state that motivation has a direct impact on work performance and can be positively influenced or managed by external factors, such as incentives and rewards. Needs of individuals are often described as being 'intrinsic' or 'extrinsic'' in nature (Sansone and Harackiewicz, 2000). Extrinsic needs are those that motivate an individual to achieve an end result. Extrinsic motivation occurs 'when employees are able to satisfy their needs indirectly, most importantly through monetary compensation' (Osterloh *et at.*, 2002: 64). In contrast to extrinsic needs, intrinsic needs exist when individuals' behaviour is oriented towards the satisfaction of innate psychological needs rather than to obtain material rewards (Ryan and Deci, 2000). Intrinsic is the motivation to "perform an activity for itself" (Van Yperen and Hagedoorn 2003: 340) trying to experience the pleasure and satisfaction inherent in the activity. Intrinsic motivation appears to be self-defined (Loewenstein. 1999) and self-sustained (Deci, 1975) and is fostered by commitment to the work itself. As far as the relationship between intrinsic motivation and work outcome is concerned, intrinsic motivation seems to be a good predictor of work performance. There are some

empirical evidences as well on assumption that monetary incentives (or extrinsic motivation) significantly improve task performance (Stajkovic, Luthanss, 2003), (Perry, 2006). However, findings from the reviewing of 72 field studies revealed that work performance improved by 23 percent when monetary incentives were used whereas stimulation with social recognition improved performance by 17 and feedback by only 10 percent. Some interesting conclusions emerged from these studies regarding different fields of activities, for example, combination of financial, non-financial and social rewards produces the strongest effect in manufacturing, whereas for service organizations financial stimulus produces more influential effect than non-financial rewards. The relationships between motivation and productivity can be summarized as that productivity is directly linked to motivation. Suitable approach of motivating employees can be hypothesized as a key contributor to maximizing productivity of the workforce. There are many factors that drive or determine productivity of employees. Productivity has many definitions, including performance factors, production rate, and unit person hour rate. In the real world, however, productivity cannot be achieved only by speed and harder work without adopting better work practices (Banik 1999). Effective performance is a measure of task output or goal accomplishment to meet the daily production targets, both quality and quantity. On the other hand, efficient performance refers to cost-effective goal accomplishments with the realization of high outputs with less input consumed. Job performance is commonly used to evaluate employees effectiveness and efficiency, however, the concept is poorly defined (Indartono, 2010). Efficiency is the ratio of actual output generated to the expected (or standard) output prescribed. Effectiveness is the degree to which the relevant goals or objectives are achieved (Sumanth, 1998. Efficiency improvement does not guarantee productivity improvement. Efficiency is a necessary, but not a sufficient condition for productivity (Sumanth, 1998). Effectiveness and efficiency are necessary in order to be productive. Both of them refer to whether a person performs his/her job well. Motivation issues with interesting approach are examined by Posner (Posner, 2010), by Highhouse (Highhouse, et al, 2007), by Tan (ta et al, 2008). The motivation, especially monetary rather than moral, has proven its influence on the productivity of employees. Research has been conducted over the past 40 years on the relationship between motivation and productivity in different manufacturing industries, however little research has been devoted to this relationship in service industries or public sector where we cannot define objective and even measurable output of an individual or a team (Locke, 2004). Several researchers have underlined that customers are recommended to integrate into the innovation process in the telecommunication industry (Schaarschmidt & Kilian, 2014). Factors influencing accountability and performance ratings are important issue (Roch, et al, 2007). Work motivation and job satisfaction are on great importance as well (Kamdron, 2005). Sustainability as corporate culture of a brand for superior performance was on research agenda for Suraksha Gupta and V.Kumar (Gupta & Kumar, 2013). Case examples are studied for interplay between an organisation's culture, its compensation system and other influences by Larry L. Cummings already several decades ago (Cummings, 1984) and we can confirm that general findings are alike already in 2015. The findings of theoretical research results are used in current empirical research.

Based on the literature review authors have stated the aim to find how important relationships between motivation factors and employee's feelings and evaluation of the company culture.

Method and measures in the study

Research methods used: scientific literature review, survey of employees. The study was conducted among 1050 internet users. The study population includes 67 % females and 33% males, 54% respondents with higher education, 52% working at current profession more than 7 years, 73% of respondents have no more than 2 companies where they have worked in the last 7 years, 46% of surveyed work in company with more than 50 employees. A questionnaire was distributed to respondents by use of *GfK* web panel service.

The following measures were used to: 1) provide list of motivators; 2) provide list of statements on skills, engagement and resources available in company; 3) perceptual performance; 4) demographic profile of sample (age, gender, occupational type and detailed information on position "specialist", education, income, and industry).

Results of empirical research

Motivators – we adapted slightly shorter version (20 instead of 32; shortened after pilot test). The respondents were asked to use 7-point scale ranging from 1 – inapplicable to 7 – applicable in higher extent to indicate which motivational instruments are applied in current working place.

Skills were evaluated in 7-point scale ranging 1 – strongly disagree to 7 – strongly agree to statements like "I feel fully confident on my skills to perform this job according to highest expectations"; 'this is the best job to do", "I help my co-workers with my expertise and knowledge", "I am fully confident on ability to solve problems in my daily work".

Resources were evaluated in 7-point scale ranging 1 – strongly disagree to 7 – strongly agree to statements like "In my job I am provided with technologies for job content", "In my job I am provided with technical, and other support necessary for job content", "All necessary management and quality systems are provided in my job".

Engagement was evaluated in 7-point scale ranging 1 – strongly disagree to 7 – strongly agree to statements like "this company inspires to do the best I can", "I am ready to go the extra mile to make my company successful", "the future success of my company means a lot to me", "I am ready to recommend my company where to work".

As productivity is objective measurement it could be quite problematic to measure it subjectively and directly, then we used perceptual performance measurement approach. Among the most commonly accepted theories of job performance are theories from the work of John P. Campbell and colleagues (1990, 1993) who described job performance as an individual level variable. That is, performance is something a single person does. Conceptually task characteristics were closely related to high performance achievement. Autonomy is ability to carry out work freely. Feedback from the job is able to impart information about an individual's performance (Humphrey et al, 2007). Individually a range of knowledge, skills, abilities, available resources and other characteristics are needed to perform a job. Knowledge of job and technical skills will appear to be essential to effectiveness of job. Whereas Self-efficacy theory employed the understanding the level of employee belief in order to achieve high performance with their actual skills (Gist, Mitchelin, 1992), author formulated question in the survey "I am fully confident on my skills and knowledge to perform this job according to highest standards"). Self-efficacy beliefs function as an important set of proximal determinants of human motivation, affect and action

which operate on action through motivational, cognitive and affective intervening process (Indartono, 2010). Bandura (1986, 1997) argues that perhaps the most important determinant of individuals' decision to engage in performance that exceeds previous level is self-efficacy. Self-efficacy is defined as an individual's perceptions of their task-related capabilities. The analysed issues are at academic interest world-wide, as well as from different sides analysis are made, including different models of motivation (Seiler, *et al*, 2012), on workplace flexibility are made many researches including role of telework and flexible work schedules (Coenen and Kok, 2014). Different innovative approaches in telecommunication industry are analysed by German researchers (Schaarschmidt and Kilian, 2014). Already a quarter of a century has been devoted to leadership research and different aspects of the issue and researchers team from USA, UK and Korea has performed retrospective analysis (Dionne, *et a*l, 2014).

Table 1

Rotated Component Matrix on Evaluations of Company Employee's Feelings and Evaluation of the Company Culture

	Component		
	1	**2**	**3**
Stable	0.536	0.361	0.046
Honest	0.786	0.171	0.179
Fair	0.788	0.171	0.271
Comparative	0.778	0.203	0.290
Arranged	0.729	0.308	0.154
Supportive for personality development	0.797	0.192	0.179
Energetic, inspiring	0.746	0.303	0.266
Provide unique professional experience	0.643	0.342	0.065
Creative	0.676	0.160	0.251
Dynamic	0.612	0.458	0.254
Controlling	0.161	0.712	-0.214
Not limiting	0.450	-0.095	0.677
Ambitious towards big goals	0.185	0.671	0.278
Flexible	0.632	0.116	0.498
Not bureaucratic	0.352	0.022	0.698
Not formal	0.371	-0.006	0.665
Exacting towards results of individuals	0.345	0.690	-0.033
Democratic	0.713	0.113	0.443
Problem recognition and solution attitude	0.751	0.220	0.273
Oriented towards client's needs	0.429	0.473	0.233
Profit guided	-0.147	0.488	0.692
Energetic	0.622	0.448	0.225
Quality oriented/guided	0.603	0.480	0.180

Scale 1 – 7, where 1 – do not agree; 7 – fully agree

Source: author's calculations based on employees survey results, (n=1098)

Taking into account mentioned before, efficient performance was proposed to measure on self-reported scale using 7 point scale asking questions like "adequately completes assigned duties".

Authors performed factor analysis based on survey data on statements how respondents feel attitude to themselves. For factor analysis rotation was chosen *varimax* method. Calculations were performed by use of statistical software program SPSS. Rotation was performed in 15 iterations with Kaiser Normalization. The results of factor analysis are presented in table 1.

On the results of factor analysis authors have identified three complex factors on feelings of employees how do they feel the company culture in their working place (from 23 statements) and gave them the following complex factor names:

- Company professional aspects factor;
- Focus on performance results factor;
- Organisational aspects factor.

More detailed analysis is performed for work Focus on performance results complex factor. Main statistical indicators (arithmetic mean, mode, median, variance, standard deviation, range, standard error of mean) of performance results complex factors are reflected in table 2.

Table 2

Main statistical indicators of performance results complex factor components

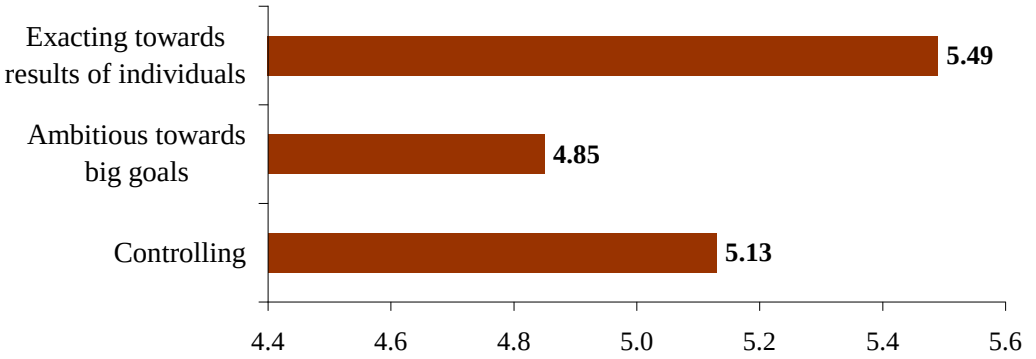
		Controlling	Ambitious towards big goals	Exacting towards results of individuals
N	Valid	1098	1098	1098
	Missing	0	0	0
Mean		5.13	4.85	5.49
Std. Error of Mean		0.045	0.052	0.042
Median		5	5	6
Mode		6	6	6
Std. Deviation		1.494	1.714	1.384
Variance		2.232	2.936	1.915
Range		6	6	6
Minimum		1	1	1
Maximum		7	7	7

Scale 1 – 7, where 1 – do not agree; 7 – fully agree

Source: Author's calculations based on employees survey results, 2010 (n=1098)

The results of survey responses calculations indicated how the respective issues are applied at work of employees: the responses are very different: all grades are given for every statement. Most of employees have indicated that they have found all evaluated factors as very important – giving the almost highest evaluation (mode is 6 – gave 26.8% of respondents for the controlling factor, 20,9% of respondents for ambitious towards big goals, 30.8% of respondents towards statement that company is exacting towards results of individuals). Other indicators of central tendency or location show that half of respondents *exacting towards results of individuals* evaluated with less than 6, half of respondents gave evaluations more than

6 (median = 6), for *controlling* and for *ambitious towards big goals* median was 5. There is a big variability for all factor components: all indicators of variability are very big, especially for *ambitious towards big goals* what is indicated by variance, standard deviation and standard error of mean. Average evaluations the biggest are *exacting towards results of individuals* and smallest for *ambitious towards big goals*. Average grades of responses by evaluation grades for factor components are included in Figure 1.



Scale 1 – 7, where 1 – do not agree; 7 – fully agree

Source: author's calculations based on employees survey results, (n=1098)

Fig. 1. **Average grades of responses by evaluation grades for of performance results complex factor components**

As the evaluations are so different, it is interesting to know the distribution of views of the respondents. Distributions of all responses by evaluation grades (1-7) for factor components are included in table 3.

Table 3

Distribution of responses for focus on performance results factor complex factor components

Evaluation	Controlling		Ambitious towards big goals		Exacting towards results of individuals	
	n	Percent	n	Percent	n	Percent
1	23	2.1	54	4.9	12	1.1
2	42	3.8	75	6.8	25	2.3
3	87	7.9	97	8.8	66	6.0
4	196	17.9	206	18.8	144	13.1
5	235	21.4	215	19.6	212	19.3
6	294	26.8	230	20.9	338	30.8
7	221	20.1	221	20.1	301	27.4
Total	**1098**	**100.0**	**1098**	**100.0**	**1098**	**100.0**

Scale 1 – 7, where 1 – do not agree; 7 – fully agree

Source: author's calculations based on employees survey results, (n=1098)

As the evaluations are so different, it is interesting to know the distribution of views of the respondents by sex as the research done in other countries have indicated differences by sex. Distributions of all responses by evaluation grades (1-7) for factor *Controlling* and by sex are included in table 4.

Table 4

Distributions of all responses by evaluation grades (1-7) for factor *Controlling* and by sex

Evaluations	Sex		Total
	Female	Male	
1	16	7	23
2	29	13	42
3	49	38	87
4	110	86	196
5	147	88	235
6	187	107	294
7	147	74	221
Total	**685**	**413**	**1098**

Scale 1 – 7, where 1 – do not agree; 7 – fully agree

Source: author's calculations based on employees survey results, (n=1098)

Data of table 4 indicates that most of female and male respondents gave evaluation 6 and the chi-square test indicated that evaluations of female and male respondents differ statistically significant with level of significance 0.106. Distributions of all responses by evaluation grades (1-7) for factor *Ambitious towards big goals* and by sex are included in table 5.

Table 5

Distributions of all responses by evaluation grades (1-7) for factor *Ambitious towards big goals* and by sex

Evaluations	Sex		Total
	Female	Male	
1	36	18	54
2	46	29	75
3	62	35	97
4	128	78	206
5	115	100	215
6	153	77	230
7	145	76	221
Total	**685**	**413**	**1098**

Scale 1 – 7, where 1 – do not agree; 7 – fully agree

Source: author's calculations based on employees survey results, (n=1098)

Data of table 5 indicates that most of female gave evaluation 6, most of male respondents gave evaluation 5 and the chi-square test indicated that evaluations of female and male respondents differ statistically significant with level of significance 0.106. Distributions of all responses by evaluation grades (1-7) for factor *Exacting towards results of individuals* and by sex are included in table 6.

Table 6

Distributions of all responses by evaluation grades (1-7) for factor *Exacting towards results of individuals* and by sex

Evaluations	Sex		Total
	Female	Male	
1	5	7	12
2	13	12	25
3	39	27	66
4	86	58	144
5	132	80	212
6	205	133	338
7	205	96	301
Total	**685**	**413**	**1098**

Scale 1 – 7, where 1 – do not agree; 7 – fully agree

Source: author's calculations based on employees survey results, (n=1098)

Data of table 6 indicates that most of female respondents gave evaluation 6 and 7 and most of male respondents gave evaluation 6 and the chi-square test indicated that evaluations of female and male respondents differ statistically significant with level of significance 0.190. Distributions of all responses by evaluation grades (1-7) for factor *Social Security (all taxes paid)* and by age are included in table 7.

Table 7

Distributions of all responses by evaluation grades (1-7) for factor *Exacting towards results of individuals* and by age

Evaluations	Your age						Total
	till 18	18 – 25	26 – 40	41 – 50	51 – 62	More 62	
1	0	2	2	6	2	0	12
2	0	4	11	7	3	0	25
3	1	8	20	22	14	1	66
4	0	15	61	42	24	2	144
5	0	22	80	71	36	3	212
6	0	26	120	106	82	4	338
7	0	26	90	96	85	4	301
Total	**1**	**103**	**384**	**350**	**246**	**14**	**1098**

Scale 1 – 7, where 1 – do not agree; 7 – fully agree

Source: author's calculations based on employees survey results, (n=1098)

Data indicate that the evaluations are higher for all age groups are quite different for age groups, they are higher for older respondents and the chi-square test indicated that evaluations of respondents in different age groups differ statistically significant with level of significance 0.093. It means that respondents from all age groups are evaluating rather highly the analysed factor. Distributions of all responses by evaluation grades (1-7) for factor possibility to take responsibility and by age are included in table 8.

Table 8

Distributions of all responses by evaluation grades (1-7) for factor *Controlling* and by age

Evaluations	Your age						Total
	till 18	18 – 25	26 – 40	41 – 50	51 – 62	More 62	
1	0	1	10	6	6	0	23
2	0	4	11	16	11	0	42
3	1	9	25	31	21	0	87
4	0	14	73	68	41	0	196
5	0	27	97	64	39	8	235
6	0	30	101	88	71	4	294
7	0	18	67	77	57	2	221
Total	**1**	**103**	**384**	**350**	**246**	**14**	**1098**

Scale 1 – 7, where 1 – do not agree; 7 – fully agree

Source: author's calculations based on employees survey results, (n=1098)

Data indicate that the evaluations are 6 for all age groups except those older than 62 years. It means that respondents from all age groups have views that company is controlling and the chi-square test indicated that evaluations of respondents in different age groups differ statistically significant with level of significance 0.004. Distributions of all responses by evaluation grades (1-7) for factor *Freedom, autonomy at work* and by age are included in table 9.

Table 9

Distributions of all responses by evaluation grades (1-7) for factor *Ambitious towards big goals* and by age

Evaluations	Your age						Total
	till 18	18 – 25	26 – 40	41 – 50	51 – 62	More 62	
1	0	1	15	20	18	0	54
2	0	7	24	28	16	0	75
3	0	6	33	34	23	1	97
4	1	18	65	81	38	3	206
5	0	24	79	57	50	5	215
6	0	24	85	63	54	4	230
7	0	23	83	67	47	1	221
Total	**1**	**103**	**384**	**350**	**246**	**14**	**1098**

Scale 1 – 7, where 1 – do not agree; 7 – fully agree

Source: author's calculations based on employees survey results, (n=1098)

Data indicate that the evaluations are very different for all age groups and the chi-square test indicated that evaluations of respondents in different age groups differ statistically significant with level of significance 0.412. Distributions of correlation coefficients for all responses for factors are included in table 10.

Table 10

Correlation coefficients for all responses

		Controlling	Ambitious towards big goals	Exacting towards results of individuals	Your age	Sex	How long do you work with the current employer	How long do you work in profession
Controlling	Pearson Correlation	1	0.309**	0.498**	0.022	-0.037	-0.019	-0.022
	Sig. (2-tailed)		0.000	0.000	0.462	0.216	0.538	0.461
	N	1098	1098	1098	1098	1098	1098	1098
Ambitious towards big goals	Pearson Correlation	0.309**	1	0.419**	-0.065*	-0.016	-0.024	-0.031
	Sig. (2-tailed)	0.000		0.000	0.030	0.600	0.433	0.306
	N	1098	1098	1098	1098	1098	1098	1098
Exacting towards results of individuals	Pearson Correlation	0.498**	0.419**	1	0.103**	-0.074*	0.074*	0.074*
	Sig. (2-tailed)	0.000	0.000		0.001	0.014	0.015	0.014
	N	1098	1098	1098	1098	1098	1098	1098
Your age	Pearson Correlation	0.022	-0.065*	0.103**	1	-0.121**	0.367**	0.455**
	Sig. (2-tailed)	0.462	0.030	0.001		0.000	0.000	0.000
	N	1098	1098	1098	1098	1098	1098	1098
Sex	Pearson Correlation	-0.037	-0.016	-0.074*	-0.121**	1	-0.128**	-0.098**
	Sig. (2-tailed)	0.216	0.600	0.014	0.000		0.000	0.001
	N	1098	1098	1098	1098	1098	1098	1098
How long do you work with the current employer	Pearson Correlation	-0.019	-0.024	0.074*	0.367**	-0.128**	1	0.670**
	Sig. (2-tailed)	0.538	0.433	0.015	0.000	0.000		0.000
	N	1098	1098	1098	1098	1098	1098	1098
How long do you work in pro-fession	Pearson Correlation	-0.022	-0.031	0.074*	0.455**	-0.098**	0.670**	1
	Sig. (2-tailed)	0.461	0.306	0.014	0.000	0.001	0.000	
	N	1098	1098	1098	1098	1098	1098	1098

** Correlation is significant at the 0.05 level (2-tailed).*
*** Correlation is significant at the 0.01 level (2-tailed).*
Scale 1 – 7, where 1 – do not agree; 7 – fully agree

Source: author's calculations based on employees survey results, (n=1098)

Data of table 10 indicates that there is not significant correlation on evaluations on factors *Controlling* and *Ambitious towards big goals* and how long work with current employers and how long person works in profession.

Conclusions

Evaluations of company employee's feelings and evaluation of the company culture have big importance for motivation of employees. The results of factor analysis authors have identified four three complex factors on feelings of employees how do they feel the company culture (from 23 statements) and have named them: company professional aspects factor; focus on performance results factor; organisational aspects factor.

The evaluations were different statistically significant on all analysed factors by sex and by age groups. There is not significant correlation on evaluations on factors *Controlling* and *Ambitious towards big goals* and how long work with current employers and how long person works in profession

Bibliography

Bandura, A., Schunk, Dale H. 1981. Cultivating Competence, Self-Efficacy, and Intrinsic Interest Through Proximal Self-Motivation, *Journal of Personality & Social Psychology*, 41(3), pp. 586-598.

Batistella, G. 2014. The Organisation of Corporate Forsight: A Multiple Case Study in the Telecommunication Industry, *Technological Forecating & Social Change*, pp. 60-79.

Cummnings, L.L., 1984. Compensation, Culture, and Motivation: A Systems Perspective, *Organisational Dynamics*, pp. 578-593.

Deci, E. L., Ryan, R. M., 2000. The "What" and "Why" of Goal Pursuits: Human Needs and the Self-determination of Behavior. *Psychological Inquiry*, 11, pp. 227-268.

Dysvik A., Kuvaas B., 2008. The Relationship between Perceived Training Opportunities, Work Motivation and Employees Outcomes, *International Journal of Training and Development*, pp. 138-157.

Gupta, S, Kumar, V., 2013. Sustainability as Corporate Culture of a Brand for Superior Performance, *Journal of World Business*, 48, pp. 311-320.

Hackman, J. R., Oldham, G. R., 1975. Development of the Job Diagnostic Survey. *Journal of Applied Psychology*, 60, pp. 159-170.

Hair J., Anderson R., Tatham R., Black W., 2008. Multivariate Data Analysis, 614 p.

Highhouse S., Thornbury, E.E., Little I.S., 2007. Social – Identity Functions of Attraction to Organizations, *Organizational Behaviour and Human Decision Processes*, 103, pp. 134-146.

Humphrey, S., Nahrgang, J., Morgeson, F., 2007. Integrating Motivational, Social, and Contextual Work Design Features: A Meta-Analytic Summary and Theoretical Extension of the Work Design Literature, *Journal of Applied Psychology*, 92(5), pp. 1332-1356.

Indartono S., Chen V. Ch., 2010. Modertation of Gender on Relationship between Task Characteristics and Performance, *International Journal of Organizational Innovation*, 2(2), pp. 195 -200.

Iveroth, E. 2012, Leading Global IT – Enabled Change Across Cultures, *European Management Journal*, 30, pp. 340-351.

Heumann, M. 2010. Considering Human Resource Management When Developing a Project – Oriented Company: Case Study of a Telecommunication Company, *International Journal of Project Management*, 28, pp. 360-369.

Kamdron, T., 2005. Work Motivation and Job Satisfaction of Estonian Higher Officials, *International Journal of Public Administration*, 28, pp. 1211-1240.

Kang, Y., Ryu, M.-H., Kim, S., 2010. Exploring Sustainability Management for Telecommunication Services: A Case Study of a Two Korean Companies, *Journal of World Business*, 45, pp. 415-421.

Latham, G. P., Pinder, C. C., 2005. Work Motivation Theory and Research at the Dawn of the Twenty-First Century. *Annual Review of Psychology*, 56, pp. 485-516.

McFillen, J.M.; Maloney, William F., 1988. New Answers and New Questions in Construction Worker Motivation. *Construction Management & Economics*, 6(1), pp. 21-35.

Locke, E. A., Latham, G. P., 2004. What Should We do about Motivation Theory? Six Recommendations for the Twenty-First Century, *Academy of Management Review*, 28, pp. 388-403.

Majumdar, S.K., 2010. Institutional Changes, Firm Size and Wages in the Telecommunication Sector, *Information Economics and Policy*, 22, pp. 201-217.

Osterloh, M., Frost, J., Frey, B., 2002. The Dynamics of Motivation in New Organizational Forms, *International Journal of the Economics of Business*, 9(1), pp. 61-77.

Perry J., Mesch D., Paarlberg L., 2006. Motivation Employees in New Governance Era: The Performance Paradigm Revisted, *Public Administration Review*, pp. 506-519.

Posner, B.Z., 2010. Another Look at the Impact of Personal and Organizational Values Congruency, *Journal of Business Ethics*, 97, pp. 535-541.

Roch, S.G., McNall, L.A., 2007. An Investigation of Factors Influencing Accountability and Performance Ratings, *The Journal of Psychology*, 4(5), pp. 499-523.

Ross, S., Loewenstein, G., 2008. Exotic Preferences: Behavioural Economics and Human Motivation. Mission Possible? The Performance of Prosocially Motivated Employees Depends on Manager Trustworthiness, *Czech Sociological Review*, 44(6), pp. 1200-1205.

Ryan, R. M., Deci, E. L., 2002. Overview of Self-Determination Theory. In E. L. Deci, & R. M. Ryan, Handbook of Self-Determination Research (pp. 3–33). Rochester, NY: University of Rochester Press.

Schaarschmidt, M., Kilian, T., 2013. Impediments to Customer Integration into the Innovation Process: A Case Study in the Telecommunications Industry, *European Management Journal*, 32, pp. 350-361.

Seiler, S., Lent, B., Pinkowska, M., Pinazza, M., 2012. An Integrated Model of Factors Influencing Project Managers' Motivation – Findings from a Swiss Survey, *International Journal of Project Management*, 30, pp. 60-73.

Sumanth, D., 1998. Total Productivity Management. A Systemic and Quantitative Approach to Compete in Quality, Price and Time. USA, CRC Press LLC.

Tan H.H., Tan M.L., 2008. Organizational Citizenship Behaviour and Social Loafing: the Role of Personality, Motives, and Contextual Factors, *The Journal of Psychology*, 142(21), pp. 89-108.

Van Yperen, N. W., Hagedoorn, M., 2003, Do High Job Demands Increase Intrinsic Motivation of Fatique or Both? The Role of Job Control and Job Social Support, *Academy of Management Journal*, 46(3), pp. 339-348.

Vroom, Victor H., Jones, Stephen C., 1964. Division of Labor and Performance under Cooperative and Competitive conditions, *Journal of Abnormal & Social Psychology*, 68(3), pp. 313-320.

Yiang D., Lin Y., Lin L., 2011. Business Moral Values of Supervisor and Subordinates and their Impact on Employees Effectiveness, *Journal of Business Ethics*, pp. 239-252.

Wimbs, C., 2004. Telecommunications, an Instrument of Radical Change for Both the 20th and 21st Centuries, *Technological Forecasting & Social Change*, 71, pp. 685-703.

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APPLYING CULTURAL INTELLIGENCE IN INTERNATIONAL PROJECT MANAGEMENT

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Abstract

In order to succeed and stay competitive in globalized business environment organizations started to incorporate cross-cultural management competencies into project management. Cultural intelligence (CQ) is an ability to proceed effectively and efficiently in culturally diverse situations when the main focus is differences in cross-cultural behaviors. This skill is increasingly becoming beneficial for project managers, as those who have high CQ can quickly adapt their management style in order to handle issues raised from multicultural background (concerning customers, suppliers, associates, etc.). Overall, there are four CQ capabilities: Drive, Knowledge, Strategy and Action. Project managers have to improve all four capabilities in parallel because focusing on only one can cause deeper cultural ignorance instead of leveraging CQ. This paper aims to introduce Cultural Intelligence as an approach for successful cultural differences management in international projects.

Key words: *Cultural intelligence, cross-cultural management, international project management*

JEL codes: F23, M16

Introduction

International projects comparing to local projects often have a higher level of complexity and uncertainty. Some of specific characteristics have to be taken into account in order to successfully implement projects in global environment: global stakeholders, cultural diversity, cultural differences, etc. It is becoming a norm that project managers have to develop intercultural skills for smooth interactions with internal and external stakeholders and project team members (Köster, 2010, 8 p.). According to Livermore (2010, 3 p.) Cultural Intelligence (CQ) is a set of skills that facilitates effective cross-cultural management. Instead of learning the intricacies of the culture and practices of every nation, CQ provides a broad-based model that helps to emphasize an overall understanding of other cultures, and it does not require comprehensive knowledge of specific information about every individual culture. The goal of this paper is to introduce Cultural Intelligence as an approach for successful cultural differences management in international projects. Main method to investigate the topic is to analyze theoretical sources (books, articles, research reports, essays, etc.) and gather insights in order to define how Cultural Intelligence can be incorporated into international project management. To

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reach the goal following topics are being discussed: Cultural Differences influence on International Project Management; Cultural differences and project team challenges; The concept of Cultural Intelligence; Actions which can be taken into account to apply Cultural Intelligence in international project management.

Cultural Differences influence on International Project Management

Project management has to foster global approach, be flexible enough in order to succeed working with stakeholders, team members from different cultural horizons. Binder (2009, 18 p.) defines international projects as projects with team members from the same company working in different countries. And expands definition of international project by adding global project concept: "Projects managed across borders, with team members from different cultures and languages, working in various countries around the globe". Roux-Kiener (2009, 10 p.) emphasizes that nowadays globalization of projects has become a common phenomenon in project management. Some years ago projects were mostly implemented on local basis with direct contact with stakeholders.

Brünnemann (2013, 4 p.) states that project managers usually have to deal with versatility of cultures at the same time as international project might be set in a specific country or it may be part of a large program spanning across several countries or the project team consists of members from various countries or cultures. As project management face cross-cultural issues it is important to review on what extent culture influence project management. Hall (1976, 16 p.) notes that culture consists of ideas, values, attitudes, norms and patterns of behavior. It is not a genetic phenomenon and it cannot exist without society involved because culture is shared between members of society. Hofstede (2001, 21 p.) defines culture as "The collective programming of the mind which distinguishes the members of one group from another", what means that culture is learned through generations but it has a tendency to change as external environment changes. Scientist states that core element of culture is system of values. Fischer, at. all (2009, 189 p.) agree that culture is a collective phenomenon and that people learn it but not transmit genetically. According to them: "...culture is passed on through socialization processes within specific groups, which require communication of key symbols, ideas, knowledge and values between individuals and from one generation to the next".

The question of how cultures influence project success during project management processes has been raised by practitioners many times but mostly in organizational sciences and not that often in project management studies. Kuusisto (2012, 27 p.) notes that the relationship between project success and different managerial features, such as leadership competency profiles of the project manager (such as cultural awareness), project management structures, the project managers' personality and project type. Influence of cultural differences in projects can unfold in direct or indirect way. Directly, people can face difficulties in basic communication because of different languages. Indirect influence manifests through behavior formed by values, customs, stereotypical assumptions or pre justice about other cultures

In perspective of multicultural project team it is very important to realize that every team member brings his country (national) culture features into the project team. Binder (2009, 2 p.) notes that country culture is beyond organizational culture. The customs and traditions of different nations and regions can bring more diversity to the work environment, reducing the group thinking and improving the collective creativity. Motivation is often increased as many

people prefer to work in multicultural environment because of the rich information exchange. Nevertheless, this diversity can sometimes be the source of conflicts and misunderstandings, and project managers must apply some basic rules and practices to take advantage of the cross-cultural communication, and to avoid its pitfalls. As Earley and Mosakowski (2004, 141 p.) states: "Cultural patterns in project environments reflect cultural patterns in the wider society. Project Managers therefore operate within the entwined cultures of their society and of their organization and of their own specific project teams".

Overall, cultural differences mainly influence communication and people's behavior in the international projects what is relevant either working with global stakeholders either with multicultural team members. It is important to emphasize that interactions with person from different cultures can help to discover cultural patterns (if identified adequately) of wider society what can be successfully used, for example, to identify customers' needs or stakeholders apprehension.

Cultural differences and project team challenges

Multicultural project team has many advantages in nowadays fast-paced and highly complex business environment: Ability to adapt to changes faster than a team with homogenous cultural, reflect and react to external environment changes, solve problems with less collective mindset and versatile solutions. On the other hand, cultural differences can cause misunderstandings and become a potential source of conflicts within team members, raise communication problems. It can cause possible loss of time and resources also it can reduce efficiency of the project team. This is the reason why cultural differences should be managed through whole processes of the international project management and project manager (as a leader) should enhance cultural awareness and socio-cultural skills. Multicultural teams can be highly effective if project manager is able to apply cultural differences management approach. In contradiction, multicultural teams can become least effective if not taking into account that cultural differences have an influence to the project success.

Kloppenborg (2014, 135 p.) defines that international project has more specific needs and there are some additional challenges in managing multicultural teams (which often are virtual project teams[2]) (Table 1). Firstly, it is notable that international project itself is more complex than traditional (local) project; also it correlates with the fact that in many cases project team is multicultural. In international projects stakeholders are international as well, what means that it is more difficult to understand them as behavior is influenced on differences of languages, traditions, business cultures, norms, values, etc.

Another aspect of multicultural teams is that in many cases they are distributed in different locations (virtual teams) so it makes communication challenging not only because of cultural differences but because of working remotely. Ware, Grantham (2010, 22 p.) emphasize that in today's globalized business culture flexible work (what includes working remotely) is rapidly becoming the norm. They outline that the most critical skill in a distributed work environment is the ability to establish trust (which in many ways translates into, or is equivalent

[2] Virtual team is a group of people and sub-teams who interact through interdependent tasks guided by common purpose and work across links strengthened by information, communication, and transport technologies (Gassmann, Von Zedtwitz, 2003).

to, employee engagement). Kloppenborg (2014, 137 p.) defines that building trust in multicultural and especially virtual team takes more time than in traditional project teams. According to McCray (2012): "In terms of national/regional inhibitors, language and the understanding of subtleties in verbal, non-verbal and written communications can be problematic. Also, expectations regarding the level of open debate, acknowledgement of potential problems, and willingness to veer from the defined process in order to complete work may vary between regions and nationalities".

Table 1

Increased challenges for multicultural and virtual project teams

International project management needs	Increased challenges for project team
1. Initiate project	1. More unique project needs
2. Understand stakeholders	2. More difficult to understand
3. Build relationship	3. Needs more time to gain trust
4. Determine communications needs and methods	4. More unique needs, reliance on electronic methods
5. Establish change control	5. More facilitating than directing
6. Manage the meeting process	6. Less nonverbal clues, interest way wander
7. Control issues	7. With less group interaction, harder to identify

Source: Adopted from Kloppenborg, 2014, 135 p.

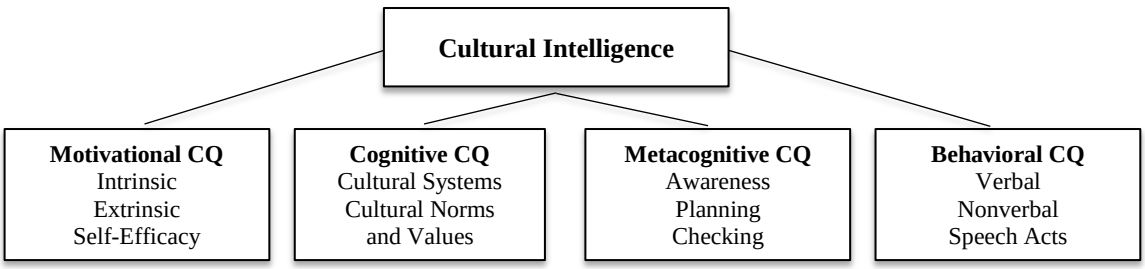
Koh, Joseph, Ang (2010, 11 p.) outline that conflict resolution is another challenging aspect working with multicultural teams as conflicts by nature are inevitable in any kind of teams but it is more sensitive when culturally based misunderstandings may contribute to more disputes and disagreements. Cultural differences influence personal approach how team members resolve conflicts, for example, in general individuals from cultures with high collectivism (mostly Asian countries such as China) tend to avoid confrontation and withdraw from conflict resolution situations as they put a high value on the harmony in the team. In contrary, countries with high in individualism (such as the United States, Great Britain, Australia, etc.) tend to solve conflicts in confrontational style as for them individual achievement and opinion is highly important.

In conclusion, multicultural project teams are considered as one of the most valuable assets while searching for different and innovative problem solutions, it let project managers combine different experiences, approaches and skills to enrich international project management. Nevertheless, if cultural awareness of project managers and team members is low it might cause misunderstandings and conflicts between team members as a consequence it can decrease teams motivation and interfere with success of the project.

The concept of Cultural Intelligence

The concept of Cultural Intelligence (CQ) was based on contemporary theories of intelligence, for example, definition of general intelligence by Schmidt and Hunter (2000, 3 p.)

is: "...the ability to grasp and reason correctly with abstractions (concepts) and solve problems." Ang and colleagues (Ang, Van Dyne, Livermore, 2007, 335 p.) states that Cultural Intelligence was specifically defined to address the phenomenon of globalization focusing on intercultural settings – capability to comprehend, adequately interpret and behave in situations rising from cultural differences. Scientists define that Cultural Intelligence is: "A capability of an individual to function effectively in situations characterized by cultural diversity". According to Livermore (2010, 19 p.) cultural intelligence is closely linked to the theories and research as it relates to insights from motivational, cognitive, metacognitive, and behavioral studies. What differs this concept from other intelligence theories is that main focus in CQ studies is on behavior that is learned through education and experience and that is not inherent personality characteristics that are difficult to change. This theory acknowledges that personal interests, thoughts, and behavior influence the leader's and team member's individual interaction in a cross-cultural situation. In addition to this concept is based on development of overall perception on other cultures what doesn't require comprehensive knowledge of specific information about every individual culture. Thomas, Elron, Stahl, et. all (2008) define Cultural Intelligence as a system of interacting knowledge and skills, linked by cultural metacognition, that allows people to adapt to, select, and shape the cultural aspects of their environment. CQ is a multidimensional concept comprising mental (metacognitive and cognitive), motivational, and behavioral dimensions (Figure 1).



Source: Ang, Van Dyne, et. all, 2012

Fig. 1. **The Four-Factor Model of Cultural Intelligence**

The Motivational (Drive) factor is based on showing the interest, confidence and *drive* to adapt to cross-cultural environment. It excludes the assumption that leaders are all naturally motivated to learn about cultural issues (there's always the risk of resistance). There are different levels of motivation: Intrinsic which is a genuine motivation of a person raising from natural interest in different cultures; Extrinsic manifests when person has some more tangible benefits from engagement; Self-Efficacy is the confidence that person is able to behave effectively in cross-cultural encounters (Van Dyne, Ang, Livermore, 2010, pp. 4-5). The factor, on the one hand, defines the ability to view cross-cultural interactions in a different way, on the other hand, make every effort to gain new experiences from people from other cultures. This is of central importance in solving problems (Earley, Peterson, 2004).

The Cognitive (Knowledge) factor determines the understanding of cross-cultural issues and differences as a *dimension of knowledge* in the concept of Cultural Intelligence. This factor is addressed mostly to emphasize typical approach to intercultural competency (Van Dyne, Ang,

Livermore, 2010, p. 5-6). The factor defines the understanding of cultural norms, values, such components of cultural systems as religious beliefs, language and communication rules, customs, etc. influences his/her behavior (Earley, Peterson, 2004).

The Metacognitive (Strategy) factor is aimed to unveil *strategic approach* in making sense of culturally diverse experiences. It determines whether person can use his/her cultural knowledge to make strategic decisions, takes into account awareness of how cultural differences influence peoples behavior; Planning on how to prepare for cross-cultural encounters by approaching people, situation, topic; Monitoring and checking if the plans and expectations were fulfilled and whether the strategic approach was appropriate (Van Dyne, Ang, Livermore, 2010, 7 p.). This factor is crucial in applying the Cultural Intelligence model because it helps to adapt and adjust actions of communication strategy from understanding cultural issues to evaluating the actions taken and improving strategy in a long-time perspective (Earley, Peterson, 2004).

The Behavioral (Action) factor represents *action dimension* as the ability to appropriately adapt verbal and non-verbal communication to a cross-cultural situations. It refers to leaders knowledge when these actions need to be taken and when not so it shows the flexibility and the highest level of cultural awareness (Van Dyne, Ang, Livermore 2010, 8 p.). In other words, behavioral intelligence focuses on what individuals do rather than what they think or feel. It is essential because it reveals the primary attributes of sustaining a relationship (Earley, Mosakowski, 2004).

Assessment of CQ. Individual can make a self-assessment of CQ using The Cultural Intelligence Scale (CQS). Individual who uses the CQS has to evaluate his/her own behavior in 20 statements that are provided in the questionnaire, the evaluation shows how capable person is to interact in culturally diverse environment. These statements are separated into four categories: Motivational CQ, Cognitive CQ, Metacognitive CQ, Behavioral CQ. For example, results from CQ-Metacognitive and CQ-Behavioral statements help to predict task performance: Those who have the capability to make sense of inter-cultural experiences (such as making judgments about their own thought processes and those of others) make higher quality decisions and perform at higher levels in multi-cultural work settings. Those who have the capability to adapt their verbal and nonverbal behavior to fit specific cultural settings have a flexible repertoire of behavioral responses that enhances their task performance in culturally diverse settings. In sum: the higher the CQ-Metacognitive and the higher CQ-Behavioral – the higher the performance. CQ-Motivational and CQ-Behavioral can help to predict three different forms of adjustment: Those who are interested in experiencing other cultures and feel confident that they can interact with people who have different cultural backgrounds (CQ-Motivational) are better adjusted in culturally diverse situations. Those who have a broad repertoire of verbal and nonverbal behavioral capabilities (CQ-Behavioral) feel better adjusted in situations characterized by cultural diversity. This pattern of relationships applies to the three types of adjustment: general, work and interactional. In sum: the higher the CQ-Motivational and CQ-Behavioral – the higher the adjustment (Cultural Intelligence Center, 2005). Livermore defines (2010, 2 p.): "The CQS is a questionnaire that is administered at two levels: an individual assessment and a peer assessment. Thus, the CQS considers an individual's own perception of their accomplishments and gauges how others rate one's level of cultural intelligence. The CQS can be used to assess capacity to fill a position overseas, to conduct diversity training, and even just for personal development".

Livermore (2010, 1 p.) defines the importance of cultural intelligence: "Cultural intelligence can enhance performance in a number of ways: reducing the time it takes to complete a job, decreasing frustration and confusion, and ultimately increasing revenue". From his point of view, according to him, there are five main reasons why every manager should consider enhancing cultural intelligence skills while operating in global environment:

- *Understanding different customers and stakeholders as* knowledge of local culture is essential to effectively approach customers and stakeholders in emerging international markets.
- *Management of multicultural teams*: Communication with diverse employees, both in the local workforce and abroad, is crucial to an organization's ability to succeed. Employees and clients are located around the globe, and cultural intelligence helps the leader to adapt policies and strategies to apply to various cultural groups.
- *Recruiting and developing talent*: There is strong competition for good employees, and many companies now recruit globally. In addition, cultural issues can make it difficult to retain employees from different nations and ethnicities. CQ increases an organization's ability to find, grow, and retain cross-cultural talent.
- *Adapting the leadership approach to different cultures*: Cultures respond differently to various leadership styles, and CQ is necessary to tailor the leadership approach to be the most effective in a given culture. For example, in Germany managers involve employees in decision making, while in Saudi Arabia managers are more effective if they make independent authoritative decisions. Person with higher levels of CQ, you're more likely to develop trust and effectively lead multicultural groups and projects at home or dispersed around the world (Livermore, 2010, pp. 1-2).
- *Negotiation.* Being able to negotiate effectively across cultures is cited as one of the most important competencies needed in today's global workplace. Individuals with higher CQ are more successful at cross-cultural negotiations than individuals with lower CQ. When faced with the ambiguity of intercultural communication, with high CQ more likely to persist and invest great effort in reaching a win–win despite the absence of cues that help you negotiate effectively in a more familiar environment (Imai, Gelfand, 2010, 84 p.).

Advantages of CQ are reasonable but in order to apply it as an method to manage cultural differences in project management there's a need to discuss actions how it could be incorporated and what kind of approach organization should apply according to it's own specifics.

Applying Cultural Intelligence in international project management

This part of the article is dedicated to discuss what actions could be taken in order to incorporate CQ approach in international project management. The main purpose and benefit of CQ incorporation would be enriched cultural differences management and more effective intercultural interactions between project managers, project team members, stakeholders.

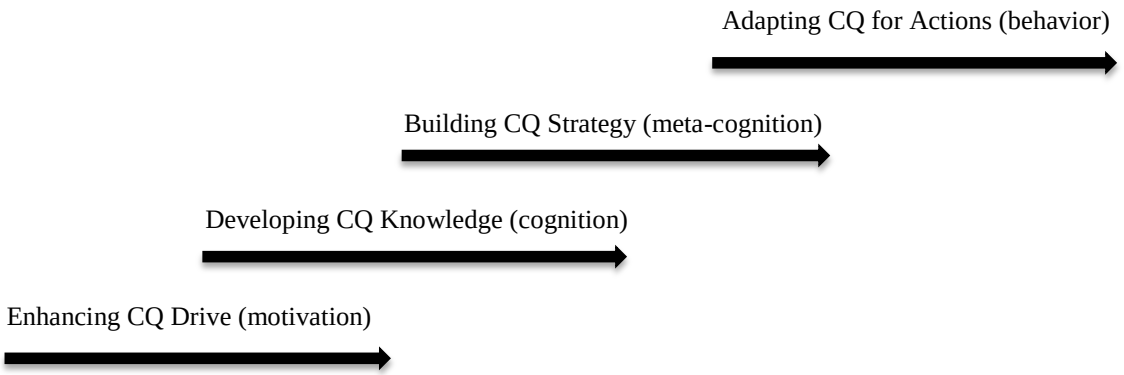
Thomas, Elron, Stahl, et. all (2008) outline that to reach this purpose, individual level of personal adjustment has to be raised. This means that if person feels uncomfortable in culturally diverse situations and communicating with people from different cultural background, his/her personal adjustment is low. If personal adjustment is in a high level multicultural

communication will not cause more stress than communication with people from same culture. Another aspect is how person can handle interpersonal relationship with culturally different people. This defines ability to maintain and develop good relationship with person from different culture as the nature of relationships is to gain mutual benefits from communication. Finally, one of the most important attribute which is relevant to project management is how each person is capable to accomplish tasks and achieve goals while interacting with people from different cultural backgrounds, in what extent cross-cultural setting influence the successful performance of a person. This approach is more targeted to reveal individual perspective of interaction but if each team member or project manager would take into account these levels of interactions the overall communication would be improved. Especially when gaining trust and build relationship in multicultural teams is often a challenge.

Similar point of view is being expressed by Smith (2014), who defines that CQ acumen can be gained through a phased program of awareness, knowledge, and skills. In her opinion, organization can increase employees' CQ by implementing organizational training focused on cultural differences awareness, which enables employees to perceive what level of cultural awareness they possess. This level of self-awareness is kept as crucial for the cultural dexterity in order for leaders, managers, and other employees to be able to use effective communication and problem solving skills in culturally complex environment and that actions would be culturally appropriate. Enhanced culture-specific knowledge should follow the baseline awareness. In business environments, people tend to recognize only visible part of a culture. However, the most important aspects of culture – opinions, viewpoints, attitudes, philosophies, values, and convictions – are unseen. Specific training is necessary to understand some of these underlying values that may drive behavior. Numerous corporations have used online training modules and group facilitation to help provide these insights. The acquisition of enriched communication skills suppose to complete the training. Global mindset and ways of conducting business and communicating shift depending on one's cultural programming. This final phase should be interactive, allowing employees to improve via cross-cultural encounters simulation exercises, real-time coaching and feedback (Smith, 2014). Livermore (2010, 8 p.) has similar approach on what kind of actions need to be taken in order to incorporate CQ in project management. According to him, if organization decides to incorporate CQ in their management system, senior leaders have to see cultural intelligence as a priority, define goals for CQ development. Entities should be aware what benefits organization gain from it because cultural intelligence increases both individual and business success in multicultural situations. The scientist suggests mindset on developing CQ in organization: "Entities have to incorporate cultural intelligence in decision making, and they have to adopt a CQ training plan. Training should be "hands on" and interesting to increase motivation, and it should be targeted to the specific job needs of the employee. As part of the training, employers can engage employees in developing an individual plan to develop cultural intelligence. The employers can offer language and skills classes and coaching and training opportunities to fulfill the individual plan. An organization should reward its employees for developing and practicing cultural intelligence". Overall, Livermore (2010, 3 p.) suggests that the learning process should be viewed as a cyclical progression. Cultural drive provides the motivation to pursue cross-cultural knowledge. The knowledge forms an understanding of basic cross-cultural issues. This understanding is the foundation for the development of strategy, which enhances the ability to engage in action. Positive results from action generate motivation to begin the cycle again.

Ideally, each time that the cycle is repeated, one's cultural intelligence skills will become more effective, and the CQS score will increase.

From all theoretical insights about how to build a foundation for CQ enhancement in organization there can be a process of different steps defined. In the case of this article the design of actions will be more universal because there is no specific organization analyzed. According to that author uses the framework of The Four–Factor Model of Cultural Intelligence, actions were divided into four steps (Figure 2) to sustain the sequence of four factors of CQ: Drive (motivation) interest and confidence in functioning effectively in culturally diverse settings; Knowledge (cognition) knowledge about how cultures are similar and different; CQ Strategy (meta-cognition) making sense of culturally diverse experiences an creating strategy for encounters in the future; CQ Action (behavior) capability to adapt behavior appropriately for different cultures.

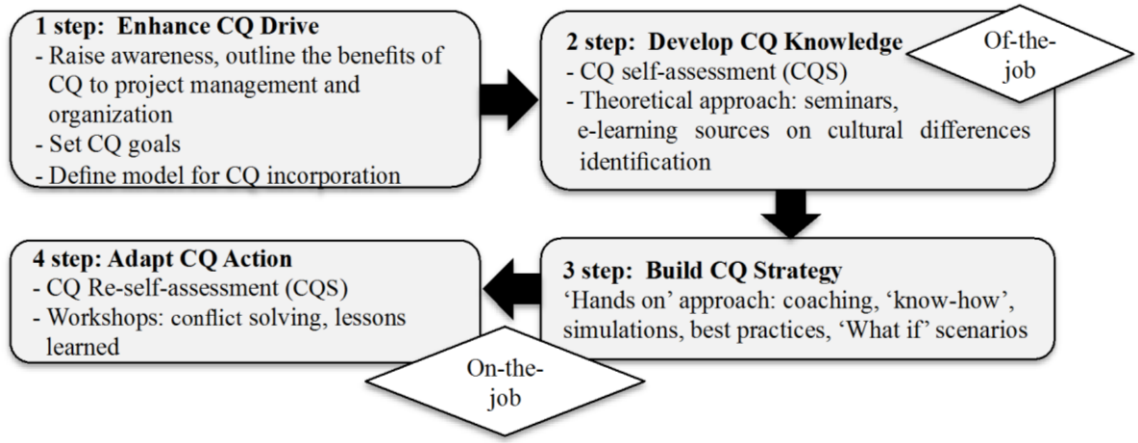


Source: Authors construction based on Ang, Van Dyne, et. all, 2012

Fig. 2. **Steps to incorporate Cultural Intelligence to project management**

The first step: Enhance CQ Drive (Figure 3) is to raise the awareness in organization on how cultural differences influence project management, what are pros and cons, how CQ can be useful for every individual and bring benefits for organization. Raised awareness will bring support from top-level management. When the decision to incorporate CQ into project management is made it is very important to set goals for it and design the approach. The form of how CQ should be incorporated to project management can differ from one organization to another. Following aspects should be considered before creating a model for CQ incorporation:

- Form of activities: training, workshops, coaching, peer-to-peer coaching, e-learning, etc.
- Content of activities: cultural sensitivity, conflict solving, cultural differences identification, etc.
- Time to hold activities: on-the-job, off-the job.
- Recourses: time, human, financial, etc.
- Approach to individual development: individual training (distributed according individual needs), team training (collaborative methods).
- Project team structure: virtual, distributed, outsourced, remote, on-site, etc.



Source: Authors construction based on Ang, Van Dyne, Livermore, et. all, (2012), Smith (2014), Livermore (2011), Earley, Mosakowski (2004)

Fig. 3. **Steps and actions to incorporate Cultural Intelligence to project management**

Second step: Develop CQ Knowledge. This stage of CQ incorporation is more based on theoretical approach which would be applied for project managers and team members to gain basic knowledge about cultural diversity, cultural differences. It is very important to outline that teams which have to work remotely could use the same material as teams on-site so e-learning can be blended with seminars. This stage would be dedicated to satisfy individual knowledge needs and wouldn't be connected to specific tasks (more of-the-job approach) in order to form baseline awareness about cultural differences management. **Third step: Build CQ Strategy.** From this stage trainings should become more practical with 'hands on' approach. Every organization has it's own project management methodology and approach so this stage would be dedicated to justify the individual knowledge about intercultural encounters with real tasks (on-the-job approach). Building CQ strategy would be based on coaching for project managers and team members, sharing best practices from their experience, creating 'what if' scenarios for the future collaboration and simulating culturally diverse situation, discussing. Concerning virtual teams there are many communication tools as webinars to hold coaching sessions remotely. **Fourth step: Adapt CQ Action.** Crucial part of this phase in re-self-assessment because this is main tool to measure if CQ has been developed. This phase would be dedicated to ensure that knowledge is being used during cross-cultural encounters and determining biggest challenges during workshops to discuss lessons learned, give feedback, gain knowledge about conflict solving from real time situations arising from tasks related to international project management.

Conclusions

Cultural Intelligence (CQ) can be applicable in international project management as a cultural differences management approach in project managers', project teams' perspective or both. The most significant advantage of CQ is that it doesn't require to have knowledge in all characteristics of many different cultures what makes theory more practical as in some situation individual cannot

predict how many different cultures he/she is going to encounter (because of such diverse societies). It represents holistic approach to cultural differences management by evaluating how individual behaves and how he/she suppose to behave in culturally diverse situations overall, instead of getting to know some specific cultures in detail. According to the analysis of scientific sources it has been found that in most cases, theories of cultural differences and behavioral sciences show patterns of behavior of specific cultures but don't take into account the aspect of personality. In the approach, represented by CQ theory, there is acknowledged that personal interests (motivation), perceptions and personal culture of communication has notable influence in what extent person is capable to develop his intercultural skills. Self-assessment of CQ (using Cultural Intelligence Scale) helps to show individuals' strengths and weaknesses in cross-cultural interactions by assessing his/her ability to adjust and helping to predict performance in multicultural environment.

In order to apply CQ in international project management it is very important that the influence of cultural differences and benefits of CQ to project management would be escalated to gain necessary support from top-level management and employees who will be incorporated in the process. It would raise the motivation to develop intercultural competences (The first step: Enhance CQ Drive). Second phase should be based on CQ self-assessment for finding strengths and weaknesses in cultural interactions, evaluate which areas need to be improved (Second step: Develop CQ Knowledge). In order to diminish weaknesses and build a base for CQ knowledge more theoretical approach according to individual needs can be applied (because some employees might already have the basic knowledge).

According to scientists, next phases should be aimed to define action plan for cultural encounters that raise from tasks in project management ('hands on' approach), conduct workshops for knowledge sharing, coaching and simulations to find solutions for possible problems (Third step: Build CQ Strategy). Last phase of actions (Fourth step: Adapt CQ Action) should include re-self-assessment in order to monitor the improvement and apply knowledge in everyday tasks, share lessons learned with colleagues.

Overall, CQ development should be perceived as cycle of actions that create incentives to one another. Cultural drive enhances motivation to pursue new knowledge, knowledge forms the basic understanding about cultural diversity, this understanding is the base to build a strategy for cultural interactions that is followed by certain actions (when individual is facing cultural encounters). There can be several cycles to achieve high CQ and each of them should start and end with self-assessment in order to monitor the improvement.

Bibliography

Ang, S., Van Dyne, L., Koh, C.K.S., Ng, K.Y., Templer, K.J., Tay, C., Chandrasekar, N.A., 2007. Cultural intelligence: Its measurement and effects on cultural judgment and decision making, cultural adaptation, and task performance. Management and Organization Review, 3.

Binder, J., 2009. Global Project Management: Communication, Collaboration and Management Across Borders. USA: Gower Publishing.

Brünnemann, K., 2013. Thee Strategic Importance of Intercultural Competency for Project Managers in the 21st Century. Working Paper Series, University of Applied Sciences bfi Vienna, No 79. [Online] Available at: http://www.fh-vie.ac.at/Forschung/Publikationen/Workingpapers/The-Strategic-Importance-of-Intercultural-Competency-for-Project-Managers-in-the-21st-Century.

Cultural Intelligence Center, 2005. The Cultural Intelligence Scale (CQS). [Online] Available at: http://www.culturalq.com/docs/Van%20Dyne_Ang_Koh%20Handbook%20Ch%202%20CQS%20Scale.pdf.

Earley, E. C., Mosakowski, E., 2004. Cultural Intelligence, Harvard Business Review October, pp. 139-146.

Earley, P. C., Peterson, R. S., 2004. The Elusive Cultural Chameleon: Cultural Intelligence as a New Approach to Intercultural Training for the Global Manager. Academy of Management Learning and Education, 3(1), pp. 100-115.

Fischer, R., Ferreira, M. C., Assmar, E., Redford, P., Harb, C., Glazer, S., Achoui, M., 2009. Individualism-collectivism as Descriptive Norms Development of a Subjective Norm Approach to Culture Measurement. Journal of Cross-Cultural Psychology, 40(2).

Gassmann, O., Von Zedtwitz M., 2003. Trends and determinants of managing virtual R&D teams. RandD Management, 33.

Hall, E.T., 1976. Beyond Culture. New York: Anchor Books/Doubleday.

Hofstede, G., 2001. Culture's Consequences: Comparing Values, Behaviours, Institutions, and Organizations Across Nations – second edition. UK: Sage Publications.

Imai L., Gelfand M. J., 2010. The Culturally Intelligent Negotiator: The Impact of Cultural Intelligence (CQ) on Negotiation Sequences and Outcomes, Organizational Behavior and Human Decision Processes 112.

Kloppenborg, T., 2014. Contemporary project management. Cengage Learning.

Koh, C., Joseph, D., Ang, S., 2010. Cultural intelligence and the global information technology work-force. NanYang Technological University, Singapore. [Online] Available at: http://www.culturalq.com/contents/research/papers/Koh%20Joseph%20Ang%20IT%20Management%202009.pdf.

Köster K., 2010. International Project Management. Heilbronn University: SAGE Publications Ltd. [Online] Available at: http://www.uk.sagepub.com/koster/Material/Background%20Information.pdf.

Kuusisto, J., 2012. Essays on managing cultural impacts in multinational projects. Aalto University. [Online] Available at: https://aaltodoc.aalto.fi/handle/123456789/8908.

Livermore, D. 2010. Leading with cultural intelligence: The new secret to success. AMACOM Div American Mgmt Assn. Business book review. [Online] available at: http://www.learningexecutive.com/CLLC/media/2011/BBR_LeadingWithCQ_chi.pdf.

McCray, S., 2012. The Top 10 Problems with Outsourcing Implementation (and how to overcome them). [Online] Available at: http://www.ssonetwork.com/articleiframe.cfm?id=10390.

Roux-Kiener, A., 2009. Project Management in Global organizations – Experience of a practitioner. Project Perspectives. The annual publication of International Project Management Association. Vol. XXXI, ISSN 1455-4178. [Online] Available at: http://ipma.ch/assets/re-perspectives_2009.pdf.

Schmidt, F. L., Hunter, J. E., 2000. Select on intelligence. E.A. Locke (Ed.), Handbook of principles of organizational behavior. Oxford, UK: Blackwell.

Smith, L., 2014. Cultural intelligence makes the world and workplace go round. PR Week: Haymarket Media Group Ltd. [Online] Available at: http://www.prweek.com/article/1303115/smith-cultural-intelligence-makes-world---workplace---go-round.

Thomas, D. C., Elron, E., Stahl, G., Ekelund, B. Z., Ravlin, E. C., Cerdin, J. L., Lazarova, M. B., 2008. Cultural intelligence domain and assessment. International Journal of Cross Cultural Management, 8(2), pp. 123-143.

Van Dyne, L., Ang, S., & Livermore, D., 2010. Cultural intelligence: A pathway for leading in a rapidly globalizing world. Leading across differences. [Online] Available at: http://linnvandyne.com/papers/Van%20Dyne_Ang_Livermore%20CCL%20in%20press.pdf.

Van Dyne, L., Ang, S., Ng, K. Y., Rockstuhl, T., Tan, M. L., Koh, C., 2012. Sub-Dimensions of the Four Factor Model of Cultural Intelligence: Expanding the Conceptualization and Measurement of Cultural Intelligence. Social and personality psychology compass, 6(4).

Ware, J., Grantham, C., 2010. Managing a remote workforce: Proven practices from successful leaders. The Work Design Collaborative, 151. [Online] Available at: http://thefutureofwork.net/assets/Managing_a_Remote_Workforce_Proven_Practices_from_Successful_Leaders.pdf.

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VALUE STREAM ACCOUNTING IN PROJECT MANAGEMENT

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Abstract

Lean accounting methods seem to gain more and more interests in recent years. One of the major feature of those methods is orientation towards distinguishing and analysing value streams. Although in the literature on the subject there are some examples of value stream analyses in companies performing repeatable (regular) activities, there are no examples of the application of such approach in relation to project activities. As nowadays the role of projects in companies' activities is increasing constantly, it is important to conduct research aimed at determining the possibilities for the application of performance measurement based on value stream accounting in such type of activities.

The main goal of the paper is to describe the major rules of value stream accounting implementation with regard to individual projects, as well as to project portfolio. In the first part of the paper the concept of value stream accounting will be presented and illustrated with selected examples. Next, the benefits resulting from the application of value stream accounting in project management, from the operational and strategic perspectives, will be discussed.

Key words: *project, project portfolio, value stream accounting, lean management*

JEL code: M41

Introduction

As the literature review indicates, in the recent years the increasing interests in so-called "lean accounting" (Michalak 2007, Kennedy, Widener 2008, Rojek, Sobańska 2012) have been observed. Lean accounting (LA) methods comprise specific solutions developed by Japanese companies, which became popular in the early 1980s, and nowadays are employed worldwide by numerous leading companies (*Accounting for.. 2006, Lean enterprises.. 2006*). The main purpose of LA methods is to present, in a very distinct manner, the activities of an entity, sometimes also of its cooperating business partners, from the perspective of value provided to direct and target customers. Thus, one of the essential features of such approach towards analysing company's activities is focus on the determination of value streams.

In general, value stream accounting is aimed at the implementation of initiatives resulting in the increase of efficiency. The purpose of these initiatives is to improve the flow of the value stream (the course of production) in such a way that flexible responses to the changing expectations of customers are assured simultaneously with minimising the consumption of resources. The main approach to diminishing the resource consumption is to identify and reduce the so-called waste. This term is understood as all resources used in these activities which do not add value to the product from the customers' perspective. Consequently, the increased

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efficiency results from the changes in the process flow as well as from the resource allocation. A relative reduction of resources (cost reduction) is achieved, and the value delivered to customers is maintained, and sometimes even increased (a potential increase in revenues).

The approach delineated above, adopted to improve the financial situation, is particularly popular with mass production companies (Van der Merwe, Thomson 2007). A typical example of a sector where this approach seems to achieve the position of a standard, is the automotive industry. Due to the repeatability of manufacturing activities, further initiatives aimed at increasing the efficiency allow for a steady improvement of the financial situation and competitiveness of entities, although maintaining the same level of resource prices. This approach is also used commonly in standardised (repeatable) services: in banking, insurance, etc. An interesting issue to be researched is the possibility and validity of adoption of value stream accounting for non-repeatable activities, i.e. projects.

Unquestionably, projects play an increasingly important role in the functioning of various organisations, and enterprises use projects in their main and supporting activities. Considering the increasing scale of project activities, and the attention paid to management accounting in projects (Finch 2007), the implementation of value stream accounting for projects seems to be an important and inspiring research issue. There is remarkably little research on the subject. The authors were unable to find publications presenting value stream accounting in project activities, or any example of its practical application in a Polish project-oriented company. Therefore, the purpose of this paper is to make the contribution and fill the existing knowledge gap concerning the application of value stream accounting in project-oriented companies. Due to the universal nature of the method, this study is limited to value stream profitability analysis. The approach presented in the paper is based on net value streams (streams of value added)[2].

Assumptions for the measurement of the value stream profitability

Principally, the analysis of the value stream profitability is based on a comparison of revenues and operation costs of a company, divided into value streams and waste (Łada 2011). The value streams comprise all activities and related resource consumption effecting the product offer and representing value for the customers. In the profitability analysis, the value streams are often apportioned to the various product offers. Waste, on the other hand, is the entire remaining area of activities (resources consumed) which does not have any impact on the customers' willingness to accept the prices determined by the enterprise. The basic sources of waste may be constituted by unexploited potential, excessive consumption of resources, and all activities not effecting the customers or not required. Usually, the value stream analysis is aimed at the assessment of the efficiency of operational activities, and therefore, it is focused on the assessment of factors determining operational profit.

When preparing profitability statement based on the value stream approach, it is necessary to adopt appropriate procedures facilitating calculations of revenues and costs for individual objects: value streams and waste (or sources of waste). Periodic revenues measurements are prepared only for the value streams (i.e. the product offer), and – with a standard pricing policy applicable to individual products – they may be conducted directly.

[2] The literature most often presents the classic costing method based on gross streams, promoted by Maskell and Baggaley (Ruiz-de-Arbulo-Lopez et al., 2013).

However, cost calculation may call a greater challenge. The total cost of activities is settled for closely related items which often use the same resources. For this reason, apart from the identification of direct costs of objects, it is necessary to allocate indirect costs. The first possibility is to divide cost with quantitative cost drivers determined for individual objects. The alternative approach to value stream costing is based on the application of the subtraction method, by reducing the total costs by the cost of individual sources of waste. In this approach, the costs of the total value stream are calculated as a result of the corrections of total operational costs by:

1) costs of unused production capacity – these include a part of the fixed costs related to the scale of operations,
2) costs of excessive consumption of resources – established on the basis of differences between the costs of used capacity and the standard costs of individual items of variable and fixed costs,
3) costs with no effect for the customers – including costs incurred in connection with the activities delivering effects not recognized by the customers,
4) costs with no value for the customers – including costs of delivery of such features of the product which are not required by the customer.

It must be underlined that in the calculations of revenues and costs for value stream and waste the approximate data can be used. The value stream revenues and costs should allow for the creation the picture of an "ideal" offer, developed in accordance to the efficiency requirements. The concept of this "ideal" is relative; therefore, the level of details and, consequently, the difficulty derives from the enterprise's determination in the strive to performance improvement. Undoubtedly, those companies which have adopted the operational excellence strategy are the most focused on the improvement of their productivity.

According to the adopted method of profitability analysis, the enterprise profit margin is the difference between the sum of profit margin of the value streams and the costs of waste. Generally, the level of the latter is surprisingly high and consumes a large part of margin which could have been generated if the entity operated more "ideally". An important addition to the statement is the analysis of data in relative terms. For example, it is suggested to prepare and use a vertical analysis of margin, and to extend the analysis to individual objects, with the total revenues as the point of reference. Such analysis offers a very synthetic view of the entity's situation in terms of profitability, with a clear indication of its sources and factors with the most destructive effect. The statement offers an inspiration to the managers in their search for methods supporting the improvement of the entity's situation. This may be achieved by increasing the level of the value streams delivered to the customers, or by decreasing the total amount of waste.

Determination of the value stream resulting from project activities

Owing to the specific nature of project activities, the way of preparing financial data for the purposes of value stream analyses must be modified properly. The value streams generated as a result of project usually comprise costs of numerous periods. The amounts of project revenues and costs recorded in each period are often distributed inadequately to the progress of the project work, and their specification does not allow for a correct determination of the project's profitability.

Usually, the project's profitability can only be established after the entire undertaking has been closed and settled. Fixed costs of the project activities raise another measurement problem, as they are related to resources maintained by the organisation and periodically allocated and used for the purposes of projects. Therefore, with respect to waste costing, it is also necessary to take into account waste at the level of the entire organization and at the level of an individual project. A third obstacle, important for the project activities, is the difficulty in establishing the cost standards. Projects, as non-repeatable undertakings, are characterised by a greater complication in establishing the benchmark resource consumption, and standards developed for a particular project may not necessarily be appropriate for other projects.

Table 1

Statement on value stream profitability

Data (k PLN)	Total				Project 1		Project 2		Project 3	
	Period results	**Value stream**	**Waste in projects**	**Common waste**	**Value stream**	**Waste**	**Value stream**	**Waste**	**Value stream**	**Waste**
Project value for customer (price)					2 450.00		1 354.00		1 984.00	
% value delivered in period					30%		70%		100%	
Earned value for customer	3 666.80	3 666.80			735.00		947.80		1 984.00	
Projects costs:										
Product delivery to customer	20.00	15.00	-	5.00	-	-	-		15.00	-
Product delivery preparation	240.00	99.00	15.00	126.00	-	-	-	-	99.00	15.00
Final assembly	560.00	420.00	40.00	100.00	-	-	-	-	420.00	40.00
Modules configuration	430.00	310.00	100.00	20.00	-	-	210.00	90.00	100.00	10.00
Modules assembly	680.00	540.00	52.00	88.00	-	-	180.00	40.00	360.00	12.00
Production planning	360.00	221.00	135.00	4.00	65.00	85.00	75.00	45.00	81.00	5.00
Materials purchasing	80.00	46.00	19.00	15.00	5.00	5.00	21.00	9.00	20.00	5.00
Direct materials	800.00	760.00	40.00	-	400.00	5.00	240.00	3.50	120.00	31.50
Establishing project requirements	100.00	55.00	5.00	40.00	25.00	5.00	-	-	30.00	-
Project management	300.00	-	205.00	95.00	-	20.00	-	65.00	-	120.00
Project gross margin	**96.80**	**1 200.80**	**-611.00**	**-493.00**	**240.00**	**-120.00**	**221.80**	**-252.50**	**739.00**	**-238.50**
% gross margin in total revenues	*2.6%*	*32.7%*	*-16.7%*	*-13.4%*	*6.5%*	*-3.3%*	*6.0%*	*-6.9%*	*20.2%*	*-6.5%*
% gross margin in project revenues					*32.7%*	*-16.3%*	*23.4%*	*-26.6%*	*37.2%*	*-12.0%*
% gross project profitability	*2.6%*				*16.3%*		*-3.2%*		*25.2%*	
Overhead costs	540.00	-	-	540.00						
Earned total margin	**- 443.20**	**1 200.80**	**-611.00**	**-1 033.00**						
% earned total margin	*-12.09%*	*32.75%*	*-16.66%*	*-28.17%*						

Source: author's calculations

The above mentioned issues are the starting point for the development of a new, modified value stream profitability accounting dedicated to project activities. The proposed model of analysis is based on two profitability reports prepared for all project activities performed in a particular period, and for individual projects. The first report is used for a periodic, cross-sectional analysis conducted across projects, and the second one presents incremental, financial effects of the progress in work on a particular project. The structure of this documentation is related to the concept of segment statements – the statements for lower level segments are more detailed and contain figures which can be reliably associated.

Due to measurement obstacles, periodic revenues from projects are calculated as estimates and described in both statements as the value created for the customer. The project price is adopted as the equivalent of the entire value delivered to the customer. The value created for the customer in a specific period is determined as the percentage of the project value generated in this reference period, and the price of the project. The percentage of the value generated can be established on the basis of different valuation models. In particular, this percentage can be determined by the difference between the end of the current and the previous periods, calculated for the following items:

- progress of the project work,
- relationship between the flexible budget and the total budget of the project,
- costs incurred, increased by the percentage profit margin,
- liquidation market value of the project product.

The added earned value, calculated in the way described above, represents the project value for the customer, created as a result of the value stream generated in the particular period, and replaces the project revenues.

The costs of the project activities, listed in appropriate structure,[3] are initially divided into costs of common waste at the organisation level, and into project costs. The first item includes only the costs of unused production capacity of the project organisation, incurred in the particular period. Then, the costs calculated for projects are divided into the value stream generated by the project, and into waste. Waste at the project level includes the costs of: above-standard consumption of resources, project products not delivered to the customer, and effects obtained with respect to the main product of the project, which – however – have no positive value for the customer.

The adopted structure of the analysis allows for the specification in the cross-sectional statement (cf. Table 1) of the value elements generated in projects, and their corresponding stream costs. It is reflected by the project gross margin, calculated in total and with a division into individual projects. The gross margin of the projects is decreased by overhead costs which are not allocated to the projects, and represents an estimate (earned) total margin generated in the particular period. It should be underlined that this value does not correspond to the accounting profit calculated in the project organisation. However, it is consistent in the long term and in these cases, when the organisation issues invoices for its customers on an ongoing basis to reflect the actual progress of the project work. Data on revenues, costs and margin of the project organisation are supplemented with percentages illustrating the profitability scale for streams generated in connection with individual projects, and the related waste. In a sample

[3] For this purpose, the best approach is to calculate activity costs, however resource costing is also suitable.

specification, the percentages are calculated both with respect to revenues from individual projects, and to total revenues.

A shift of the value stream profitability analysis to the level of individual projects is possible in the case of the second type of statements (cf. Table 2). These include decomposed information on the created value, the project costs, and the gross margin for a single project, presented in an increasing order from the beginning of the project implementation, along with a detailed division into further reference periods. Data for individual periods are compliant with the information presented in the cross-sectional statement. The project costs are broken down by the value stream costs and the costs of waste. Each item is additionally expanded in the adopted cost analytical structure. In the sample statement, these are costs divided by further processes. A comparison of the same data for subsequent periods allows to follow the progress of the project work, and to analyse the occurring waste as a deviation from the adopted standard. As in the cross-sectional statement, the percentages determined for the project value generated for the customer are also useful at the project level for the purposes of the profitability analysis.

Table 2

Statement on project value stream profitability

Data (k PLN)	Project	%	Period 1	Period 2
% value delivered in period	75%		5%	70%
Earned value		**1 015.50**	**67.70**	**947.80**
Value stream costs	**749.00**	**73.76%**	**23.00**	**726.00**
Product delivery to customer	-	0.00%	-	-
Product delivery preparation	-	0.00%	-	-
Final assembly	-	0.00%	-	-
Modules configuration	210.00	20.68%	-	210.00
Modules assembly	180.00	17.73%	-	180.00
Production planning	75.00	7.39%	-	75.00
Materials purchasing	24.00	2.36%	3.00	21.00
Direct materials	250.00	24.62%	10.00	240.00
Establishing project requirements	10.00	0.98%	10.00	-
Project management	-	0.00%	-	-
Value stream margin	**266.50**	**26.24%**	**44.70**	**221.80**
Waste costs:	**292.00**	**28.75%**	**39.50**	**252.50**
Product delivery to customer	-	0.00%	-	-
Product delivery preparation	-	0.00%	-	-
Final assembly	-	0.00%	-	-
Modules configuration	90.00	8.86%	-	90.00
Modules assembly	40.00	3.94%	-	40.00
Production planning	45.00	4.43%	-	45.00
Materials purchasing	14.00	1.38%	5.00	9.00
Direct materials	5.50	0.54%	2.00	3.50
Establishing project requirements	-	0.00%	-	-
Project management	97.50	9.60%	32.50	65.00
Project gross margin	**-25.50**	**-2.51%**	**5.20**	**-30.70**

Source: author's calculations

Preparation of data according to the approach described above requires the use of appropriate costing methods. When these methods are an integral element of the costing system of the project organisation, the value stream profitability statements can be generated automatically for reference periods. On the other hand, for the purposes of ad hoc analyses of the value stream profitability, they can be used for a one-off settlement of costs recorded previously. One of the methods supporting the determination of the cost of waste at the level of the entire organisation is the unused capacity costing. However, similar results may be obtained with the valuation of internal benefits (i.e. the costs of fixed resources used in projects), at the level of the total cost calculated for 100% consumption. Similarly, in the case of determination of waste at the project level – it is possible to use the standard project costing, as well as the project cost budgeting with a division into areas creating and not creating value for the customers. In the case of project companies using mainly fixed resources, a solution integrating the required functions is the standard time-driven activity based costing.

Application of the value stream profitability accounting in project management

As it was underlined before, the basic purpose of profitability statements is the search for possibilities to improve all project activities. The proposed statement system allows for efficiency analyses at two levels: the operational level and the strategic level. Statements on the value streams of individual projects support the operational management, and above all are addressed to project managers and their supervisors. On the other hand, the cross-sectional statements can be used by the top management, to focus the search for strategic changes at the level of the entire organisation and related to project portfolio.

In the operational management of projects, the value stream analysis primarily supports the ongoing supervision of the project implementation, and the decisions regarding their further development. When compared with traditional reporting, covering only the costs of projects, the proposed approach also allows for the ongoing supervision of:

- the growth rate of the value for the customer, created through the project,
- the actual costs of projects in connection with effects in the form of increased value of the project from the customer's point of view,
- the project's profitability achieved in individual periods, and incrementally from the beginning of its implementation,
- the scale of deviations of individual cost items in the project from the adopted performance standards,
- all significant cost items which do not create value for the customers.

Operational decisions made on the basis of such information should stimulate the management to concentrate on the effects of projects, and to move resources from the area of waste to the value streams. Therefore, this method serves to support the efforts of project managers aimed at increasing efficiency, i.e. in order to meet the customers' requirements and simultaneously achieve acceptable profitability. In addition, the possibility for the management to compare regularly the value streams and waste in individual projects should stimulate the better accountability.

Unquestionably, information on the value streams can also be useful in the decision-making process regarding the entire project portfolio of the organisation. Regular, cross-

sectional monitoring of the project activities, assists in identification of the main sources of inefficiency. In particular, the data provided in the statements delivers information on:

- the actual scale of the project activities performed in a particular reference period,
- the profitability of individual projects,
- the general scale of waste, its structure and sources,
- the resources held by the project organisation and used to a small extent,
- the bottlenecks which hinder the development of the project portfolio,
- the reasons for weak performance recurring in subsequent projects,
- the functional areas or other cost objects, where cost going beyond standard are noted,
- the expertise of individual managers in the operational management of projects.

The above information may be used for a variety of purposes, e.g. for determination of the objectives of the project organisation and the target values for future periods, in the selection of a new market strategy, for the development of a business model standard for project activities, when developing the principles of portfolio selection for projects, and as a basis for regular strategic control. Consequently, data regarding the value stream may convey the modification of the adopted direction of the project organisation's development, as well as give rise to the alterations of the adopted approach to the assessment of the effectiveness.

Conclusion

Value stream accounting is regarded mainly as an instrument applied to improve the efficiency of enterprises with repeatable activities. However, as it was demonstrated in the paper, this approach may also be successfully implemented in the case of projects and project-oriented enterprises. Certainly, the principles of this accounting should be adapted to the specific nature of the project activities.

In the approach proposed in the paper, the value stream accounting may be an instrument of both: operational improvement and strategic management. The analyses of value streams of individual projects support the operational management of their process, and are a basis for improvement of their efficiency; they also meet the needs of the managers of individual projects as well as their supervisors. The analyses of value streams of project portfolios are a tool which facilitates the decision-making process at the strategic level. They are the basis for a search for directions of strategic changes and development. The interest in the methods oriented towards efficiency improvement, and the relatively vast range of possibilities for application of the value stream accounting, lead to the conclusion that this instrument should be the subject of further consideration and research.

Bibliography

Finch, C. 2007. Why Project Accounting, *Strategic Finance*, November, pp. 24-29.

Institute of Management Accountants, 2006. *Accounting for the Lean Enterprise: Major Changes to the Accounting Paradigm*. Statements on Management Accounting.

Institute of Management Accountants, 2006. *Lean Enterprise Fundamentals*. Statements on Management Accounting.

Kennedy, F.A. & Widener S.K., 2008. A Control Framework: Insights from Evidence On Lean Accounting. *Management Accounting Research*, 19, pp. 301-323.

Łada, M., 2011. Analiza strumieni wartości dla odbiorcy – narzędziem poprawy efektywności. *Rachunkowość*, 12, pp. 2-12.

Łada M. & Kozarkiewicz A., 2007. *Rachunkowość zarządcza i controlling projektów*, Warszawa: C.H. Beck.

Łada, M. & Kozarkiewicz, A. 2010. *Zarządzanie wartością projektów. Metody rachunkowości zarządczej i controllingu*. Warszawa: C.H. Beck.

Michalak, J. 2009. Założenia, zasady i narzędzia Lean accounting. *Zeszyty Teoretyczne Rachunkowości*, 49 (105), pp. 169-183.

Ruiz-de-Arbulo-Lopez, P., Fortuny-Santos J. & Cuatrecasas-Arbo´s, L., 2013. Lean Manufacturing: Costing the Value Stream. *Industrial Management & Data, Systems*, 113 (5), pp. 647-668.

Rojek, D. & Sobańska, I. 2012. Wykorzystanie informacji z rachunku redukcji kosztów w procesie ciągłego doskonalenia. *Zeszyty Teoretyczne Rachunkowości*, 64 (120), pp. 83-99.

Van der Merwe, A. & Thomson, J. 2007. The Lowdown On Lean Accounting. *Strategic Finance*, February, pp. 26-33.

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THE INTERPROFESSIONAL CLASSROOM; INTEGRATING PROJECT MANAGEMENT WITH SUPPLY CHAIN MANAGEMENT

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Abstract

Koskela and Howell (2002) suggest that the traditional methods of educating project managers are becoming outdated. In order to respond to this, universities need to adapt the way that project management skills are taught in order to produce graduates with the necessary skills to work within the modern project management industries, in cross-functional inter-professional teams. This paper explores the concept of utilising an integrated approach to project management and supply chain management education within a UK University Business School, in order to develop the project managers of tomorrow with the skills needed to gain employment in an increasingly complex field. Both graduates and employers rank skills which are common to both project and supply chain management highly, such as procurement, quality and risk management (McArdle K., Gunning J.G., and Spillane J.G., 2012) highlighting the need to train these two related professions in an integrated manner.

Corsini et al (2000) suggest that the traditional silo approach to education most commonly adopted in universities is producing graduates which are technically competent but do not have the knowledge or expertise to work within cross functional teams. As this is a fundamental part of the Project Manager role, this paper presents the rationale and developments on integrating two large modules at a UK University Business School with the aim of providing students with knowledge and skills which are more appropriate for work within cross-functional, inter-professional teams. The innovative use of an integrated assessment across these modules will provide students the opportunity to work and reflect on a real project, as well as exposure to taught sessions to ground the underpinning concepts that link the specialisms of project and supply chain management together. Challenging established methods of assessment will allow these two innovative modules to better prepare students for inter-professional working as well as developing many of the key soft skills needed to be a successful project manager. This paper will discuss the issues and challenges with adopting such educational methodology, and will be of interest to all within the project management training sector.

Key words: *inter-professional, integrated, assessments, project, management*

JEL code: I2

Introduction

As projects become more complex, with an ever increasing need to work across teams, countries, and industries, the requirement for highly skilled project managers is self-evident (Barlow, J, 2000). Despite this, the ways in which project managers are currently trained and educated is becoming outdated and does not provide project managers with the skills required to

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deal with projects of an ever increasingly complex nature (Koskela & Howell 2002, Thomas and Mengel 2008, Winter et al 2006). As todays project managers are expected to work within cross-functional and inter-professional teams, more needs to be done to better prepare the project managers of tomorrow by developing skill sets and appropriate ways of thinking for these types of environments.

It is often suggested by authors such as Pant and Baroudi (2008), along with Schultz (2008), that the focus for project management education in recent years has been on the more technical skills required, however this has been at the expense of future project managers being able to develop their softer skills which are fundamental for project success. In additional to this, typical project management courses focus solely on established project management methodologies such as PRINCE2 or PMBoK, with little or no opportunities to collaborate and engage with other professional disciplines essential to the successful completion of various projects, Córdoba and Piki (2012) suggest that project management education should be facilitated in groups in order to provide a more realistic representation of real world project management, Mengel (2008) went further and suggested that project management should be taught in the context of live projects that students are currently working on in order for them to see that it is an essential skill and not only an area of study. Ashleigh et al (2012) suggest that high project failure rates around the world can be attributed to a lack of overall skills development during project management education and training. This paper will therefore aim to explore the potential for improving the education received by future project managers at a UK University Business School, placing particular emphasis on developing the skill set required in the modern project management environment.

The objectives of this paper are as follows:

- To explore the current state of project management education.
- To begin the discussion around inter-professionalism in project and supply chain management.
- To outline potential developments of two modules at a UK Higher Education Institution in order to better develop future project and supply chain managers.
- To discuss the perceived risks in challenging established methods of education.

Although this paper focuses specifically on the UK, it is expected that this paper will be beneficial to those both across Europe and internationally, within both higher education and training settings.

Methodological Approach

This paper will adopt a conceptual approach in order to open the discussion on the integration between project management and supply chain management in both higher and professional education. The first half of this paper will focus on an extensive and systematic literature review in order to better understand the current state of project management and supply chain management education, as well as looking at the wider education landscape.

The paper will then suggest a new conceptual model for project management and supply chain management education based upon the findings of the literature review and experience of the authors, which will in time, be implemented at a UK University Business School. It is this UK University Business School that will provide the case study for this paper.

It is hoped that in the future focus groups and surveys can be undertaken with students who have taken the modules in their traditional, current form, and also students who will have undertaken the new, revised format of the course in order to fully evaluate the effectiveness of the developments. It is also hoped that industry leaders can also form part of the research project associated with these developments.

Literature Review

Traditional Education

Traditional approaches to education, both in higher education institutions and industry based training sessions, tend to focus at the modular, subject specific, level (Cantoni and Botturi, 2005; Kolodii et al, 2015; Tanrisever, 2009; Burchell et al, 2002). This means that we educate current and future managers based upon specific and discreet subject areas, such as marketing, accountancy, project management, supply chain management and HRM, and in doing so we ignore the bigger picture of business and management, and instead encourage understanding in silos of knowledge. Years of modular based teaching and education have meant that we are within a continuing cycle of educating, working, and leading in discreet silos, without the knowledge, understanding and appreciation for the wider business environment, ignoring the true interrelated nature of business and management.

There is substantial evidence within the literature of discreet subject based silos in healthcare education (Butcher and MacKinnon, 2014; Margalit, 2009). It could be suggested that there may be greater levels of evidence of this in the healthcare field as opposed to the management sciences as the need for healthcare professionals to work together and collaboratively is imperative in considering the lives of those in their care. This does not however mean that the educational silos are only limited to nursing or medical education where the need to work collaboratively across specialisms is key to success. Wee, Kek & Kelley (2003) have identified silos in the wider educational environment and suggest that the subject based curriculum of traditional educational programmes encourages silo thinking, whilst also lacking overall integration. It could therefore be considered that the traditional design of university or training courses, which focuses on modules or units, is actually encouraging these types of silos. Newhouse and Spring (2010) also identify educational silos as a result of the traditional design of courses, and they suggest that in order to educate in a more synergistic nature a radical paradigm shift is required. Leveille (2005) along with Boud and Falchikov (2006) also highlight the need challenge existing structures within universities in order to move away from the silo based system.

Traditional assessments, whether within the university structure or professional training, tend to focus on the students ability to memorise subject material in order to answer set questions. Struyven (2005) identifies a number of traditional assignments types seen within the higher education system including, examinations, multiple choice tests, and written essays amongst others. Brown (2004) suggests that assessments should move forward and rather than focus on memory recall, and instead should be designed so that those undertaking them are the central focus. This then may mean that assessments have be to adapted and adjusted depending on the needs and experiences of the students, as well as their requirements and goals. In practical subject areas such as project management and supply chain management, traditional

forms of assessment such as examinations bear no resemblance to the methods of working after graduation once in industry, however academic rigor must be maintained.

Much of the structures that are seen within UK higher education institutions, and those across Europe, can be accredited to the drive to find standardised methods of ensuring quality across the sector (Ecclestone 1999; Ask 2007; Cappellari and Lucifora 2008). Indeed much of the need to assign a particular number of credits to different units of learning and assessment are driven by the need to be able to transfer evidence of learning between international institutions due to various study abroad programmes including the Erasmus mobility programme. Cappellari and Lucifora (2008) suggest that following the introduction of the Bologna process, the need for a common university degree structure has had varying levels of impact across Europe. They suggest that for some countries such as Italy, a major redesign of the system and structure of courses was necessary, whereas others such as the UK only required minor superficial changes to be made. It can therefore be suggested that the traditional approach to education identified so far in this literature review is evident not only in the UK, but across Europe due to the introduction of the Bologna process which requires a greater level of standardisation.

Interprofessionalism & Integration

The health and medical sciences have approached education and practice in a different manner to the rest of the higher education landscape, Barr (2009) identifies sporadic initiatives across North America and Europe in the early 1970's which led to a more integrated approach between related healthcare professions. Despite clear evidence and rationales for these methods of education in the health sciences, little has been observed outside of these realms. Prideaux (2009) and Barr (2009) both suggest that the closer professions work together, the greater the level of quality and success.

D'Amour and Oandasan (2005) suggest that interprofessionality is more cohesive and less fragmented way of working, compared to the silo like nature of many professions, therefore it should be an ideal that we strive for in other related professions such as project and supply chain management.

The World Health Organization (WHO) recognised the benefits of interprofessional education and suggested that it could among other areas:

- Develop the ability to share knowledge and skills collaboratively;
- Enable students to become competent in teamwork;
- Decompartmentalise the curricula;
- Integrate new skills and areas of knowledge;
- Ease interprofessional communication;
- Promote interprofessional research;
- Improve understanding and cooperation between educational and research institutions;
- Ensure consistency in curriculum design. (WHO, 1988, pp. 16-17)

Given the limitations already suggested in the traditional curricula of higher and professional education; related professions who rely upon one another in order to meet their objectives and goals should look to break down the barriers and work towards the ideas of interprofessionalism and interprofessional education in order to increase the success rate of

projects and key objectives. The Centre for The Advancement of Interprofessional Education (CAIPE, 1997) define the idea of interprofessional education as occasions when "two or more professions learn with, from and about each other to improve collaboration". As the requirements of both project managers and supply chain managers focuses more on the need to develop softer skills which enhance communication and collaboration it is important to work collectively and learn lessons from the different, yet related professions in order to constantly develop and improve. Parker and Anderson (2002) and Edum-Fotwe and McCaffer (2000) suggest that supply chain managers need to move away from technical or operational skills and instead move towards softer skills more commonly seen within project management, further highlighting the lessons that these related professions can learn from one another. Mangan and Christopher (2005) also emphasise the links between project management and supply chain management, and highlight the ever increasing need to operate as 'learning organisations', which allow for the development of collaboration across the professions. In addition to this Bozdogan et al. (1998) suggest that by proactively integrating these professions at the beginning of the projects or concept definition stages, this can lead to increases in the overall success rates and levels of innovation. It should be noted however that trying to integrate two professions, such as project management and supply chain management is not an easy task, despite the similarities and need to work together regularly. Parker and Anderson (2002) however suggest that the people who are supply chain integrators are particularly useful in project based scenarios in order to ensure that various suppliers and vendors are working collaboratively. Given the need for improved efficiency, effectiveness and success within both project and supply chain management it is important to consider the role of learning and education in ensuring these two professions can work with each other and learn from each other, as well as developing the mangers and integrators of tomorrow.

When we consider the need for a more integrated approach to educating project managers and supply chain managers it is initially difficult to see how the traditional model of education can be changed and adapted to better suit these more practical professions. Hollowell, Middaugh and Sibolski (2010) identify an integrated education programme at the University of Delaware which is primarily targeted at first year students, and runs across a number of modules common to all of the student. They identified that the drive for such initiatives should come from the institution itself, however we should question whether bring students together in the initial stages of their university education and trying to support them with a whole course approach is actually integrated their education. We need to question whether this type of activity within the university setting would actually get the students to think about the linkages between subject; whether it would break down the silos and barriers we traditionally see in education. When all of this is taken into consideration, perhaps a smaller, more focused approach can bring about greater benefits. The Higher Education Academy (2012) along with McDowell et al. (2009) propose that integration of learning and assessment should become rich in feedback and reflective of the authentic and complex nature of the professions. The South African Qualifications Authority (2005) likened integrated learning and assessment to outcome-based assessment where by the teaching, learning and assessment in any given units are designed to support the learners' progressive attainment of practical and theoretical skills, attitudes and knowledge.

Research results and discussion

The current degree programme at the UK Higher Education Institution, being utilised as a case study, offers a very traditional approach to university level education. A large proportion of the graduates from this BA Business Management programme go on to work within project management, operations and supply chain management sectors after graduation. Due to the popularity of both project management and supply chain management post-graduation, registration for these types of module is particularly high, with all students being required to undertake the second year supply chain management module, and the vast majority of students opting to take project management in the final semester for year 3. The full, current structure of the course is shown below in table 1. This table clearly demonstrates the overall lack of integrations and the high degree of subject specific silos, with many of the semesters have modules run which have very few connections between them.

Table 1

Current Degree Structure

Year 1, Semester 1	Academic Skills Development
	Organisational Behaviour
	Economics
Year 1, Semester 2	Business Management
	Statistics
	Business Law
Year 2, Semester 1	Career Development
	Accounting
	Marketing
Year 2, Semester 2	Supply Chain Management
	E-Commerce
	Decision-Making
Year 3, Semester 1	Advanced Career Development
	Strategic Management
	Dissertation
Year 3, Semester 2 (all optional)	European Business
	Logistics
	Purchasing
	Strategic Supply Chain Management
	Responsible Management
	International Business
	Project Management

Source: author's construction

Although the current programme does offer some elements of integration by way of an integrated assessment at level two between supply chain management and decision making, it does not offer a true reflection of life beyond university. It has therefore been suggested that in order to take advantage of the popularity of project management and supply chain management, changes need to be made to the programme. Table 2 below highlights the change at levels two and three.

Table 2

Proposed Degree Structure at Year 2 and 3

Year 2, Semester 1	Career Development
	Accounting
	Marketing
Year 2, Semester 2	Supply Chain Management
	Project Management
	E-Commerce
Year 3, Semester 1	Advanced Career Development
	Strategic Management
	Dissertation
Year 3, Semester 2 (all optional)	European Business
	Logistics
	Purchasing
	Strategic Supply Chain Management
	Responsible Management
	International Business
	Decision-Making

Source: author's construction

The change highlighted in Table 2 allows the popular optional project management module to be shifted to a mandatory year 2 module and run alongside the current supply chain management offering. It is hoped that by bringing these two modules to run at the same time, it will allow students to develop a better understanding of the interrelated nature of these two subject areas. Given the previous research in the area and literature as shown earlier in this paper, it is clear that this development alone would not break down the barriers between project management and supply chain management. Table 3 below represents the state of integration if the only change that is made is to the timing of the modules. In comparison, Table 4 below shows a visual representation of what the authors feel we should be aiming for in education in order to give our students the skills and understanding they require, whilst also providing work ready graduates to employers.

Table 3

Potential Module Set Up

Supply Chain Management	Project Management

Source: author's construction

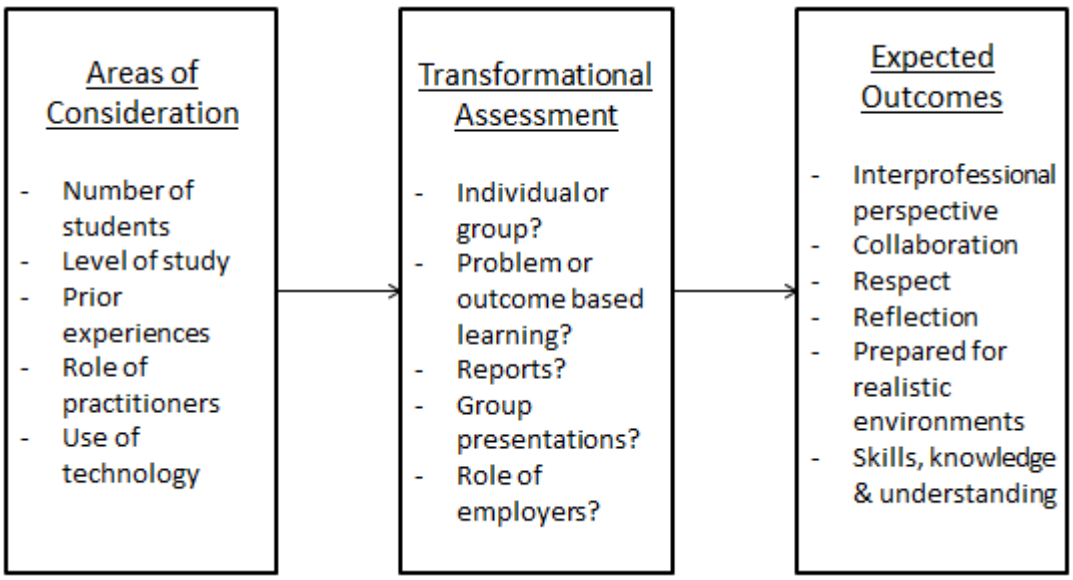
Table 4

Anticipated Module Set Up

Supply Chain Management	Supply Chain Project Management	Project Management

Source: author's construction

It could be suggested that it would be more beneficial for all to develop an entirely new module that encompasses both subject areas, however it is felt that this would only serve to reinforce the educational silos seen throughout degree programmes across Europe. Instead, by blurring the lines between the two modules (as seen in Table 4), and allowing the two distinct yet interrelated subjects to coexist the true interrelation between the subjects can be better represented. It is hoped that this would allow students to still understand each of the subject areas in depth and be able to develop the technical skills and knowledge associated with each, but also develop the softer skills that are common to both. It is also expected that some technical areas such as risk management, supplier selection and vendor management be taught in combination to avoid repartition and further enhance the integration and interrelated aspects of the subjects.



Source: author's construction

Fig. 1. **Conceptual Framework for Integrated and Interprofessional Learning**

In order to give students the opportunity to undertake tasks which are representative of the work of a project or supply chain manager in industry, it is important to carefully consider the assessment strategy for such an integrated and interrelated set of modules such as the proposal above. With an ever increasing focus upon the development of softer skills in both fields it is suggested that this focus should inform the development of both the content of taught sessions and the overall assessment. Clearly a one of the most challenging aspects with these developments is the size of the courses. Currently there are around 300 undergraduate students on the case study, business management course at year two. This means that decisions have to be made in light of the large student groups and the specialist resources potentially available. In order to better understand the role of the assessment a conceptual framework has been developed to highlight the areas of consideration required and the expected outcomes, this can be seen in Figure 1.

Assessment

It is anticipated that the transformational assessment as shown in the conceptual framework would include employers so as to encourage both students and employers to see the value of an integrated and realistic assessment. Rather than focusing solely on a traditional reports or examinations to assess students, it is anticipated that a raft of more useful assessments will be designed in order to better prepare students for future work within these industries. This could include an 'assessment centre' style week which could include activities such as:

- Group presentations;
- Practical tasks;
- Conference style talks from researchers and industry professionals;
- Challenging & timed problem solving tasks to simulate realistic working environments;
- Q&A sessions.

Utilising an 'assessment centre' style event will of course present some challenges when we consider the number of students involved with the modules, however it is expected that this type of assessment would benefit from the involvement of industry professionals. It is also suggested that industry professionals should also have a role in the grading process so as to give more input and value from the industry perspective.

Issues

Certain logistical issues are to be envisaged when moving away from traditional assessments to a more innovative format. Initial concerns would focus around resourcing such a large scale event, therefore it is important to gain buy-in from key stakeholders including industry professionals, researchers, academics, and students who have perhaps returned from industrial placements in project or supply chain management. On top of this, it is expected that barriers within the institutions academic structures will need to be challenged in order to allow for the development of such a truly integrated assessment which requires grades to cross boundaries of different modules.

Outcomes

The conceptual framework above highlighted a number of expected outcomes that the authors feel are vital to move project and supply chain management education forward to something that is more representative of the real world. In challenging to status quo of the current traditional education systems, students are expected to complete these integrated and interrelated having become more prepared for careers in project management and supply chain management, whilst also developing the skills, knowledge and understanding of the technical skills required for these competitive industries. It is also hoped that in making these changes, students will begin to see through the remaining silos both in education and the business world and begin to appreciate the integrated nature of professional environments, and collaborate with different professions in order to find new and innovative methods of working.

Conclusions

This paper has highlighted the deficiencies with the traditional approach to project management education and suggests that more needs to be done in order to integrate project management with other related subject areas in order to improve interprofessional working and collaboration. Supply chain management is suggested as an appropriate related subject area in which to integrate with due to the commonalities of some of the technical skills required, whilst also related softer skills being demanded in line with project management.
Overall it is suggested that:

- Traditional methods of education need to be reevaluated as they may not be fit for purpose.
- Integration between disciplines should be highlighted and if necessary involve joint teaching sessions in order to avoid repartition and increase collaboration.
- Industry professionals need to be included in the education process in order to break the cycle created by the silo mentalities within education and therefore begin to change and develop professional post-graduation education demanded by practitioners.
- Those working with universities involved in project management education need to challenge structures and policies in order to ensure that the education and training received by students and participants can be as innovative as required.

Bibliography

Ashleigh, M., Ojiako, U., Chipulu, M., Wang, J. K., 2012. Critical learning themes in project management education: Implications for blended learning. *International Journal of Project Management*, 30, pp. 153-161.

Ask, B., Haugen, H., 2007. Collaborative e-learning as a driving force towards standardisation and higher university standards. *WBED'07 Proceedings of the sixth conference on IASTED International Conference Web-Based Education* , 2, pp. 555-560.

Barlow, J., 2000. Innovation and learning in complex offshore construction projects. *Research Policy*, 29, pp. 973-989.

Barr, H., 2009. Interprofessional education. *Section 3:Educational strategies*, 24, pp. 187-192.

Boud, D., Falchikov, N., 2006. Aligning Assessment with long-term learning. *Assessment and Evaluation in Higher Education*, 31 (4), pp. 399-413.

Bozdogan, K., Deyst, J., Hoult, D., Lucac, M., 1998. Architectural innovation in product development through early supplier integration. *R&D Management*, 28 (3), pp. 163-173.

Burchell, H., Dyson, J., Rees, M., (2002) Making a difference: a study of the impact of continuing professional development on professional practice. *Journal of In-Service Education*, 28 (2), pp. 219-230.

Butcher, D. L., Mackinnon, K. A., 2014. Educational silos in nursing education: a critical review of practical nurse education in Canada. *Nursing Inquiry*.

CAIPE, 1997. Interprofessional Education – A Definition. *CAIPE*, London.

Cantoni, L., Botturi, L., 2005. eLearning Meeting Modular Education, the Case of Learning Objects. *Schweizerische Zeitschrift für Bildungswissenschaften*, 27 (2), pp. 231-251.

Cappellari, L., Lucifora, C., 2008. The 'Bologna process' and College enrolment decisions. *ISER Working Paper Series*, 16.

Córdoba, J., Piki, A., 2012. Facilitating project management education through groups as systems. *International Journal of Project Management*, 30 pp. 83-93.

Corsini, L. S., Crittenden, V. L., Keeley, R. C., Trompeter, G. M., & Viechnicki, B., 2000. Integrating cross-functional undergraduate teaching and learning: A work in progress. *Marketing Education Review*, 10 (3), pp. 1-17.

D'Amour, D., Oandasan, I., 2005. Interprofessionality as the field of interprofessional practice and interprofessional education: An emerging concept. *Journal of Interprofessional Care*, 1: pp. 8-20.

Ecclestone, K., 1999. Empowering or Ensnaring?: The Implication of Outcome-based Assessment in Higher Education. *Higher Education Quarterly*, 53 (1), pp. 29-48.

Edum-Fotwe, F, T., McCaffer, R., 2000. Developing project management competency: perspectives from the construction industry. *International Journal of Project Management*, 18, pp. 111-124.

Kolodii N.A., Latysheva E.V., Rodionova E.V., 2015. The integrative-modular approach in design of modern educational standards in the tourism sector. *Procedia - Social and Behavioral Sciences*, 166, pp. 364-368.

Koskela, L, J. and Howell, G., 2002. The Underlying Theory of Project Management is Obsolete. *The PMI Research Conference*, Seattle, Washington.

Leveille, D. E., 2005. An Emerging View on Accountability in American Higher Education. *Center for Studies in Higher Education*, UC Berkeley

Mangan, J., Christopher, M., 2005. Management Development and the Supply Chain Manager of the Future. *International Journal of Logistics Management*, 16 (2), pp. 178-191.

Margalit, R., Thompson, S., Visovsky, C., Geske, J., Collier, D., Birk, T., Paulman, P., 2009. From Professional Silos to Interprofessional Education: Campuswide Focus on Quality of Care. *Quality Management in Health Care:* 18 (3), pp. 165-173.

McArdle, K., Gunning, J.G., and Spillane, J.P., 2012 Effectiveness of the construction management courses In: Smith, S.D (Ed) *Procs 28th Annual ARCOM Conference*, Edinburgh, UK, Association of Researchers in Construction Management, pp. 167-176.

McDowell, L., Sambell, K., Davison, G., 2009. Assessment for learning: a brief history and review of terminology. In: Rust, C., (ed.) *Improving student learning through the curriculum*. Oxford: Oxford Centre for Staff and Learning Development, pp. 56-64.

Newhouse, R. P., Spring, B., 2010. Interdisciplinary evidence-based practice: Moving from silos to synergy. *Nursing Outlook*, 58 (6), pp. 309-317.

Pant, I., Baroudi, B., 2008. Project management education: The human skills imperative. *International Journal of Project Management*, 26, pp. 124-128

Parker, G. G., Anderson, E. G., 2002 From buyer to integrator: The transformation of the Supply Chain Manager in the vertically disintegrating firm. *Production and Operations Management*, 11 (1).

Prideaux, D., 2009. Integrated learning. *Section 3:Educational strategies*, 23, pp. 181-186.

SAQA, 2005, Guidelines for integrated assessment. [Online] Available at: http://www.saqa.org.za/docs/guide/2005/intassessment.pdf [Accessed 20 February 2015].

Schulz, B., 2008. The Importance of Soft Skills: Education beyond academic knowledge. *NAWA Journal of Language and Communication*, pp. 146-154.

Struyven, K., Dochy, F., Janssens, S., 2005. Students' perceptions about evaluation and assessment in higher education: a review. *Assessment & Evaluation in Higher Education*, 30 (4), pp. 331-347.

Tanrısever, S., Erien, Y., 2009. The evaluation of modular education programmes developed for the "modernization of vocational and technical education project". *Procedia Social and Behavioral Sciences*, 1, pp. 1384-1388.

The Higher Education Academy, 2012. A Marked Improvement: Transforming assessment in higher education.

Thomas, J., Mengel, T., 2008. Preparing project managers to deal with complexity – Advanced project management education. *International Journal of Project Management*, 26, pp. 304-315.

Wee, L. K. N., Kek, M. A. Y. C., Kelley, C. A., 2003. Transforming the marketing curriculum using problem-based learning: A case study. *Journal of Marketing Education;* 25 (2); pp. 150.

Winter, M., Smith, C., Morris, P., Cicmil, S., 2006. Directions for future research in project management: the main findings of a UK government-funded research network. *International Journal of Project Management* 24, pp. 638-649.

WHO, 1988. Learning together to work together for Health. *World Health Organisation*, Geneva.

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THE IMPORTANCE OF AN EFFECTIVE PROJECT MANAGEMENT APPROACH TO EU PROJECTS; A CASE STUDY: CBRN COE PROJECT FAILURE MEANS PUTTING THE EU'S SECURITY AT RISK

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Abstract

CBRN are weaponized or non-weaponized Chemical, Biological, Radiological and Nuclear (CBRN) materials that can cause great harm and pose significant threats in the hands of terrorists. Recently, the European Union (EU) together with the European Commission's Joint Research Centre (JRC) and the United Nations Interregional Crime and Justice Research Institute (UNICRI) have established some CBRN Centres of Excellence (CoE) in several regions worldwide. The objective of these CoEs is to mitigate CBRN risks of criminal, accidental or natural origin by promoting a coherent policy, improving coordination and preparedness at national and regional levels and by offering a comprehensive approach covering legal, scientific, enforcement and technical issues. This is planned to be done through projects, but also establishing these CoEs in eight different regions is a complex project in itself that requires an effective plan, execution and project management approach. The relevant EU initiative currently covers African Atlantic Façade; Central Asia; Eastern and Central Africa; Gulf Cooperation Council Countries; Middle East; North Africa; South East Asia; South East Europe, Southern Caucasus, Moldova and Ukraine. In each region a regional secretariat has been or is being established to assist partner countries in the assessment of national needs, to facilitate the implementation of projects and to provide technical support to national chemical, biological, radiological and nuclear teams, in particular in the development of related national action plans and the development or enhancement of an integrated policy in this area.

Although the European Commission (EC) uses the Project Cycle Management (PCM), which is an approach of management activities and decision-making procedures used during the life cycle of a project. There is no standardized project management methodology approach highlighted in the stated plans for the "The Cycle of Activities" of the CoEs. According to PMI, program failure in government can have dreadful consequences. In addition to the very bad visibility of being seen mismanaging public initiatives, project failure can results in taxpayer funds being wasted. Not to mention that in the current political and economic circumstances, the 'euro-crisis' governments are highly scrutinize on their spending. According to PMI, government organizations in the USA risk $148 million for every $1 billion dollars spent, which demonstrates that government lags behind private industry in key success areas that point a way forward for effectively managing programs. This same assumption applied to the CoE initiative means that without a standardized project management approach, it will be more difficult to realize the stated goals and benefits of this initiative in general. There are different project management methodologies that cater to the needs of different projects spanned across different domains such as PMP, PRINCE2, EXIN AGILEPM and IPMA. Not to mention, there is a wealth of knowledge on establishing Project Management Offices as a basis of international best-practices. This paper emphasises the need for a standardized project management approach to assure success of the CoE initiatives. Just as with other EU-funded projects, not only is the tax-payers money at stake – but potentially the increased risk of a CBRN event, which is even more disastrous for the reputation of Europe and safety of its citizens.

This paper will also explore the importance of an effective project management approach in the execution of CBRN CoE and their projects and emphasize that in the cycle of the activities of the programme there are two important steps that must be managed with a careful project management

approach (project implementation and benefits realization). Also, the paper will examine examples best-practices in implementing a strong project management approach in the public sector to see how the EU can learn from best practices in other countries who have an integrated project management approach.

Key words: *CBRN, Project Management, Global Risks, Centres of Excellence, EU Institutions*

JEL code: H43

Introduction

CBRN are weaponized or non-weaponized CBRN materials that can cause great harm and pose significant threats in the hands of terrorists. Recently, the EU together with the European Commission's Joint Research Centre (JRC) and the United Nations Interregional Crime and Justice Research Institute (UNICRI) have started the implementation of the CBRN CoEs. The objective of the CoEs is to mitigate CBRN risks of criminal, accidental or natural origin by promoting a coherent policy, improving coordination and preparedness at national and regional levels and by offering a comprehensive approach covering legal, scientific, enforcement and technical issues. This is planned to be done through projects, but also establishing such CoEs in eight different regions is a complex project in itself that requires an effective plan, execution and project management approach. The initiative currently covers African Atlantic Façade; Central Asia; Eastern and Central Africa; Gulf Cooperation Council Countries; Middle East; North Africa; South East Asia; South East Europe, Southern Caucasus, Moldova and Ukraine. In each region a regional secretariat will be established to assist partner countries in the assessment of national needs, to facilitate the implementation of projects and to provide technical support to national chemical, biological, radiological and nuclear teams, in particular in the development of related national action plans and the development or enhancement of an integrated policy in this area.

Although the European Commission uses the Project Cycle Management (PCM), which is an approach of management activities and decision-making procedures used during the life cycle of a project, there is no stated standardized project management approach highlighted in the stated plans for the "The Cycle of Activities" of CoE. Without a consistent project management approach and methodology, it will be more difficult to realize the stated goals and benefits of this initiative. There are different project management methodologies that cater to the needs of different projects spanned across different domains such as PMP, PRINCE2, EXIN AGILE and IPMA. A standardized project management approach should be infused into the critical processes, procedures and organizational culture of the initiative to ensure the success of the CoE initiatives worldwide. Just as with other EU-funded projects, not only is the tax-payers money at stake – but potentially the consequences of a CBRN event, which is even more disastrous for the reputation of Europe and safety of its citizens.

This paper will also explore the importance of an effective project management approach in the execution of CBRN CoE and their projects and emphasize that in the cycle of the activities of the programme there are two important steps that must be managed with a careful project management approach (project implementation and benefits realization). Also, the paper will examine examples best-practices in implementing a strong project management approach in the public sector to see how the EU can learn from best practices in other countries who have an integrated project management approach.

Background on CBRN issues and an Introduction to the CoE, an EU Initiative

CBRN are weaponized or non-weaponized Chemical, Biological, Radiological and Nuclear materials that can cause great harm and pose significant risk in the hands of terrorists. Weaponized materials can be delivered using conventional bombs (e.g., pipe bombs), improved explosive materials (e.g., fuel oil-fertilizer mixture) and enhanced blast weapons (e.g., dirty bombs). Non-weaponized materials are traditionally referred to as Dangerous Goods (DG) or Hazardous Materials (HAZMAT) and can include contaminated food, livestock and crops.

The EU CBRN CoE is a worldwide EU initiative jointly implemented with the European Commission's Joint Research Centre (JRC) and the United Nations Interregional Crime and Justice Research Institute (UNICRI). The objective of the establishment of the regional CBRN CoEs under the EU initiative Instrument for Stability in various parts of the world outside the Europe in order to assist the EU in fighting the international CBRN threats and to minimize the associated hazards by adopting adequate prevention, preparedness and response measures. The main aim of CoEs and their Regional Secretariats is to strengthen the institutional capacities of selected countries to mitigate CBRN risks, including such criminal activities as CBRN proliferation and terrorism. The CoEs are supposed to assist the EU in developing a structural, all-hazards CBRN policy at the national, regional and international levels to be able to respond the these threats, and to reduce the vulnerability of countries to CBRN events. Until recently, the main attention in this field was paid to the countries of the former Soviet Union focusing on nuclear safeguard and security of nuclear material and high-activity radioactive sources. At present, however, the growing interest in developing nuclear, biotechnology and chemical capabilities in many countries in Africa, Middle East and in South East Asia requires the extension in implementing reliable and efficient tools to improve the safety and security of the CBRN material on a global scale.

The EU CBRN CoE aims to mitigate CBRN risks of criminal, accidental or natural origin by promoting a coherent policy, improving coordination and preparedness at national and regional levels and by offering a comprehensive approach covering legal, scientific, enforcement and technical issues. The Initiative mobilizes national, regional and international resources to develop a coherent CBRN policy at all levels, thereby aiming to ensure an effective response.

In each region a regional secretariat will be established to assist partner countries in the assessment of national needs, to facilitate the implementation of projects and to provide technical support to national chemical, biological, radiological and nuclear teams, in particular in the development of related national action plans and the development or enhancement of an integrated policy in this area.

The Cost of Poor Project Management

The EU is still enduring the negative effects of the economic-crisis, and thus it is important to reduce the cost of poor project management. According to PMI, project management in government institutions can have devastating consequences. Not only from the negative visibility of the current government, but also the frustration of mismanaged tax payer's funds during an economic crisis. A study published by PMI demonstrated that government organizations risk $148 million for every $1 billion dollars spent. This demonstrated that

governments are indeed behind in terms of best practices, when compared to private industries in competence areas such as effectively managing projects. Just a quick search in the online press reveals online articles that highlight the poor management of certain EU funds and projects – see figure below:



Fig. 1. **Examples of Articles highlighting Inefficient Funding for EU Projects**

Around the world this trend has been observed, and many countries are taking action driving government to adopt Project Management methodologies across their departments. For example, the UK government has streamlined PRINCE2 in their complex projects and many Canadian Government departments are now adopting PRINCE2 as a common project management approach in the public sector. Environment Canada, which is a department within the Federal Canadian government, has decided to drive the implementation of PRINCE2. This federal department is responsible for the country's projects that focus on the environment including: protecting and preserving natural resources, forecasting weather and environmental change. This implementation is a formidable task since the department has a staff of over 6,000 professionals and a budget of over $500 million dollars. In the USA, the Federal government boasts project managers that are supported by the application of PRINCE2 project management method as a standard approach as they deliver IT investments that satisfy requirements of the Clinger-Cohen Act and Capital Planning and Investment Control.

Another positive example of a government-funded organization, which implemented a Project Management Office (PMO) to ensure standardized project execution, is Health Infoway, which also became the 1st Canadian recipient and the first government-funded organization to win the prestigious PMO of the Year Award in Canada. Although independent, it is funded by the government and oversees CA$2.1 billion in public funds, and works on advising on a portfolio of digital healthrecord projects. What is outstanding is that only 4% percent of projects in the Infoway portfolio have failed.

Governments worldwide are aware of this trend, and seeing the headlines from the figure above demonstrate that the EU is no exception. These same problematic issues in project execution are trying to be mended through EU Budget efficiency and improvements in the next financial framework (2014-20). These improvements place a focus on designing rules and programmes in a way that will reduce errors across the board, and in the meanwhile ensuring greater focus on the quality of the spending through Simplification, stronger incentives and stronger deterrents. However, no mention of a stronger project management approach is mentioned.

Also, the European Commission has made a positive stride forward by creating their own project management methodology called Project Cycle Management (PCM). The European Commission requires the use of the PCM principles, for the identification, appraisal, implementation and evaluation of EU funded projects. According to the European Commission, this approach helps to ensure that projects are supportive of the overarching policy objectives of the European Commission and of development partners; are relevant to an agreed strategy and to the real problems of target groups/beneficiaries; are feasible, meaning that objectives can be realistically achieved within the constraints of the operating environment and capabilities of the implementing agencies; and generate sustainable benefits. Nevertheless, a more comprehensive and standardized project management approach is necessary at an EU-level. Now it is the turn for EU to take on the same challenges as Environment Canada and the UK government and let CBRN issues be the impetus for this unified project management approach.

The Butterfly Effect and Risk Management with CBRN Issues

Although the PCM approach has been a good starting point for improved project success, it is by no means the final result, and continuous improvement for a standardized project management approach for the execution of projects is necessary. And unlike the projects that were mentioned in the above figure, the risk of CBRN projects failing translate directly into deadly risks for EU citizens. Not to mention, that with the rise of the world's interconnectedness, growing integration and complexity, we have entered into an age of new systemic risks as described Dr. Edward Lorzen in the term "Butterfly Effect". He explained this phenomenon as a butterfly flapping its wings in Brazil will cause a chain reaction which could cause a hurricane or tornado in Texas. What he meant by that was that essentially that small changes in an initial condition can lead to a large scale and unpredictable variation in the state of a system. CBRN risks fall into the category of systematic global risks, just as financial crisis was the first of the systemic crises of the 21st century that started in North America, but whose consequences we are still living today – but certainly this will not be the last.

CBRN threats demonstrate as well the importance of a standardized project management approach, focused also on risk management. In an interconnected world, we have been connected by the forces of globalization in such a way that a CBRN risk in a distance country that one could perceive as inconsequential, could have the potential to cause a chain reaction, which in turn can have a profound consequence somewhere else in the world (i.e. a nuclear substance in a former soviet country could be used for a dirty bomb in the Western world). A strong project management approach also integrates risk management as a central tenant, which in complex times helps to reduce risk and effectively navigate the complexities of our

interconnected world. With CBRN projects, which are inherently complex, this additional dimension of risk management must be taken into consideration.

The critical Dependence on Project Management in the Cycle of Activities of the CoE

The cycle of activities of the CoE is represented as six critical phases. The success of two key cycle activities is strongly dependant on the success of the project management and programme management approach. These activities are:

- Project Implementation;
- Review and Quality Control and Impact Assessment.



Source: http://www.unicri.it/topics/cbrn/coe/

Fig. 2. **The Cycle of Activities related to Project Management and Benefits Realization**

Firstly, in Project implementation, the CoE under the supervision of the Regional Secretariats and the European Commission, contracted resources together with the National Teams to implement the projects. The Regional Secretariats also provide logistical support when necessary. According to the CoE website there are currently, 40 EU projects being executed and two pilots being run. Since the CoE initiative is relatively new, with the first project starting in 2013 the majority of the projects can be assumed to be in execution (or implementation) phase. This category is the one that requires the most focus on a strong project management approach because this is the phase in which the plan designed in the prior phases of the project life are put into action. The purpose of project execution is to deliver the project expected results (deliverable and other direct outputs). At this phase, it is necessary that the appropriate Project Management controls and milestones are integrated into the process and that stakeholders are working together (project level, national and EU) to ensure the success of the project. In the various PM methodologies that exist on the market such as PMP this is the

moment when clear milestones are reviewed, decision points and metrics to measure your success. Otherwise, it is not such an efficient process and the need for skilled Project Managers is necessary to ensure proper control, checks and monitoring.

Secondly, the Review and quality control and impact assessment step, where according to the CoE "The European Commission, together with the Regional Secretariats and the National Teams, evaluate implementation of activities, and carry out quality control, review and impact assessment. The analysis of the review and feedback will provide the basis for improving the CBRN guidelines, the technical support and the management of the network." For the projects that will be finishing, this phase can be seen as analogous to the principle of benefits realisation management (BRM) in programme management, which is the process for the identification, definition, tracking, realisation and optimisation ensuring that potential benefits arising from a project are actually realised. Many of the early CoE project will be entering into this phase shortly.

Conclusions – Looking forward to a more effective Project Management Methodology

The PMI 2013 Pulse of the Profession report found that "organizations with developed project management practices, benefits realization processes, portfolio management practices and program management practices and those with high organizational agility all have significantly better project outcomes than their counterparts who are less advanced in their project management practices". And since the current Programming Period 2014-2020 of the European Commission holds lots of promise to fund projects, the EU must consider the right approach to project management. The opportunity of European Funds and direct grants continues to offer a wide range of funding prospects in the Member States. However, as the EU engages in more complex projects funding is often not used as effectively as possible due to lack of an effective project management approach. The '2012 PMI Pulse of Profession' study found that organizations with more than 35% PMP certified project managers had a better project performance. And according to a 2007 PricewaterhouseCoopers survey, 80% of high performing projects use a credentialed project manager. Efficient programme and project management is critical to ensure that EU projects are delivered successfully, while effectively and efficiently using tax payer's funds. There are many methodologies and standards that can further compliment the current EU PCM. Not to mention, internationally there have been many success stories and best practices that the EU can emulate such as the adoption of PRINCE2 in Environment Canada. Also, tapping into the wealth of knowledge of PM organizations on establishing PMOs and certifications has many benefits, which can help to ensure that complex projects like the CoE initiatives have a better chance of success and expected benefits are maximized. This is especially critical when discussing the case of CBRN threats. Applying a strong project management approach to these initiatives will complement existing methodologies and in turn diminish the risk of CBRN events. As such helping to guide these projects through a more standardize and predictable set of activities (from controlled start-up to review), through well managed milestones and resources (identifying stakeholders and interdependencies) and will keep all parties clear about their goals and individual responsibilities. Therefore, securing the safety of EU citizens from a CBRN event and ensuring an efficient and positive image of Europe. More research is needed into this field, especially as many initial CoE initiatives will be soon reaching the "review and quality control and impact

assessment step", which will be a good opportunity to measure progress and benefits of these initiatives, but also take the occasion to look-back and see if a strong project management approach is necessary.

Bibliography

European Commission, 2013. *Instrument for Stability Annual Action Programme 2013 to be financed from the general budget of the European Union.* [Online] Available at: http://www.europarl.europa.eu/RegData/docs_autres_institutions/commission_europeenne/comitologie/ros/2013/D027664-02/COM-AC_DR%282013%29D027664-02_EN.pdf [Accessed 23 February 2015].

Canadian Government Executive (2014) *Project management's next step: Leading the way in strategic execution.* [Online] Available at: http://www.canadiangovernmentexecutive.ca/category/item/1708-project-management%E2%80%99s-next-step-leading-the-way-in-strategic-execution.html [Accessed 23 February 2015].

PMI., 2014. *PMI's Pulse of the Profession In-depth Report: Navigating Complexity.* [Online] Available at: http://www.pmi.org/~/media/PDF/Business-Solutions/Navigating_Complexity.ashx [Accessed 23 February 2015].

European Commission., 2005. ECHO Manual Project Cycle Management. [Online] Available at: http://ec.europa.eu/echo/files/partners/humanitarian_aid/fpa/2003/guidelines/project_cycle_mngmt_en.pdf [Accessed 23 February 2015].

APMG-US., 2009. ENVIRONMENT CANADA ADOPTS PRINCE2 Implementing a Consistent Methodology for Project Success. [Online] Available at: http://www.prince2trainingen.nl/prince2-wp-content/pdf/PRINCE2_Helps_Environment_Canada.pdf [Accessed 23 February 2015].

Euractiv., 2014. Merkel admits EU's youth unemployment initiative has been a failure. [Online] Available at: http://www.euractiv.com/sections/social-europe-jobs/merkel-admits-eus-youth-unemployment-initiative-has-been-failure-303158 [Accessed 23 February 2015].

CBRN CoE initiative., 2015. CoE projects in the world. [Online] Available at: http://www.cbrn-coe.eu/Projects.aspx [Accessed 23 February 2015].

EXIN., 2015. EXIN AGILE SCRUM FOUNDATION. [Online] Available at: https://www.exin.com/uploads/framework/LR_EXN307_flyer_Agile_Scrum_EN.pdf [Accessed 23 February 2015].

IPEG, 2011. *Polish Presidency Delivers Failed EU Unitary Patent Initiative*. [Online] Available at: http://www.ipeg.com/polish-presidency-delivers-failed-eu/ [Accessed 28 February 2015].

Mail Online., 2013. *Wasted, the millions Britain has poured into aid for Congo: Damning report reveals EU projects have failed to deliver any results* [Online] Available at: http://www.dailymail.co.uk/news/article-2441580/Wasted-millions-Britain-poured-aid-Congo-Damning-report-reveals-EU-projects-failed-deliver-results.html [Accessed 28 February 2015].

Telegraph., 2014. *Gone to ruin: the £3.4m white elephant backed by the EU and paid for by taxpayers* [Online] Available at: http://www.telegraph.co.uk/news/worldnews/europe/10597106/Gone-to-ruin-the-3.4m-white-elephant-backed-by-the-EU-and-paid-for-by-taxpayers.html [Accessed 28 February 2015].

Metro (London)., 2013. *A waste of money? EU spends £5 billion in wrong areas by mistake* [Online] Available at: http://metro.co.uk/2013/12/10/a-waste-of-money-eu-spends-5-billion-in-wrong-areas-by-mistake-4224025/ [Accessed 28 February 2015].

IPMA., 2015. *IPMA Four Level Certification (4-L-C)* [Online] Available at: http://ipma.ch/certification/competence/4-l-c-features [Accessed 28 February 2015].

Tucker, Richard, ICOR Partners, LLC, 2009. Using PRINCE2 to Manage US Federal Government IT Projects. [Online] Available at: http://www.apmg-international.com/offices/us/case-studies-us.aspx [Accessed 23 February 2015].

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MACHINE-TO-MACHINE (M2M) TECHNOLOGY IN PALESTINE – AN ASSESSMENT OF M2M ADOPTION READINESS IN THE PALESTINIAN ICT SECTOR

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Abstract

Machine to Machine (M2M) communication and the smart solutions associated with it have been under focus in recent years, due to the rapid increase in the number of machine connections. Not only does it promise benefits and increased revenues to the Information & Communication Technology (ICT) sector, but also to all other major sectors due to the fact that M2M smart solutions enable companies to offer new, enhanced, and more cost efficient services. With the emergence of the Palestinian economy and the increasing international recognition of the Palestinian state, it becomes more and more rewarding for local and international companies to invest in Palestine. One of the most promising sectors in the Palestinian economy is the ICT sector. It is the fastest growing among Palestinian economic sectors with annual growth rate of more than 10% and an 8% contribution to the Palestinian Gross Domestic Product (GDP) (Solutions for Development Consulting Company, 2013). Therefore, it is crucial for the economy that the ICT sector keeps up with international trends. This paper aims to analyse the readiness of the Palestinian market to adopt M2M solutions, based on the M2M Smart Systems Readiness Canvas (Wolff & Nuseibah, 2014), which poses a number of questions leading to the analysis of the strategic, regulatory, technical and socio-economic status of Palestine. The conclusion would shed the light on areas of improvement. It would also include a proposal for potential M2M Value Chain scenarios that could be implemented in Palestine based on the market facts.

Key words: *M2M, Smart Solutions, ICT, Palestine*

JEL code: L8

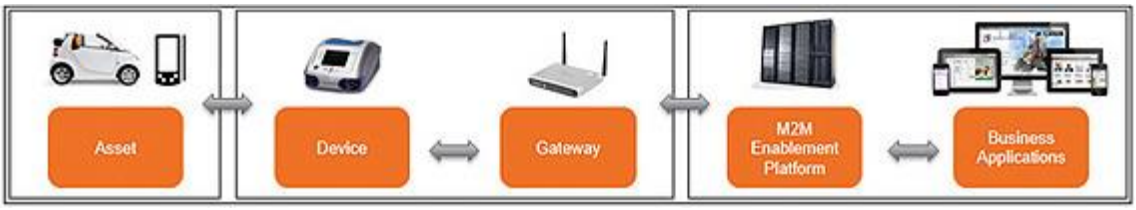
1. The Machine-to-Machine Concept

Machine-to-Machine (M2M) Technology is the concept of machines using network resources to communicate with remote application infrastructure for the purposes of monitoring and controlling the machine itself or its surroundings (ABI Research, 2010, 4 p.). Rouse (Machine-to-Machine, 2010) provides a broader dimension to the concept to include any "technology that enables networked devices to exchange information and perform actions without the manual assistance of humans." According to an ABI Research (2010) sponsored by Cisco, mobile machine-to-machine (M2M) market is expected to grow globally from approximately 71 million connections in 2009 to roughly 225 million connections by 2014.

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In its simplest forms, any M2M communication has three components (see Figure 1):

a) an M2M device, contained in an asset (a physical object or a person) to collect data or control the asset, which can either be stationary or moving.
b) a gateway that links to a network and provides data communication (wired/wireless) between a device and a platform. This gateway can be integrated with the device.
c) a platform (device) with computing software (applications and databases) to analyse the data and make decisions, e.g. a personal computer.
(Rouse, 2010) (Crosby, 2013) (Umate, 2013)



Source: (Umate, 2013)

Fig. 1. **M2M Key Components**

The applications of Machine-to-Machine technology are many and fall into several areas. According to Beecham Research (2011), they can be categorized into nine sector areas, as follows: buildings, energy, consumer & home, healthcare, industry, transportation, retail, security, networks and IT.



Source: (Beecham Research, 2013)

Fig. 2. **M2M Sector Areas (modified)**

2. Overview of M2M Value Chain

In order to understand the basic requirements for the set-up and adoption of M2M technology and trends, it is essential to understand the components of the M2M value chain and environment and ensure the adoption readiness of the stakeholders involved. Regardless of the

size, label, need and core business of the value chain, its completion requires the involvements of the following parties:

a) Hardware Providers: Device and module manufacturers produce and sell M2M devices, with built-in modules that enable connectivity, allowing machines, equipment, vehicles and devices to communicate over a network. (Telit, m2mAir, 2013) (Telecompaper, 2008) (ITR Manager, 2008)
b) Connectivity Service Providers (CSPs): CSPs offer connectivity: SIM cards, M2M rates and billing services, quality, testing and IT security and finally, service level agreements (SLAs). They may contribute in, have partnership with or completely take over the role of the Application Enablement Platform (AEP) provider. (Viswanathan, 2012) (Telco 2.0 Research, 2011) (Deutsche Telekom, 2013) (Vodafone, 2013) (ABI Research, 2010)
c) Software Providers: Application Service Providers (ASP) designing M2M applications and customizing them for customers. Due to the fact that the technical details and network infrastructure deployed by CSPs directly impacts the capabilities of an ASP in such areas as rapid service creation, ensuring Quality of Service, and enabling granular management and diagnostic tools, a tight collaboration between CSPs and ASPs is needed. It might either be done through a partnership or CSPs incorporating software development in their business units (ABI Research, 2010).
d) System & Service Integration: System integrators and providers of additional integrated services for M2M solutions such as enhancing business processes and integrating machine data into the enterprise. (Zujewski B., 2013) (Yaacobi, 2013) (Deutsche Telekom, 2013) (Vodafone, 2013)
e) M2M Application Enablement Platform (AEP) Providers: "software systems designed to streamline M2M applications development across multiple verticals" (Dawson, 2012). They enable users to set the management rules for their M2M platform, allows for terminal management, remote automation, notification and user-defined fault handling strategy, includes tools for users' subscription management and administrational operational management and finally uses data captured from devices to perform real-time analysis, generating reports and providing insights that can help optimize business management to eliminate extraneous costs and increase revenue. (SingTel Corporation, 2013) (Datang Corporation, 2013)
f) End-to-End Solutions: A complete end-to-end M2M solution includes offering M2M modules with device management software, M2M connectivity, M2M data analysis and management, M2M applications, M2M integration framework and added services such as subscription and billing management. (Axeda Corporation, 2013)

Environment surrounding the M2M Value Chain

In addition to the elements of the M2M value chain, there are a few other players in the M2M ecosystem who do not have a direct input in the creation of value from M2M solutions, but do aid in the success of the entire ecosystem:

a) Government and Regulatory Bodies
b) Universities and Innovation and Research Centres

c) Companies whose core business falls within M2M service sectors (Sector companies): utilities, healthcare, retail, etc.
d) Manufactures of Machinery and Appliances

3. Overview of ICT Sector in Palestine

Information & Communications Technology (ICT) has a direct and major effect on the Palestinian infrastructure and the improvement of other sectors, whether private or public. Palestinian ICT companies are devoted to maintain and develop quality of life, education and start-up community while fostering the cultural and historical touch of the Palestinian expertise. (Expotech Palestine, 2013)

The ICT sector in Palestine contributes to around 8% of the country's GDP with a market size of around $500 million and around 250 companies. In addition, it is worth noting that Palestinian ICT creates the highest added-value to the economy as compared to its total production with a percentage of 89.6%. (Expotech Palestine, 2013) (Solutions for Development Consulting Company, 2013)

In Palestine, a wide spectrum of ICT solutions is carefully utilized to serve local, regional and international markets. These services include software development, office automation, internet services, telecommunications, integrated media communications, hardware distribution, consultancy and training. (Solutions for Development Consulting Company, 2013)

The official body acting as coordinator and regulator of ICT in Palestine is the Ministry of Telecommunications and Information Technology (hereby after: MTIT) (MTIT, 2015). On the other hand, private ICT companies in Palestine have unified their voice by establishing the Palestinian Information Technology Association of Companies (PITA) in 1999 with the goal of nurturing ICT in Palestine. Its four pillars are: Advocacy and Policy, Enterprise and Start-up Development, Sector Branding and Human Capital Development (Expotech Palestine, 2013). Finally, the Palestine Information and Communications Technology Incubator (PICTI) has been established in 2004 with the goal of developing Palestinian Micro, Small and Medium Enterprises (MSME's), as well as tackle growth model sectors in order to generate new jobs, attract foreign investment and improve the economic situation in Palestine (PICTI, 2015).

The above mentioned bodies and several other major bodies, e.g. the Palestine Telecommunications Company (PalTel), play a major role in shaping ICT in Palestine. Together, they define the strategic, regulatory, technical and socio-economic factors that would lay the basis to the adoption of new technologies, such as M2M and smart solutions.

4. Applying the M2M Adoption Readiness Canvas to Palestine: Analysis of the Strategic, Regulatory, Socio-economic and Technical Status of the current Palestinian State

Machine-to-Machine communication is characterized by a number of technical features such as real-time data, high data processing, small amounts of data transfer, need for high data security, confidentiality and integrity. Data shall be transmitted in some applications only when needed, in other cases it shall have continuous and regular connectivity and real-time data exchange. Therefore, it should allow for different connectivity modes such as Wi-Fi, GPRS, 3G,

LTE, radio waves, etc. These features also require reliable hardware characterized by long battery life, device discovery, remote management and high endurance (Internet of Things – Architecture, 2011-2013) (Juniper Networks, 2011). This creates an inevitable need to standardize how hardware modules, network and data exchange protocols and software platforms from different solutions interact together.

However, M2M characteristics are not limited to the technical features. As any innovative technology, its implementation entails a socio-economic change process, which should be implemented carefully to ensure a smooth adoption. It requires innovative business models and value chain roles, re-engineered business processes, new strategic alliances and partnerships and a holistic ecosystem that includes necessary infrastructure, partner companies, governmental initiatives or subsidies. This ecosystem will help strengthen efforts and alleviate financial burdens related to the implementation of M2M smart solutions.

Thus, several factors influence the adoption and implementation of M2M smart solutions. For the purpose of analysing such factors in the Palestinian market, the following M2M Adoption Readiness Canvas will be used (Wolff & Nuseibah, 2014):



Source: (Wolff & Nuseibah, 2014)

Fig. 3. **M2M Smart Systems Readiness Canvas**

a) Strategic and Regulatory Factors

This category aims to evaluate strategies and laws set by the ICT governmental institutions. It provides answers about ICT governmental strategy, laws to regulate exchange of data, ensure adherence to standards and create a market with equal investment opportunities (Wolff & Nuseibah, 2014).

As mentioned in Section 3, the Ministry of Telecom and IT (MTIT) acts as the main regulator in the ICT field. In 2009, telecommunications regulatory authority has been established. The legal framework of this sector is defined by Telecommunications Law 3/1996 and by regulatory provisions under the Oslo Agreement (World Bank, 2008). There have been several drafts and readings for laws related to ICT or others that would eventually affect the ICT sector, such as Competition Law (the latest in 2012) and E-Transactions Law (latest in 2015) (Abed Rabbou, 2015). Furthermore, there is no legal framework regulating Information Technology, nor critical issues in the field such as data protection, access to information rights

and cybercrime. Given the fact that the Parliament in Palestine is not in session for many years already, the regular legislative process is not possible. Therefore, legal issues can for now be in the form of decrees adopted under the system applied in Palestine or in other forms, pending a resumption of normal legislative activities (Abed Rabbou, 2015) (Metcalf-Neyman, 2014).This is adding more complexity to the current legal instability in the sector.

As for innovation, research and development opportunities, and exposure to international experiences, these are not always affordable or accessible to the majority of ICT Small & Medium-size Enterprises (SMEs) in Palestine, but all the more necessary to be provided by supportive and representative bodies such as PITA or PICTI. Another challenge is the limited ability of the government to support education, research and development (R&D) in ICT (Solutions for Development Consulting Company, 2013). Government efforts are needed to support improved curricula, student training opportunities, to create innovation and R&D centres and to offer financial incentives reducing barriers to market entry for start-ups and SMEs.

As for standardization and IT security measures, the context where governmental institutions usually lag behind private sector in realizing the need for such standards and measures, Palestine has completely adopted or developed its own standards and policies based on a number of international organizations such as International Standards Organization (ISO), International Telecommunications Union (ITU) and United Nations (UN) Frameworks. In addition, several local bodies join effort to establish ICT standards, starting with the IT and Licensing Directorate in MTIT, the Palestinian Interoperability Framework Team, the Palestinian Computer Emergency Response Team and the Palestinian Standardization Institution. However, the work performed by such bodies is still in progress.

In Palestine, there are several factors that affect various sectors, including ICT, such as the political instability and the recurrent changes in the government in the past few years. Also, the country has moved to emergency plans several times over the last years (latest in the summer of 2014), thus making it difficult to allocate sufficient budget to the advancement of other less urgent, though very promising, sectors such as ICT. Under such circumstances, it becomes more challenging to achieve long-term strategies. Despite these challenges, many non-governmental organizations and private companies lead the way to future technologies, especially relevant are M2M smart solutions, and have stressed the importance of adopting them on many occasions. The main theme of the Expotech Palestine 2014 (an annual national IT exhibition) was building ‘Palestinian Smart Cities’ and several municipalities such as Ramallah, Al-Bireh and Hebron showcased how they are implementing solutions to convert their governance areas into ‘Smart Municipalities’ starting with smart governance and smart utilities. More of these cases will be discussed in the next section on ‘Socio-economic Factors’.

b) Socio-economic Factors

This category deals with people and economy factors, referring to M2M market and customers, the size and type of companies that have the potential to adopt M2M solutions and scenarios for M2M value chain (Wolff & Nuseibah, 2014).

The ICT market in Palestine was for many years a monopoly, dominated by PalTel Group, which includes companies in all main sectors of the telecommunications and information technology (IT) market (World Bank, 2008). In 2008, MTIT announced a

liberalization of the local telecom market. Since then, there have been many efforts by MTIT to increase competition in the telecommunications market including liberalization efforts, the government network, and the academic network. This resulted in improved competition including the introduction of more service providers to the local market. However, the incumbent operator's (PalTel) de facto monopoly still remains, resulting in high connectivity costs and issues with the network quality of service (Solutions for Development Consulting Company, 2013) (Booth, 2014).

Currently, there are two licensed dominant mobile operators: Jawwal and Wataniya Mobile and over 20 Internet Service Providers (ISPs) (MTIT, 2015). Though, unauthorized competition still exists in the mobile market, where Israeli operators, authorized under the Oslo Agreement to offer services to the Israeli settlers residing in settlements within the Palestinian Territories, cover a large part of the Palestinian areas. (World Bank, 2008)

There are about 250 firms linked to other non-telecommunications and IT-related subsectors in Palestine. These are "software development, hardware development, web-related production and services, including mobile application development, internet applications, program development, and Arabization of content and software services. The majority of these firms are small or medium in size with an average of 11-25 employees. These SMEs provide IT-related solutions in human resources management, projects and sales management, finance and accounting, education-related solutions, management information and systems, children's education, entertainment services, products in web development, e-businesses, web portal development, ICT consultancy, and office automations." (Solutions for Development Consulting Company, 2013)

As an oligopoly, the Palestinian ICT sector still has high entry barriers, especially for SMEs. The SME experience in Palestine often lacks exposure/experience, financial resources, or qualified human capital needed to access international opportunities which ultimately present an obstacle to growth or development. SMEs and start-ups particularly face challenges in accessing early stage funding. This is a major obstacle to doing business. Potential sources of finance include: government programs, the banking sector capital markets, venture capital, trade financing, informal sector financing (loans from family and friends) (Solutions for Development Consulting Company, 2013).

Along the M2M value chain, Palestinian market includes Connectivity Service Providers (CSPs), Software Providers, and Integration-service Providers and could potentially host End-to-End (E2E) Solution Providers. However, the specialized modules needed for M2M communication cannot be locally built, as there are no local hardware providers with such capacity. Also, when it comes to developing sophisticated Application Enablement Platforms, local software providers may require further training or development or even international partnerships.

Based on this, here are the proposed scenarios for the implementation of M2M solutions in Palestine:

a) M2M initiative by CSPs, especially large companies, such as PalTel. Other CSPs, such as CoolNet, have long been marketing their service offering to encourage the creation of smart meters, smart surveillance systems, smart homes, etc. However, they do not have any hardware or software partners that would enable them to offer E2E M2M solutions, limiting their service offering to connectivity.

b) Joint M2M initiative through partnerships between local CSPs and local Software Providers who would eventually join efforts with international companies for M2M hardware modules and application platforms for the purpose of completing the M2M value chain and achieving and End-to-End Solution.
c) M2M initiative by specialized sector companies: It has been observed that many sector companies seek to improve their service offering through sophisticated technological means.

Based on this, M2M initiatives in a particular sector could be started by a specific company in that sector encouraging its adoption by other companies.

One interesting example in this case is the banking sector. Most Palestinian banks use ATMs built by Diebold, Incorporated, a global leader in providing integrated self-service delivery and security systems and services. With the technological trend to move to a software-driven self-service terminal, Diebold sought to remotely service its ATMs over the Internet with a proven, secure solution. Diebold partnered with Axeda to create OpteView®. OpteView enhances key aspects of servicing ATMs, including accuracy, timeliness and communication, enabling Diebold to expand the level of its service and support offerings to include predictive maintenance, software version control and remote monitoring and notification (Axeda Corporation – Case Studies, 2013). Although Palestinian banks in this case are customers of Diebold, they can upgrade to Diebold's M2M solutions in partnership with Axeda. However, they would be still lacking connectivity and therefore must partner with Palestinian CSPs. The result is a complete M2M solution that banks can benefit from to improve their services to their own customers. Another example of M2M initiatives by sector companies will be discussed in Section 5.

c) Technical Factors

This category deals with the ICT infrastructure of a country, and its ability to produce or import hardware and software components needed for operation. It also discusses connectivity options and technologies applied for data security and integrity (Wolff & Nuseibah, 2014).

Palestine's strength in the ICT sector lies in software development: desktop, mobile and cloud applications, with over 140 companies specializing in this field (PITA, 2012). The digital divide between Palestinian urban areas and rural areas is significant. Although, the ICT infrastructure in big cities is fairly developed, remote villages still need time, budget and effort to reach adequate internet penetration. According to the International Tele-communications Union (ITU, 2013), internet penetration in Palestine was slightly above 55%. Means of connectivity range from local networks, radio frequencies, city-wide wireless networks and Second Generation (2G) connections. This is already viable for M2M communication that requires transferring small data or infrequent communication, such as alerts in the industry, retail or healthcare, but would prove unfitting to video streaming or surveillance. Unfortunately, frequencies that would allow the deployment of expanded mobile voice applications and new technologies, including Third Generation (3G) systems and services, Fourth Generation (4G) systems and services and Long Term Evolution (LTE) have not been released for the usage of the Palestinian market (MTIT, 2012). It is worth noting that Palestinian operators are compelled to route international communications through a licensed

Israeli operator. This increases costs and limits the potential of Palestinian operators. Such political barriers also exist when it comes to importing hardware components needed to improve the ICT infrastructure and to obtain permits to build ICT infrastructure in large parts of the country (World Bank, 2008).

Overcoming the obstacles related to obtaining hardware will facilitate the adoption of M2M solutions immensely; especially that software components and connectivity currently allow for many M2M solutions in different sectors, proven by the aforementioned cases. However, greater efforts should be dedicated to creating higher security and interoperability standards.

5. Sample Case of M2M Deployment in Palestine

One interesting case of M2M solution deployment in Palestine that has gained wide media coverage in the past few years is the case with the Jerusalem District Electricity Company (JDECO) Smart Metering Solution.

JDECO is a joint stock company established in its current form in 1956. The company distributes and supplies electricity to consumers in and around Jerusalem, Bethlehem, Ramallah and Jericho, servicing approximately 240 thousand customers (PowerCom, 2014) (Public Utilities Authority, Jerusalem).

In 2011, JDECO decided to get 'smarter' and start implementing smart-grid and smart-metering solutions. However, what is unusual about this case is that JDECO did not act only as a utilities company benefitting from potential E2E M2M solutions; it also acted as a CSP. JDECO established JDECO Fiber in May 2011 and was granted a permit from MTIT to develop a fiber network that utilizes its electricity infrastructure on condition that the fiber would be opened for other licensed Internet Service Providers (ISPs) to use (Abudaka, 2014). As for the devices themselves, JDECO partnered with PowerCom, a leading provider of Smart Grid solutions for electricity, water, and gas utilities (PowerCom, 2015). PowerCom supplied JDECO with 42,965 smart meters utilizing Power Line Communication (PLC), General Packet Radio Service (GPRS) and Local Area Network (LAN) communications as well as 437 concentrators, and their user-friendly Meter Data Management (MDM) System. "The system enables remote readings (scheduled and on-request); loss alerts; and tamper alerts. The MDM solution helps JDECO manage the above systems and provides a smooth integration to billing." (PowerCom, 2014).

Thus, by establishing JDECO Fiber, JDECO covered the connectivity component along the M2M value chain and by partnering with PowerCom, it gained hardware, software and application enablement platform through its MDM system. In this way, JDECO can now offer an end-to-end smart solution to its customers, either private households or businesses.

The smart-grid technologies will surely encourage community participation in finding alternative supplies of energy, such as wind- and solar energy. JDECO is now installing two-way electricity meters, so JDECO subscribers can generate their own power and supply the grid with electric power at a favourable cost deferential. The fiber telecommunication cable is the main attraction of this development. (Abudaka, 2014)

Conclusions and Recommendations

Based on the results of the analysis in Section 4 Applying the M2M Readiness Canvas, it becomes obvious that there is potential for adoption of M2M solutions and creation of new business models and value offerings in Palestine. However, the success of such efforts is tied to many reforms that are needed on political, regulatory and socio-economic levels; to start with, lifting the political and physical barriers to the prosperity of the ICT sector, implementing stricter governmental regulations to minimize market oligopoly and enable higher and more just competition among local ICT companies and dedicating more time and effort towards establishing ICT-related laws by relevant regulatory bodies. As the Palestinian human resource is its most valuable asset, more funding should be dedicated to improving their skills at an early point through education, internships, exposure to international experiences and building international partnerships that would eventually enable more and more companies to use smart technologies and offer smart services to customers.

Although the authors of this article based their conclusions on detailed local and international researches and statistics, it is inevitable that personal observations may have been involved in the final results. The content is therefore open for further research and improvement.

Bibliography

Abed Rabbou, J., 2015. Legal Advisor – Ministry of Telecom and IT. (A. Nuseibah, Interviewer, 20 January 2015).

ABI Research, 2010. *Maximizing Mobile Operator Opportunities in M2M: The Benefits of an M2M Optimized Network.* New York: ABI Research – Sponsored by Cisco.

Abudaka, M., 2014. *Jerusalem District Electricity Company Getting Smarter*. [Online] Available at: http://archive.thisweekinpalestine.com [Accessed 9 August 2014].

Al Monitor, 2014. *Palestinian high-tech companies should target the Saudi market*. [Online] Available at: http://www.al-monitor.com [Accessed 8 February 2015].

Axeda Corporation – Case Studies, 2013. *Diebold and Axeda Resolve Issues and Reduce Downtime with OpteView®.* [Online] Available at: http://www.axeda.com [Accessed 12 November 2013].

Axeda Corporation, 2013. *About Axeda*. [Online] Available at: http://www.axeda.com [Accessed 15 November 2013].

Axeda Corporation, 2013. *Axeda Application and Data Integration Platform*. [Online] Available at: http://www.axeda.com [Accessed 15 November 2013].

Beecham Research, 2013. *Research*. [Online] Available at: http://www.beechamresearch.com [Accessed 13 July 2013].

Booth, N., 2014. *The Palestinian Networker Who Bought an Israeli Company*. [Online] Available at: http://www.idgconnect.com [Accessed 2 February 2015].

Crosby, T., 2013. *How Machine to Machine Communication Works?* [Online] Available at: http://computer.howstuffworks.com [Accessed 31 August 2013].

Datang Corporation, 2013. *M2M IOT Solutions*. [Online] Available at: http://en.datanggroup.cn [Accessed 7 November 2013].

Dawson, F., 2012. *Shifts in M2M Ecosystem Reshape Strategic Outlook for New Entrants*. [Online] Available at: http://www.screenplaysmag.com [Accessed 2 October 2013].

Deutsche Telekom, 2013. *M2M Solution*. [Online] Available at: https://partner.m2m.telekom.com [Accessed 30 April 2014].

Deutsche Telekom, 2013. *Partner Programme*. [Online] Available at: https://partner.m2m.telekom.com [Accessed 30 September 2013].

Expotech Palestine, 2013. *Palestinian ICT Sector*. [Online] Available at: http://www.expotech.ps [Accessed 10 October 2014].

Harbor Research, 2013. *The Emergence of Smart Systems: Analyzing the Internet of Things Market Opportunities.* Baltimore: Harbor Research.

Internet of Things – Architecture, 2011-2013. *Project Deliverable D3.1 – Initial M2M API Analysis.* Internet of Things Architecture (IOT-A).

ITR Manager, 2008. *Siemens rend sa liberté à sa division Modules sans fil*. [Online] Available at: http://www.itrmanager.com [Accessed 20 October 2013].

Juniper Networks, 2011. *Machine-to-Machine – The Rise of the Machines.* Juniper Networks.

Metcalf-Neyman, K., 2014. *Palestine eGovernance Legal Issues.* Tallinn: eGovernance Academy.

MTIT, 2012. *Imposed Israeli Restrictions on the Palestinian ICT Sector*. [Online] Available at: http://www.pmtit.ps [Accessed 10 January 2015].

MTIT, 2015. *Ministry Overview*. [Online] Available at: http://www.mtit.pna.ps [Accessed 1 January 2015].

PICTI, 2015. *About PICTI*. [Online] Available at: http://www.picti.ps [Accessed 1 January 2015].

PITA, 2012. *ICT Sector Profile*. [Online] Available at: http://www.pita.ps [Accessed 1 December 2014].

PowerCom, 2014. *Building a More Efficient World: PowerCom Deals Nearly 43,000 Smart Meters to JDECO Along With Their Advanced PLC Technology*. [Online] Available at: http://www.powercom.co.il [Accessed 2 February 2015].

PowerCom, 2015. *Company Profile*. [Online] Available at: http://www.powercom.co.il [Accessed 2 February 2015].

Public Utilities Authority, Jerusalem. (n.d.). *Jerusalem District Electricity Co. Ltd ("JDECO") – Description of Corporate Business.* Jerusalem: Public Utilities Authority.

Rouse, M., 2010. *Machine to Machine (M2M)*. [Online] Available at: http://whatis.techtarget.com [Accessed 26 August 2013].

SingTel Corporation, 2013. *SingTel M2M Features*. [Online] Available at: http://info.singtel.com [Accessed 7 November 2013].

Smart Cities Council, 2013. *Smart City Readiness Guide – Quick Tour.* Redmond: Smart Cities Council.

Solutions for Development Consulting Company, 2013. *Palestinian ICT Sector 2.0: Technology Sector Development Report and Recommendations Relevant to Regional and Global Market Opportunities.* Ramallah: Solutions for Development Consulting Company & Mercy Corps Scotland.

Telco 2.0 Research, 2011. *M2M 2.0: Market, Business Models, and Telcos' Role(s)*. [Online] Available at: http://www.telco2research.com [Accessed 26 October 2013].

Telecompaper, 2008. *Cinterion takes over Siemens Wireless Modules*. [Online] Available at: http://www.telecompaper.com [Accessed 20 October 2013].

Telit Wireless Solutions, 2013. *Telit Company*. [Online] Available at: http://www.telit.com [Accessed 15 November 2013].

Telit, m2mAir, 2013. *m2mAir Module Management*. [Online] Available at: http://m2mair.com [Accessed 10 October 2013].

Umate, A., 2013. *Machine to Machine*. [Online] Available at: http://www.globallogic.com [Accessed 31 August 2013].

United Nations, 2012. *World Population Prospects.* United Nations Population Division.

Viswanathan, H., 2012. *Expanding the Mobile Service Provider's Role in M2M*. [Online] Available at: http://www2.alcatel-lucent.com/techzine/ [Accessed 26 October 2013].

Vodafone, 2013. *Partner Programme*. [Online] Available at: http://m2m.vodafone.com [Accessed 30 September 2013].

Wolff, C., & Nuseibah, A. (2014). Designing Smart Systems: Developing the M2M Smart Systems Readiness Canvas. *Dortmund International Research Conference 2014.* Dortmund: Dortmund University of Applied Sciences & Arts.

World Bank. (2008). *Introducing Competition in the Palestinian Telecommunications Sector*. West Bank & Gaza: World Bank.

Yaacobi, S. (2013). *Monetizing M2M: How CSPs can play a more significant role in the M2M Value Chain.* Amdocs Company Publications.

Zujewski, B. (2013, July 24). *What CEOs Need To Know About M2M*. Retrieved November 10, 2013, from Axeda Company Blog: http://blog.axeda.com.

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THE WAY OF ESTABLISHMENT OF THE ORGANIZATION'S PROJECT MANAGEMENT PROCESS

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Abstract

This paper delineates the way of establishment of an organization's project management process based on a Guide to the Project Management Body of Knowledge (PMBOK). It begins by introducing the current situation of organizations in today's changing world. The organizations have to be able to learn to be flexible, adapt quickly to the changing world and survive through achieving organizational strategy and objectives via portfolio management and project management. In order to manage portfolios and projects efficiently and effectively, the organizations should develop their own processes. Their own portfolio management process. Their own project management process. In the Project Management Institute's view, the project management process is stated as "the process ensures the effective flow of the project throughout its life cycle. This process encompasses the tools and techniques involved in applying the skills and capabilities." (PMBOK Guide, 2013, 47 p.) By developing their own project management process, the organizations take benefits as following: Enhance the organizational ability to meet organizational strategies and objectives, obtain greater business value, provide a structural way, increase the project success rate, be the outcome significantly better, complete more projects on time and under budget, occur no surprises. This paper focus only project management process. Before explaining it in detail the key terms are defined based on standards such as PMBOK, Projects In Controlled Environments version 2 (PRINCE2) and International Organization for Standardization (ISO). Next it describes the benefits and challenges of developing project management process. Finally, this paper proposes a new way for establishing of an organization's project management process.

Key words: *Establishment of an organization's project management process*

JEL code: Z00

Introduction

The world has changed rapidly and dramatically due to globalization and advances in technology in the last few years. The world. Everything in the world. To be able to adapt to rapidly change, the organizations have to change themselves in order to survive and thrive in this changing world. They must develop new products, new services and new businesses, improve their business processes, design strategies to enter in the new markets, maximize their market sharing rate, increase their margins, decrease their cost, update their internal technology or be compliant with regulations.

In order to realize these aims, the organizations should select the right works and do the right works. In addition, doing the right work is not enough, doing the right works in the right manner is necessary. The organizations achieve these as using two tools: Portfolio management and project management. The portfolio management, a tool for doing the right works, is defined in the standard for portfolio management as "the coordinated management of one or more portfolios

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to achieve organizational strategies and objectives." (The Standard for Portfolio Management, 2013, 17 p.) The focus of the portfolio management is to assure that the right projects or programs are selected, prioritized and done. According to the standard for portfolio management, the three process groups are defined as follows: Defining, Aligning, Authorizing and Controlling. In addition, there are five knowledge areas: Portfolio Strategic Management, Portfolio Governance Management, Portfolio Performance Management, Portfolio Communication Management and Portfolio Risk Management. (The Standard for Portfolio Management, 2013) The project management is a tool for ensuring that the project is done right, achieved the project objectives, completed on time, within budget and to expected quality. The definition of project management given in the Guide to the Project Management Body of Knowledge (PMBOK) is "the application of knowledge, skills, tools, and techniques to project activities to meet project requirements." (PMBOK Guide, 2013, 47 p.) According to the PMBOK, the five process groups are defined as Initiating, Planning, Executing, Monitoring and Controlling, Closing and ten knowledge areas are defined as Project Integration Management, Project Scope Management, Project Time Management, Project Cost Management, Project Quality Management, Project Human Resource Management, Project Communication Management, Project Risk Management, Project Procurement Management and Project Stakeholder Management.

To manage efficiently projects and portfolios, most of organizations create project management office, which is abbreviated PMO. As stated in PMBOK, a project management office is a management structure that standardizes the project-related governance processes and facilitates the sharing of resources, methodologies, tools, and techniques. (PMBOK Guide, 2013, p.554) The main functions performed by PMO are as following: Project / program delivery management, portfolio management prioritization, strategic planning, governance and performance management, standards, methodologies and processes. (The Impact of PMOs on Strategy Implementation, 2013, 4 p.) Although the PMO has important functions, the most important function is to develop standards, methodologies and processes. Establishing an organization's project management process, program management process and portfolio management process and following them ensure that the projects, programs and portfolios are managed in an efficient, effective and quality way. In addition, the success rate of projects is highly improved and more projects are delivered on time and on budget and the customer satisfaction has increased as a result. On the other hand, the failure rate is reduced.

This paper identifies and defines the major key terms of project management process in order to develop a common understanding of the subject. Having a common understanding helps the reader understand the main subject and the numerous details related to the main subject.

Then, the paper discusses the benefits and challenges of establishing an organization's project management process. Even if it worth to assign organizational resources during project management process development, when will the benefits show up.

Lastly, the author suggests a new way. This way explains how an organization's project management process is developed based on PMBOK, published by Project Management Institute (PMI). The author named it as "The Way of Establishment of The Organization's Project Management Process". This way contains for steps as following:

- Do AS-IS Analysis;
- Do TO-BE Analysis;
- Do GAP Analysis;
- Establish The Organization' s Project Management Process.

The figure 1 shows the way of establishment of the Organization's Project Management Process.

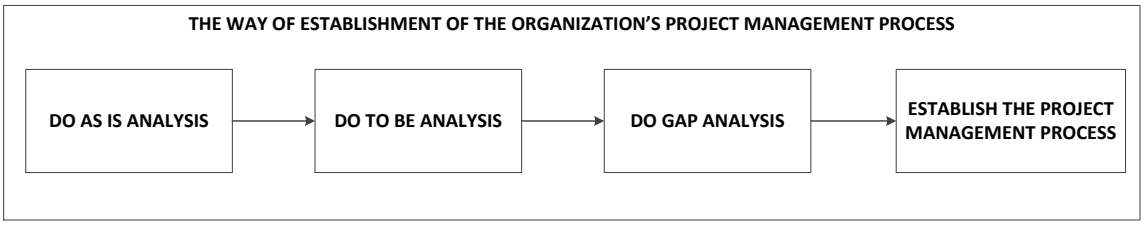


Fig. 1. **The Way of Establishment of Organization's Project Management Process**

The Key Terms

Before addressing the benefits and challenges of associated with project management process, it is important to define the key terms used in project management process area so that all readers will have a common understanding. In order to realize that, this section defines the key terms for ensuring that all key terms are known, understood and evaluated when establishing an organization's project management process. In addition, defining key terms helps us to establish accuracy and consistency, and avoid possible confusion and misunderstanding. For each key term this paper presents various definitions that are found in various sources, including PMBOK, PRINCE2 and ISO. PMBOK is a Guide to the Project Management Body of Knowledge. The fifth edition of PMBOK is published by Project Management Institute in 2013. PRINCE2 is a project management methodology and an acronym for Projects in Controlled Environments. ISO, an acronym for The International Organization for Standardization, is an international standard-setting body composed of representatives from various national standards organizations. After all definitions of the key terms are listed, this paper presents the benefits and challenges of project management process.

There are five key terms fundamental to understanding the subject. They are project, process, project management, project management process and project management office. Each key term is unique with its attributes. On the other hand, each term is related to other terms. The figure shows the key terms and the relationship amongst project, process, project management and project management process.

The first key term is project. The PMBOK Guide Fifth Edition the global standard for project management defines a project as "a temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates that a project has a definite beginning and end." (PMBOK Guide, 2013, 3 p.) Another definition stated in the Manual Managing Successful Projects with PRINCE2 is that a project is a temporary organization that is created for the purpose of delivering one or more business products according to an agreed business case. (OGC, 2009) ISO10006 states that a project is a unique process consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including constraints of time, cost and resources. (ISO 10006:2003, 2003) Wysocki and McGary define a project as "a sequence of unique, complex and connected activities having one goal or purpose and that must be completed by a specific time, within budget, and according to specification." (Wysocki &

McGary, 2003) The other definition of a project stated in ISO 21500:2012 is "a unique set of processes consisting of coordinated and controller activities with start and end dates, performed to achieve project objectives. Achievement of the project objectives requires the provision of deliverables conforming to specific requirements. (ISO 21500:2012, 2012)

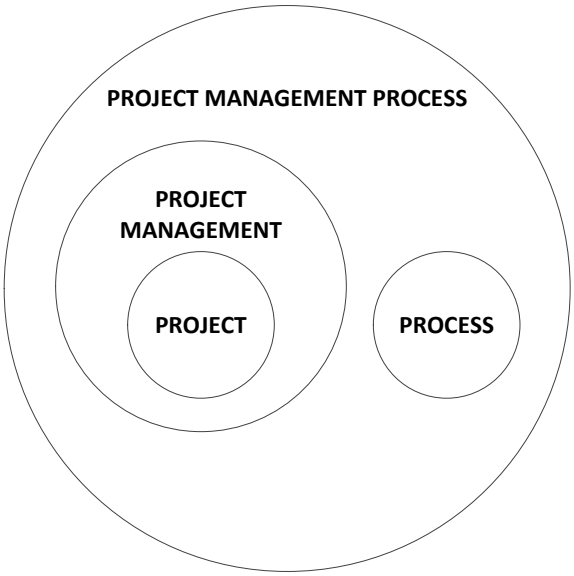


Fig. 2. **The Key Terms**

The second key term is process. The definition of process is broad and is varied depending on areas. The process is defined as "a systematic series of activities directed towards causing an end result such that one or more inputs will be acted upon to create one or more inputs." (PMBOK Guide, 2013, 551 p.) In ISO 9001:2008, the definition of a process is set of interrelated or interacting activities, which transforms inputs into outputs. (ISO 9001:2008, 2008) Liu and Agah define a process as "a sequence of activities for achieving a goal." (Liu & Agah, 2009).

The next key term is project management. From the PMI' s perspective, stated in the introduction section, project management is the application of knowledge, skills and techniques to project activities to meet the project requirements. (PMBOK Guide, 2013, 5 p.) In ISO 21500, a project management is defined as "the application of methods, tools, techniques and competencies to a project."(ISO 21500:2012, 2012) Gray and Larson define project management as "more than just a set of tools; but a result oriented management style that places a premium on building collaborative relationships among a diverse cast of characters." (Gray & Larson, 2006) The other definition of project management is "the process of controlling the achievement of the project objectives. Utilising the existing organizational structures and resources, it seeks to manage the project by applying a collection of tools and techniques, without adversely disturbing the routine operation of the company." (Munns & Bjeirmi, 1996, 81 p.)

The fourth term is project management process. The PMBOK introduced project management process as "ensuring the effective flow of the project throughout its life cycle".

(PMBOK Guide, 2013, p.47) In PMBOK, 47 logical processes are defined and grouped in five process groups. The process groups are Initiating, Planning, Executing, Monitoring and Controlling, Closing. In ISO 10006:2003, there are seven project management processes. These project management processes are interdependency-related processes, scope-related processes, time-related processes, cost-related processes, communication-related processes, risk-related processes, purchasing-related processes. The other standard, 21500:2012, defined five process groups as following: Initiating, Planning, Implementing, Controlling, Closing.

The last term is project management office. The PMBOK defines project management office as following: a management structure that standardizes the project-related governance processes and facilitates the sharing of resources, methodologies, tools, and techniques. (PMBOK Guide, 2013, 11 p.) There are three types of PMO: Supportive, Controlling and Directive. The PMO is defined as "a centralized unit within an organization or department that oversees and improves the management of projects." (Gray & Larson, 2006, 561 p.) Heldman and Mangago define the project management office as "a centralized organizational unit that oversees the management of projects and programs throughout the organization." (Heldman & Mangano, 2009, 7 p.)

Benefits and Challenges

Once the author defined the key terms of project management process it was required to clearly describe the benefits and challenges of project management process. What are the benefits of project management process? Which challenges are existed? In this section, the author will try to answer these questions.

In this century, every organization wants to grow their business rapidly and gains a competitive advantage in their marketplaces. To realize that, every organization should develop their own organizational strategies and objectives and develop appropriate processes to reach their organizational strategies. Project management process is one of them. Developing project management process increases to meet organizational strategies and objectives through projects and obtain greater business values. In addition, the project management process provides a structural way of managing projects. Following a structural way during project management increases the success rate over a wide range of projects. By increasing the success rate of projects, organizations are able to increase income, reduce cost and minimize risks. The outcome of projects is significantly better and more projects are completed on time and under budget. No surprise is occurred. The other benefit of following project management process within organization is to help optimize performance, because following a process is the only way to optimize what the organization is doing. If there is not a project management process, the projects will be managed in chaos. There is no documentation or existed poorly documentation. The projects will be completed late, over budget, or not met the customer expectations.

The challenges of developing project management process are as following: develop without executive management commitment, poorly communication, deal with resistance, neglect the people's values and beliefs, focus only process design and ignore other things.

Table 1

Benefits & Challenges

Benefits	Challenges
Increase to meet organizational strategies and objectives	Develop without executive management commitment
Obtain greater business value	Poorly communication
Provide a structural way	Deal with resistance
Increase the success rate	Neglect the people's values and beliefs
Increase income, reduce costs, minimize risk	Focus only process design and ignore other things
Be the outcome significantly better	
Complete more projects on time and under budget	
Occur no surprises	
Help optimize performance	

The Way of Establishment the Organization's Project Management Process

In this section of this paper the author will plan to focus on the main topic. In order to ensure the reader has a clear understanding about establishment of the project management process, the author has explained the definition of key terms as following "project", "process", "project management", "project management process" and "project management office" in the previous sections. After that, she has identified the benefits and challenges of developing project management process in detail.

The main topic of this section is to explain how a project management office will develop a project management process based on PMBOK. The Project Management Institute (PMI) has provided guidelines for developing project management process via PMBOK Fifth Edition. There are 47 project management processes grouped into five process groups. These process groups are Initiating, Planning, Executing, Monitoring and Controlling, and Closing.

It is very important for organizations to have their own project management process which is often part of an organizational process assets. It could be developed based on any standard such as PMBOK, PRINCE2 or ISO and tailored to the needs of the organization as including experience, knowledge and professional approach of the organization. This process will allow the organization to obtain managing projects in the right manner.

The project management process should have the following characteristics, but not limited:

- being defined clearly;
- being provided a structural way that is common and repeatable;
- being flexible for adapting to the needs of any project;
- being embedded in the organizational structure;
- being known by everyone within organization and used by all departments.

The author offers a new method for developing a organization's project management process and named it "The Way of Establishment of The Organization's Project Management Process". The way includes the below activities: Do AS-IS Analysis, Do TO-BE Analysis, Do GAP Analysis, Establish the Organization's Project Management Process.

Do AS-IS Analysis

The overall goal of the AS-IS analysis is to get a better understanding of the existing situation and its weaknesses before developing a new organization's project management process. Understanding the existing situation and its weaknesses are basis for the development new project management process. "Do AS-IS Analysis" activity consists of two steps. The first step of the AS-IS analysis is to examine the organizational process assets. Organizational process assets are defined in the PMBOK Fifth Edition as "the plans, processes, policies, procedures, and knowledge bases specific to and used by the performing organization." (PMBOK Guide, 2013, 27 p.) In the second step, the weaknesses, input of "Do TO-BE Analysis", are identified and documented. Several tools could be used during doing AS-IS analysis such as workshops, group interviews or individual interviews. Existing processes, part of an organizational process assets, should be examined and the weakness of them are identified and documented.

Do TO-BE Analysis

After being completed the first activity "Do AS-IS Analysis", the next activity has to be conducted. The objective of this activity is to develop the new project management process as eliminating the weaknesses of existing project management process. The PMBOK will be used as guideline during this activity. The following tools could be used during doing TO-BE analysis such as brainstorming, workshops, group interviews, individual interviews or expert judgement.

Do GAP Analysis

The third activity is "Do GAP Analysis". The aim of doing GAP analysis is to define the gaps between AS-IS process and TO-BE process. This activity will be conducted after "Do AS-IS Analysis" and "Do TO-BE Analysis". The definition of GAP Analysis, stated in the "Performance Gap Analysis: Tips, Tools and Intelligence for Trainers", is "the process used to determine where you are and where you want to be. In other words, this is when you reveal the desired state of performance and compare it with the current state of performance." (Franklin, 2006, 2 p.) First of all, the existing situation is defined. Then the existing outcome is identified. After all the desired outcome and process are identified.

Establish The Organization's Project Management Process

The fourth activity is "Establish the Organization's Project Management Process". The objective of this activity is to establish the organization's project management process. The input of this activity is AS-IS analysis documentation, TO-BE analysis documentation, GAP analysis documentation and enterprise environmental factors. Enterprise environmental factors

are referred in the PMBOK Fifth Edition as "to conditions, not under the control of the project team, that influence constrain, or direct the project. Enterprise environmental factors are considered inputs to most planning processes, may enhance or constrain project management options, and may have a positive or negative influence on the outcome." (PMBOK Guide, 2013, 29 p.) In addition, the organizational constraints, information technology (IT) constraints and cultural constraints should be considered. After completing the establishment the organization's project management process, training should be conducted.

Conclusions

The value of having a project management process moves the organization forward to remain competitive in the marketplace. This paper offers a new way to develop an organization's project management process. The way described in this paper is the one developed by the author to meet the requirements of effective project management. This way enables that the projects are completed on time and within budget. A standardized, documented and structured project management process assures the project success rate, increases income, reduces costs and minimizes risks. Based on this paper, further research could be conducted based on the other standards such as PRINCE2, ISO 21500: 2012 or etc.

Bibliography

Franklin, M., 2006. *Performance GAP Analysis: Tips, Tools and Intelligence for Trainers.* American Society for Training and Development.

Gray, F.C., & Larson, E.W., 2006. *Project Management: The Managerial Process.* McGraw -Hill/Irwin.

Heldman, K., & Mangano, V., 2009. *PMP Project Management Professional Exam Review Guide.* John Wiley & Sons.

International Organization for Standardization (ISO), 2008. *ISO 9001:2008 Quality Management Systems.*

International Organization for Standardization (ISO), 2012. *ISO 21500:2012 Project Management – Guidance on project management.*

International Organization for Standardization (ISO), 2013. *ISO 10006:2003 Quality management systems – Guidelines for quality management in projects*.

Liu, Y. & Agah, A., 2009. Crawling and Extracting Process Data from the Web. In *Advanced Data Mining and Applications*, Vol. 5678, pp. 545-552. Springer Berlin Heidelberg.

Munns, A., & Bjeirmi, B., 1996. The role of project management in achieving project success. *International Journal of Project Management*, 14, pp. 81-87.

Office of Government Commerce (OGC), 2009. *Managing Successful Projects with PRINCE2, The Stationary Office.*

Project Management Institute, 2013. *A guide to the project management body of knowledge (PMBOK Guide)*. Newtown Square, Pa: Project Management Institute.

Project Management Institute, 2013. *The Standard for Portfolio Management*. Project Management Institute.

Project Management Institute, 2013. *The Impact of PMOs on Strategy Implementation*. Project Management Institute.

Wysocki, R.K. & McGary, R., 2003. *Effective Project Management, Third Edition.* John Wiley & Sons.

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KNOWLEDGE MANAGEMENT IN IT OUTSOURCING/OFFSHORING PROJECTS

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Abstract

Outsourcing and offshoring in the Central Europe countries are increasingly common and they impact on sales and growth of global companies nowadays. This region attracts corporations from around the world because of the crucial costs reduction and by providing highly educated workforce with excellent language skills. The O&O projects in IT are a well known trend; however, this sector is difficult, unstable and complex due to dynamic technology changes, frequent indecision of the customers and instability on the IT market. There are many challenges in O&O projects which can have potentially negative consequences, such as a loss or distribution of knowledge, when a company decides to outsource a part of its work abroad.

The aim of this paper is to present how companies can leverage knowledge management in O&O projects. The researchers indicate the barriers and facilitators in KM process and point out how maturity and experience in PM and KM are important in project life cycle.

The study was initiated by a review of literature, followed by a set of informal, conversational interviews which helped to determine areas of interests and prepare a list of the final questions. The last part of the research consisted of several standardized, open-ended interviews with members of top management, boards, executives and projects managers employed by medium and big companies implementing IT projects in Poland.

Key words: *project management, knowledge management, knowledge, outsourcing*

JEL codes: O22, D83

Introduction

A characteristic feature of service development is nowadays creating centers of support services and the transfer of business services between countries. The key here is the strategy of transnational corporations, which move a range of their activities outside the home office. Usually, it refers to activities and business processes that are not core business and can be successfully pursued outside the main seat of the organization. This is due to the phenomenon of globalization in the world economy. The changes result from, at least, two reasons. On the one hand, they are effects of competition and the consequent need to find ways of increasing productivity and efficiency of the company, where the reduction of operating costs is one of the basic methods. On the other hand, rapid technological development of Information and Communication Technologies (ICT) facilitates the development of successful models in the field of provision of business services. In practice, this amounts to the creation of outsourcing and offshoring centers.

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Reports of A. T. Kearney Global Services Location IndexTM (The AT Kearney Global ..., 2011. 2014) indicating the most interesting countries as far as investing in offshoring services is concerned, show that the top three countries have remained unchanged over the recent years. These are still India, China and Malaysia. However, a very significant place on the list belongs to the countries of Central and Eastern Europe (CEE). This is due to several factors, among others, to favorable business environment, financial attractiveness, or still cheaper and highly educated workforce, as well as the fact that most countries in the region are members of the European Union. One of the leaders is Poland, which over the last three years, has jumped thirteen positions up the list. About 40 percent of IT sector companies are in Krakow, Poland's "Silicon Valley." Among the global providers in Poland are IBM, HP, Accenture, Atos, Capgemini, and HCL, alongside tech giants such as Google and Cisco (The A.T. Kearney… 2014). The slide of the Baltic States in the ranking may be surprising (Latvia by 10 and Estonia by 11 positions), but the rate has not changed significantly, which means that there has not been a deterioration of conditions for O&O project and the countries are still attractive to investors.

The scope of outsourcing and offshoring is wide and can cover: financial services, logistics, HR and IT. In IT projects the key factor is knowledge management, especially when tasks are performed beyond the client's site or are carried out by an independent entity.

Knowledge management issues are a very popular area of research. In the respective literature, diversified research perspectives can be found. One of the most common cited works are Nonaka's studies (Nonaka 1994). Nonaka differentiates tacit and explicit as two dimensions of the knowledge in organizations. The tacit knowledge consists of the cognitive elements, such as mental models of paradigms, and technical elements, such as concrete knowledge or contextual skills. The explicit knowledge is the expressed and codified knowledge in symbolic form. Nonaka suggests four modes of the knowledge creation: internalization, externalization, combination and socialization. He also suggests that knowledge passes step by step from individuals to groups, to organization and interorganization level thanks to communication between individuals. The knowledge-based view of the firm explains (Grant 1996) that: firms use knowledge to the production of goods and services, there is strategically valuable resource of the company, individuals create knowledge not organizations and firms exist thanks to high costs of coordination of individual's knowledge. In turn Dyer and Nobeoka (2000) consider knowledge-sharing network that: motivates members to participate, prevents free riders and reduces the costs associated with finding and accessing different types of knowledge. They suggest strong liaisons between individuals in their network and it results in dynamic learning capability between firm and its partners what creates a competitive advantage.

Irrespective of the research perspective adopted, the fact is that thanks to the adequate KM the following can be achieved (Mason M.K., 2015):

- increasing employee satisfaction due to greater personal development and empowerment,
- keeping employees longer and thereby, reduces the loss of intellectual capital from people leaving the company,
- saving money by not reinventing the wheel for each new project,
- reducing costs by decreasing and achieving economies of scale in obtaining information from external providers,

- increasing productivity by making knowledge available more quickly and easily,
- providing workers with more democratic working place by giving everyone access to knowledge,
- learning faster with KM,
- staying competitive.

The aim of the research presented in this article is to show the significance and the reasons of knowledge management in IT projects. Processes, methods and best practices of gathering and sharing knowledge, as well as barriers and facilitations in knowledge management have been presented through the research conducted among Polish executives in Polish companies of the IT sector.

Characteristics of IT, offshoring, outsourcing projects

According to definition "project is a temporary endeavor undertaken to create unique product, service, or result" (PMBOK – Fifth Edition, 2 p.). Areas of project activities and their scopes are very wide and cover virtually every human activity. Particular type of projects, which the authors deal with in this paper, is the IT projects related to outsourcing and offshoring. IT (information technology) projects require a specialized knowledge, skills and experience in the field of computer science. The specific character of IT projects is based on both multiplicity and variability of technological conditions, as well as heterogeneity of the projects. The challenge for the project teams are changing customer expectations, diversity of hardware and software systems, security issues, as well as technological and market trends. Based on the standard project management methodology, IT project passed through successive phases (project life cycle): requirements, design, implementation, verification, maintenance. Project setting, as mentioned above, makes the implementation of IT projects, following adoption of such an approach, ineffective. Currently in relation to IT projects the most effective methods of project management are agile methodologies, in which the course of the project is of an adaptive character. Under this approach, the scope of the project is divided into smaller task groups called product backlog and project team works iteratively determines which tasks should be performed in subsequent iterations. After each iteration the partial product is reviewed by the sponsor and the client, and project team receives feedback on product compliance with the expectations of the recipient. In this methodology, continuous customer engagement is necessary. Application of these methods enables flexibility and speed of response, as well as greater reliability to meet customer expectations.

As it can be seen in table 1, IT projects are characterized by a high degree of complexity and require increasing resources. The result is that they are potentially exposed to a high risk of the ineffective implementation related to the initial assumptions. Many studies have shown what sort of human and technical factors may cause the failures (Kapellman… 2006). Often the scale, the needs and requirements of the cost expansions tend to go to more efficient models. Therefore, increasing number of IT projects are carried out outside one organization. Economic factors, globalization of the economy, along with the development of technology make the outsourcing phenomenon, namely the separation from the corporate structure of some in-house performed functions and delegating them to other entities (Trotsky M., 2001), common in IT projects. There may be many organizational variations of

outsourcing depending on the location of the entities to which the outsourced projects are assigned. These forms are:

- on shoring,
- nearshoring,
- offshoring.

Table 1

Characteristics of IT projects

Name	Main components and characteristics
Lack of constraints	IT projects do not have limitations as other engineering projects (for example as laws of physics for civil engineering). Sometimes expectations of the customer are much higher than the capability of the supplier to deliver.
Visualization	Software products, which are a main product in IT projects, are physically invisible and immaterial. It causes problems with presenting and monitoring the progress of the work to the stakeholders.
Flexibility	The intangible nature of software results in excessive requests for new features and potentially increases project failure. Flexibility means also multiple ways of solving problems.
Complexity	IT projects are multi-dimensional, scalable, diverse and heterogeneous. These are the reasons why achieving objectives in large complexity is difficult and assessment of feasibility is complicated.
Uncertainty	Lack of clear specifications for the projects software/products which can exceed technical capabilities and causes failure in implementation.
Software and failure	Infinite number of assumptions are in every piece of software, therefore small changes can make failure of the project. The system should be planned without any noticeable impact on the user.
Supporting change	There is need for suppliers to understand business processes and mistakes in this field resulting in slowing down of the IT system. It is required a close cooperation between customer and supplier.

Source: author's construction based on The Challenges of Complex IT Projects, 2004

On shoring is outsourcing tasks and projects to companies which are in the same country or region. Nearshoring refers to outsourcing to the companies that operate in adjacent or nearby countries, usually from within the same cultural circle, and often using the same language. Offshoring is outsourcing unlimited by space and can relate to every country in the world. Most often, the target countries are in different cultural zones and use different languages. Each form of outsourcing has its advantages and disadvantages, so the choice depends on the analysis of potential profits and is determined by the characteristics of a particular project. The most common reason for outsourcing is cost savings which the business model provides. In this respect, offshoring is preferred. Placements of offshoring in countries with cheap labor, where exchange rate differences provide additional opportunities to achieve high savings, are usually the highest. Also, the speed and flexibility of projects implementation under offshore format

seems to be the best. This is due to low labor costs in the target country and makes it easy to find the necessary staff and specialists. Each project is inextricably linked with a risk. From this perspective, risk management in on shoring or even nearshoring projects is potentially easier than in implementation of offshoring projects. Definitely the biggest barriers to offshoring projects are language and cultural differences. Also, the distance between the seat of the company commissioning work and the one to carry out the assignment, constitutes a certain limitation (time differences or the cost of trips – direct contact is needed at times). In on shoring there are no such problems, yet there are also no cost benefits. Nearshoring as an intermediate solution in many projects can be an effective and efficient idea.

In this article the researchers decided to present how the members of the project teams cope in their daily work, what other problems in the model O&O they perceive, and whether they have developed some experience, technology and observations supporting the process of the knowledge management.

Research results and discussion

The research was conducted using open-ended interviews with members of top management, boards, executives and projects managers employed by medium and big companies implementing IT projects in Poland. A total of 20 semi-structured interviews were conducted to explore reflection, interpretation and assessment of the respondents regarding knowledge management in IT projects from the perspective of their own experience. The research also allowed gathering a wide range of information about practical barriers in KM and practical approaches from an O&O perspective.

First of all, it should be emphasized that the analysis of linguistic layer shows that respondents have a very good knowledge and deep understanding of the subject matter. A very large number of specific terms (KM and IT jargon) and very clear way of expression indicate and confirm their involvement in KM processes. Below are presented in a very concise way only selected results of the research divided into two main categories: first sub-chapter depicts the main aspects of KM cycle, the next presents a summary of the most characteristic barriers and facilitators in this specific environment and deals with the most critical challenges in O&O IT projects.

1. Processes, best practices, methods of knowledge gathering and sharing within O&O IT projects

The first group of questions is closely related to organizational process assets and enterprise environmental factors. The vast majority of respondents clearly pointed to the differences between O&O IT projects and other categories of IT projects. The respondents also claim that the shape and maturity level of KM in O&O projects strongly depends on current strategic direction, market conditions and the level of staff turnover. The following characteristics were dominant and were most frequently repeated among the opinions of the respondents about an internal organizational approach to KM:

- appropriate selection, recruitment process of employees (the team) for the project in a balanced proportion – 80% of new recruits must have: learning attitude, commitment (“take it till the end”) and delivery attitude (“what I'd like it to be” and “make it

work"). The rest – 20% of new recruits must have as their top priority: wider experience and creativity,

- centralized knowledge centres should be established and promoted across the entire organization, such a role can be provided by a PMO centres of excellence or knowledge centres,
- a set of established processes and procedures of knowledge gathering and sharing, a system of rewards and penalties for employees,
- an appropriate mentoring approach and a way of working with employees from different cultures and locations,
- each bigger, important virtual team or scarce resource should be frequently visited by a project manager or a line manager to ensure that sufficient level of effort and motivation is put in KM.

Organizational requirements for leveraging intellectual capital from an external source as suggested by the respondents should consists of the following:

- communities of practice, where both sides can share their experience and their thoughts, organized jointly with the customer or cooperating companies,
- brainstorming sessions should be established with representation of each side (major stakeholders) iterative through project life cycle,
- long-term contracts should generate common and shared base of known bugs, FAQ (frequently asked questions) and instructions,
- long-term cooperation should induce each side to adopt a more flexible way of working - including the use of cost-reimbursable contracts instead of firm fixed-price contracts,
- change control board and project steering committee should consist of a member of each major virtual team, group or department,
- customer should be interested and involved in determination and establishment of boot camp for new recruits (more focused on quantity and less on quality),
- customers should also be involved from the beginning in mentoring of not self-confident resources to increase their motivation and leverage their competencies for further on-site leadership and self-education (less focused on quantity and more on quality).

It should be noted that in several cases, respondents are quite sceptical about the significance of the above-described specific features of knowledge management due to the lack of comprehensive and universal approach to IT projects.

2. Barriers and facilitators in KM process within O&O IT projects

During the interviews the authors tried to obtain a wide range of information and opinions about some specific impediments and facilitations present in their organizations. The questions and the main stream of this part of interviews refer to their everyday events, controls and issues through entire project life cycle. The summary of the most frequently indicated barriers and facilitators is presented below in table 2.

Table 2

Barriers (B) and facilitators (F) in KM within O&O IT projects

No.	Type	Name	Main components and characteristics
1.	B	Communication difficulties	Virtual teams, different time zones and locations, distinct ways of working, differences in culture, style of work - generally do not facilitate the transfer of knowledge.
2.	B	Directive leadership	Frequently in a distributed environment there is some kind of persuasive management style which supports "one-way" communication model.
3.	B	No time assigned	High utilization of employees in project's activities approaching a target. Lack of mandatory knowledge related to planned activities.
4.	B	No clear strategy for future	Frequently, there is no clear and specific explanation for "why to share if we don't know whether it will be useful".
5.	B	Emphasis on business continuity	Focusing on the current work limits KM processes.
6.	B	Lack of proper tools/processes, methods of rewarding	No proper tools, structures supporting KM, maintaining it and rewarding for related effort is demotivating.
7.	F	Community of practice	Entity of CoP is an often used tool for sharing and gathering knowledge in organization.
8.	F	Knowledge departments	In the more mature organization there is a perceived need for a separate, external unit for collecting information from all the projects and activities across the entire firm.
9.	F	KM career paths	Frequently firms open positions related to knowledge management activities, which is an evidence of significance and importance of this area.
10.	F	Well-structured motivation systems	It has a great impact on increased effort by rewards or penalties.
11.	F	Continuous learning environment	IT sector from the beginning has consisted of open-minded employees with learning attitudes and self-learning needs (to align with fast changing technologies and external environment).

Source: own research

In the course of the interviews – most respondents frequently emphasize the role of proper communication. The degree of openness of the culture, language and the way of interpreting communication content have a significant impact on the overall shape of the implemented KM. In addition to the significant barriers and facilitations listed in table 1, the respondents indicated that their organization actually does not recommended accumulation of knowledge due to possible leakage of sensitive business or technological data. With reference to

this issue in the subsequent talks, the respondents were asked how the already codified data is protected in their organization and they pointed out, among others, to:

- mechanisms of monitoring exchanged information,
- application of statutory stipulations and developing appropriate safety policies,
- using "black box" procedures, by means of which knowledge is stored and accessible to a small group and distributed only by a few specified authorized individuals,
- application of dedicated software , such as: Data Loss Prevention System (DLP – Data Leak/Leakage/Loss Protection/Prevention) to support electronic data protection against theft or leakage.

Other respondents directly stated that despite all the regulations and control systems, knowledge cannot be effectively protected. There is a smooth flow of knowledge within an organization, where each employee (often due to the character of work – frequent reallocations between the projects) has access to knowledge exceeding their scope of responsibilities, and at the end of cooperation with the given entity the knowledge often leaves together with the employee.

Personnel fluctuation in KM related to O&O project is a major challenge. Many outsourcing companies are located in the same city, often special zones (clusters) are set up, bringing IT companies together. This creates natural opportunities for workers to move to other companies, offering better conditions for the development and higher earnings. Therefore, it is important to create a KM system retaining key employees in the original companies. The respondents indicated that a model system should cover:

- an effective incentive systems,
- a specified career path,
- an opportunity to gain expertise.

Conclusions

In Central Europe there is a high level of competitiveness in the IT sector; usually many O&O companies co-exist in the same local market and usually how they compete with each other also affects the offshoring or outsourcing capabilities. As demonstrated by the studies, KM in IT projects is fairly widely known and used by the Polish companies. Those firms pointed that to increase attractiveness and competitiveness to world-class level they should compile and use the right mix of methods and tools for knowledge management processes.

Polish companies recognize the potential behind KM and the increased awareness should be taken advantage of right in KM so that, especially in the most complex and risky projects within O&O, the project chances of success could be increased through effective and systematic learning, collecting and sharing experience within the organization.

In IT projects, being the projects of high technology, particularly those implemented through outsourcing, the key issue is knowledge. Effective knowledge management ensures implementation of O&O projects. Unfortunately, O&O business model in IT projects raises many problems. These include:

- communication problems due to language differences,
- cultural barriers adversely affecting the communication,
- problems in "remote" project management.

The study had the character of the pilot studies, and therefore has a number of limitations. However, preliminary results indicate real problems and a keen interest of the project team members in the knowledge of the management topics. The studies indicate the potential for expansion of the scope and focus on narrower areas of the IT sector in order to be able to adjust the tools and knowledge management techniques to a specific branch of the specificities of the sector or the market.

Bibliography

A.T. Kearney, 2011. *The A.T.Kearney Global Services Location Index™*. [Online] Available at: http://www.atkearney.com/research-studies/global-services-location-index/full-report [Accessed 21 January 2015].

A.T.Kearney, 2014. *The A.T.Kearney Global Services Location Index™*. [Online] Available at: http://www.atkearney.com/documents/10192/f062cfd8-ee98-4312-ae4f-0439afc10880 [Accessed 21 January 2015].

Carmen E., Tjia P., 2005. *Offshoring Information Technology: Sourcing and Outsourcing to a Global Workforce.* Cambridge, Cambridge University Press.

Dyer, J.H., Nobeoka, K., 2000. *Creating and Managing a High-Performance Knowledge-Sharing.*
Network: The Toyota Case. Strategic Management Journal, Vol. 21, pp. 345-367.

Grant, R. M., 1996. *Toward a Knowledge-Based Theory of the Firm*. Strategic Management Journal, Vol.17 (Winter Special Issue), pp. 109-122.

Groff T., Jones T., 2003. *Introduction to knowledge management: KM in business.* Burlington, MA :Butterworth-Heineman.

Kappelman L.A., McKeeman R., Zhang L., 2006. *Early Warning Signs of it Project Failure: The Dominant Dozen*. Information Systems Management, Vol. 23, Issue 4, pp. 31-36.

Krishna S., Sahay S., Walsham G., 2005. *Managing cross-cultural issues in global software outsourcing.* Communications of the ACM, Vol. 47, Issue 4, pp. 62-66.

Mason M.K.,2015. *Knowledge Management: The Essence of the Competitive Edge.* [Online] Available at: http://www.moyak.com/papers/knowledge-management.html [Accessed 18 January 2015].

Nonaka I., 1994. *A Dynamic Theory of Organizational Knowledge Creation*. Organization Science, Vol. 5, Issue 1, pp. 14-37.

Project Management Institute, 2013. *A Guide to the Project Management Body of Knowledge (PMBOK Guide) – Fifth Edition*.

The Royal Academy of Engineering, 2004. *The Challenges of Complex IT Projects.* [Online] Available at: http://www.bcs.org/upload/pdf/complexity.pdf [Accessed 15 January 2015].

Trocki M., 2001. *Outsourcing*. Warszawa, Polskie Wydawnictwo Ekonomiczne.

Wengraf T., 2001. *Qualitative Research Interviewing: Biographic Narrative and Semi-Structured Methods.* London, SAGE.

Wiig K.M., 1997. *Knowledge Management: An Introduction and Perspective.* Journal of Knowledge Management, Vol. 1, Issue 1, pp. 6-14.

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MICRO-ECONOMICAL ASPECTS OF PUBLIC PROJECTS: IMPACT FACTORS FOR PROJECT EFFICIENCY AND SUSTAINABILITY

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Abstract

Project management approach in the public administration becoming gradually applied tool for implementation of different public programs and activities. Latvia has several methodological documentations to evaluate the possible benefits from infrastructure but still there is need for improvements as the only clear defined methodology is for transport sectors and those which have been provided by the European commission, but not always have been practically used in local municipalities' project evaluations.

Public projects, and planning for such projects, generally have the following characteristics:

- Such projects are inherently risky due to long planning horizons and complex interfaces.
- Technology is often not standard.
- Decision making and planning are often multi-actor processes with conflicting interests.
- Often the project scope or ambition level will change significantly over time.
- Statistical evidence shows that such unplanned events are often unaccounted for, leaving budget contingencies sorely inadequate.
- As a consequence, misinformation about costs, benefits, and risks is the norm.
- The result is cost overruns and/or benefit shortfalls with a majority of projects.

Paper exanimates public project management applications in the context of the underlying structure that adverse dynamics and their application to specific areas for micro-economical level of project management, synthesizes the policy messages, and provides directions for future research. Public sector project management in Latvia become popular in recent years as there is different type of public funding sources available.

The paper examined the application of the project management practice and its micro-economic aspects in public sector in Latvia. Public sector project management in Latvia become popular in recent years as there is different type of public funding sources available. The paper describes the public sector project management practice in Latvia. Study shows that public sector project maturity level is low and should be improved. Research period covers the time from January 2013 – March 2015.

Key words: *project management, project planning and initialization, public sector, efficiency*

JEL codes: O220, H430, H540

Introduction

Government and organizations usually embark on different projects with the aim of creating new service or improving the functional efficiency of the existing ones. All these projects require appropriate skills and techniques that go beyond technical expertise only, but

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encompass good and sound skills to manage limited budgets, and monitor shrinking schedules and unpredicted outcomes, while at the same time dealing with people and organizational issues (Abbasi, Y. G. & Al-Mharmah, 2000). The application of project management practice in public sector has been identified as an efficient approach which would help in upgrading management capabilities and enable public sector to efficiently complete projects and attain developmental objectives (Arnaboldi M., Azzone G., & Savoldelli A., 2004).

Recipients of funding – both public authorities, public institutions and businesses, is a major challenge for financial gain and to promote public welfare. However, the benefits bring with them the responsibility for waste and financial records and reports on practical goals. Funding Administration requires thorough knowledge and understanding of the law. A growing number of mass media and the administration of financial instruments institutional statements we hear that a large number of project applications, which is a low quality place. Now that the errors and weaknesses in project development and administration are unacceptable, more and more to think of an effective system that would be according to the conventional project management theory. Such a system would be built at local level, ensuring appropriate project specialist, but the program level, i.e. need to improve the administration of financial instruments including methodical and regulatory documents update and synchronize project management theory to improve the project initiation process and ensure the quality of project applications development, thus resulting in an effective and rational use of taxpayers' money (Pūlmanis, 2012).

The typical steps of project planning are:

1. Development by, or on behalf of, the project sponsor of a project concept plan to explore the possibilities and clarify the broad nature of the project;
2. Development by, or on behalf of, the project sponsor of a more comprehensive project business case with details of the proposed outcomes, product requirements and firm costing; and
3. Consideration and approval by the decision-maker of the project business case.

In many cases, there will be subsequent consideration and approval of a more detailed implementation plan and further approvals at key points during the project. Effective project planning and approval will also be assisted by having effective support arrangements at the entity level – such as promoting strategic alignment, having the right people and culture, and having effective governance arrangements. This is the responsibility of the chief executive, normally assisted by the Senior Executive team (Pūlmanis, 2013).

Viewed in a broader sense, it can be concluded that the planning process phenomenon consists of three connected plans: the strategic plan, functional plans and project plans. Project plans are a reflection of the strategic plan, while functional plans represent a detailed guide to using resources to achieve a set purpose. Project realization planning represents a rational determination of how to initiate, sustain and complete a project (*Investment Management Standard*, 2010).

The **object** of the research is public sector project management.

The **aim** of the article is to evaluate public project micro-economical aspects in Latvia, defining their links to the project effectiveness and sustainability.

The **objectives** of the article are as follows:

- assess the public sector project initialization practice in Latvia,
- identify the problem areas of public sector project management,
- provide proposals for public sector project management process improvement.

The research methods used in the article include the project and program empirical data analysis and literature review as well as survey based on questionnaire.

Public project micro-economical aspects'

Investments can be seen as a bridge between generations, both for creating jobs for the young generation, and for inheriting the fixed assets, which it receives from previous generations. Also, investments are the material support for introducing the technical progress in all sectors of activity, while systematic updating allows maintaining them within the superior performance parameters.

The concept of economic sustainable development means both resource protection in terms of raw materials, and environmental protection and restoration of ecological balance in order to provide equal opportunities to the future generations. Any investment project has an environmental component on which the investment decision will be built. Public investments are defined as funds allocated by the authorities of the central or local public administration to achieve objectives or works of general interest in a certain administrative unit (Adriana Grigorescu, *Management of public sector investment projects*, course support, National School of Politic and Administrative Studies (SNSPA) in Bucharest) (Grigorescu Adriana, 2011). Public investments are designed to ensure the development of the society in general, seen as a whole. The effects of the public investments can be found in the social, cultural, health, science, and public order, etc. fields.

Public investment funds are limited through budget restrictions, however consuming and exceeding the limits granted in the originally approved budget can be made only by obtaining additional allowances or by redistributing the funds within the budget.

The whole community benefits directly or indirectly by the effects of public investments because they are designed to improve infrastructure, relationships, and services, all of them being available to all citizens.

Strategies, represented by the goals of the public projects, are a need for local authorities which have the possibility to implement investment projects based on the following: election programs, making a poll of the public opinion, establishing a long- or short-term thinking, establishing the way forward so that the relationship authority – community can run in the most harmonious manner possible. Public investment projects provide a direct correlation between the fundamental objectives, which take the form of capital expenditure, which in their turn, lead to producing public assets. (Philip, 2007)

Specific characters of governmental projects are in the direct relation with peculiarities of the government as the specific subject of decision-making process. Apart from such characteristics as heterogeneous object of its impact, public authority, the combination of double, triple and so on standards there is a specific context that should be taken into account dealing with governmental projects:

- *The existence of specific legal norms* that determine activities of the whole society, on the one hand, and of institutions which realize projects – on the other. There are far more such legal norms than in business.
- *The existence of a wide range of stakeholders* and *the accountability to the society*, at that stakeholder can be both within the accountability process and outside this process. The inner stakeholders are governmental institutions, government agencies, public

managers and so on. The range of external stakeholders is wider – the mass media, citizens, interest groups, etc.

- *The usage of public resources* which governmental projects are financed through a state budget by. That is why the responsibility of a public manager increases and it is complicated by the fact that it is rather difficult to measure the success of a project as well as of manager's work. Besides, it is also very difficult to appraise project's benefits for the society because sometimes it is not possible to use such indicators as Benefit-Cost Analysis (BCA) and Return of Investment (ROI). Public managers tend to estimate project's effectiveness and benefits by qualitative indicators (PMI, 2006).
- *Difficulties in establishing priorities and in the differentiation of governmental projects*. This characteristic follows from the previous one. While in business the system of projects' differentiation is based on principles of cost and profit, these principles often cannot be applied to governmental projects and it is necessary to establish the system which is quite different from the business one and which considers interests of different groups of citizens.

Thus, the necessary condition of "plausable effectiveness of Cohesion policy" according to (Molle, 2007) has been met, which however, does not represent a sufficient condition on which to draw conclusions on the effectiveness of a particular country or regions. Meeting such a sufficient condition requires provision of effective and successful management of public funds at the micro level, an aspect that has also been pointed out by (Vanhoudt *et al*, 2000), who suggest that in order to define the productivity of capital expenditures in Europe, "(...)project selection and performance need to be studied in more detail. This clearly calls for a complementary bottom-up approach (...)" (*ibid*, 102). The second sufficient condition rests on the impact of public funding on private investment.

Table 1

Micro-economic impact factors to project efficiency and sustainability

Project micro-economic impact factors	Main factor description
Project management methods, tools and technics	• Cost-benefit analysis; • Risk analysis; • Problem definition and solving methods; • Work Breakdown Structure (WBS); • Project situation analysis (SWOT, PEST); • Program Evaluation and Review Technics (PERT); • Critical Path methods (CPM); • SMART goals; • AGILE, PRINCE, Body of Knowledge, ICB (IPMA) and etc.
Project manager, project team	• Personnel competencies; • Professional education; • Experience; • Certification and etc.

Source: author's construction

So far most of the public project implementation efficiency aspects and research has been analysed through macro-economic approach, mostly by investment analysis and impact to GDP growth. Meanwhile there is not so much evaluation on project micro-economical aspects and their possible impact to project efficiency and sustainability.

As the main micro-economical aspects and their possible impact to ensure effectiveness and sustainability of project author has identified project management methods and tools (technics) and social aspects – personnel and their competencies.

Research

There is little evaluation done in the field of micro-economical aspect evaluation of cohesion policy implementation. As main authors who have done research in the field could mention Bachtler J, Bradley J, Wostner P.

Municipalities present several types of economies but effects are not limitless, diseconomies might arise. Polycentric approach to development of region territories is one of the ways how to move EU finance resources to investments of infrastructure and establish attractive environment both for inhabitants and investors. Regional resource inventory and assessment of development potentials is based on:

- region's own perception & knowledge by active involvement of stakeholders;
- resource inventory from the lowest level gradually aggregating to macro levels;
- from generalized statements to more abstract, systematic and interlinked analysis of underlying causes, constraints and emerging opportunities.

Factors that make the difference:

- natural endowments,
- settlements pattern,
- infrastructure,
- production costs e.g. labour costs,
- human resources,
- innovation capacity,
- quality of the services,
- local institutions,
- regional identity.

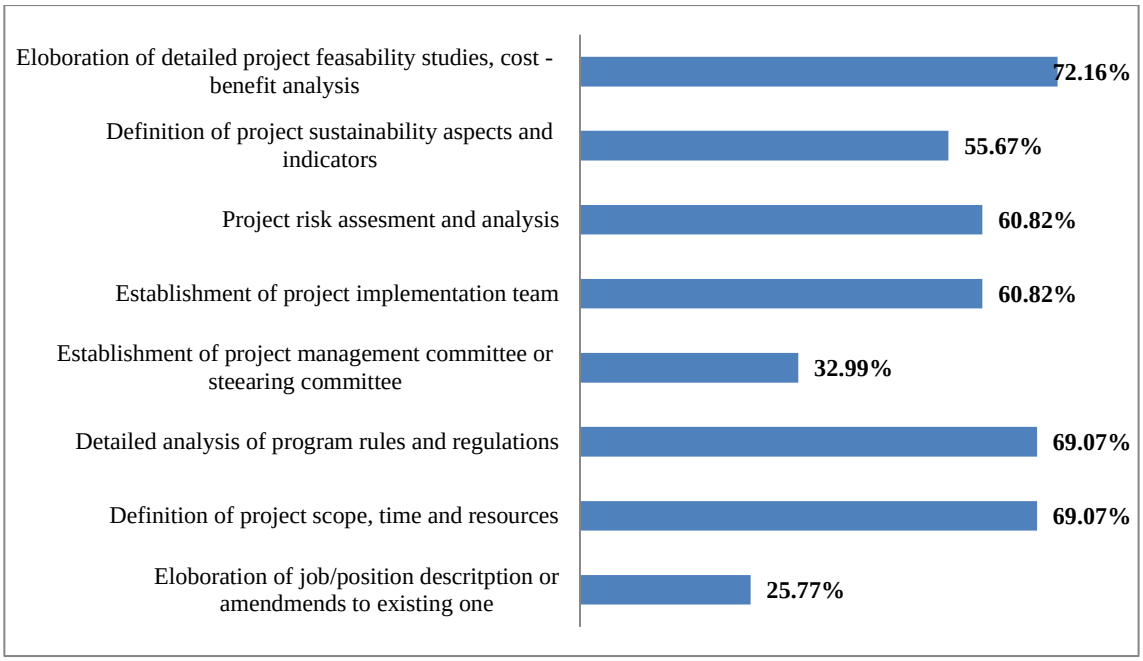
The later study concluded that the fund management system advances towards simplification, nevertheless many aspects can be improved. The 3 main recommendation blocks of the report were the following: the EU structural fund programming is isolated from long-term state development planning, from industry focus or prioritization and from financial planning that municipalities and businesses carry out. Final beneficiaries have trouble planning their development in the context of Structural Funds available and delays in program introduction creates substantial losses to the final beneficiaries in form of cancelled orders or cost increases.

The second recommendation group stated that fund management institutions should harmonize their procedures and cooperate better to avoid situations when the final beneficiaries face large amount of different requirements, to reduce the amount of required documentation that the institutions can easily obtain themselves from each other or public

registers and to disseminate best practice among intermediate bodies. The third finding was that administrative culture of fund management institutions is at times unacceptable when the institutions see the support applicant as an unreliable suppliant rather than as a valuable partner whose activates actually contribute to the country development. Such attitude is demonstrated by formal, at times excessive requirements regarding quantity and designs of documents for submission. It also shows in lack of enthusiasm to reconcile Project amendments quickly, even if those amendments do not materially affect the project substance and do not impede achieving project goals.

Authors has elaborated survey questionnaire for local municipality project management specialists. Questionnaire has been sent to all Latvian municipalities (in total 119), in the frame of study 97 responses has been collected (research sample is 97 out of 119, n=97). Research period is January 2013 – February 2014.

Quantitative analysis carried out in two steps: describing the central tendency and variation of parameters and in accordance with the empirical distribution with the normal distribution choice of parametric or non-parametric method for Inferential Statistics.



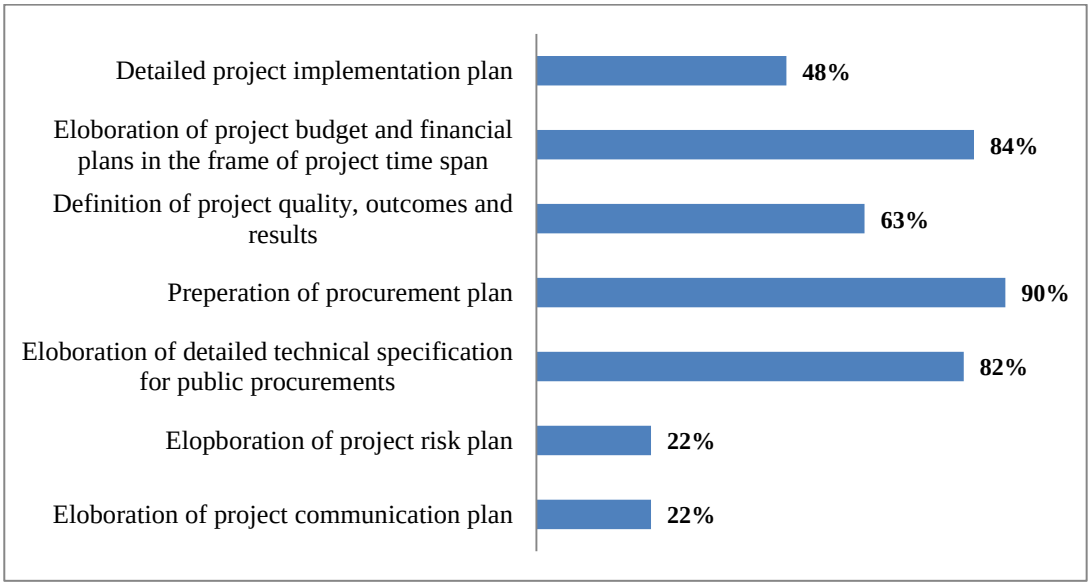
Source: author's empirical research

Fig. 1. **Institutional aspects in public project planning in Latvia** (n=97)

Study shows that in public sector project management there is lack of deep problem and situation analysis. 45.78% of respondents elaborated project proposals based on local municipal development programs and policy planning documents and don't provide deep analysis of problems. 26.05% of respondents accepted that they don't use situation analysis methods but project proposals are elaborated based on desired situation. Still 28.17% of respondents showed that they used project management methods such as current situation analysis and research, case

study methods by clarifying the factual situation and the desired situation. To be mathematically justified fair view of the project planning capacity in the public sector – was made in the survey data obtained in quantitative analysis, analysis of prior training, continuing education and practical work experience aspect of the relationship with the real operation of the methods used. The quantitative analysis carried out in two steps: describing the central tendency and variation in performance and in accordance with the empirical distribution with the normal distribution of parametric or non-parametric choosing the method of conclusive statistics.

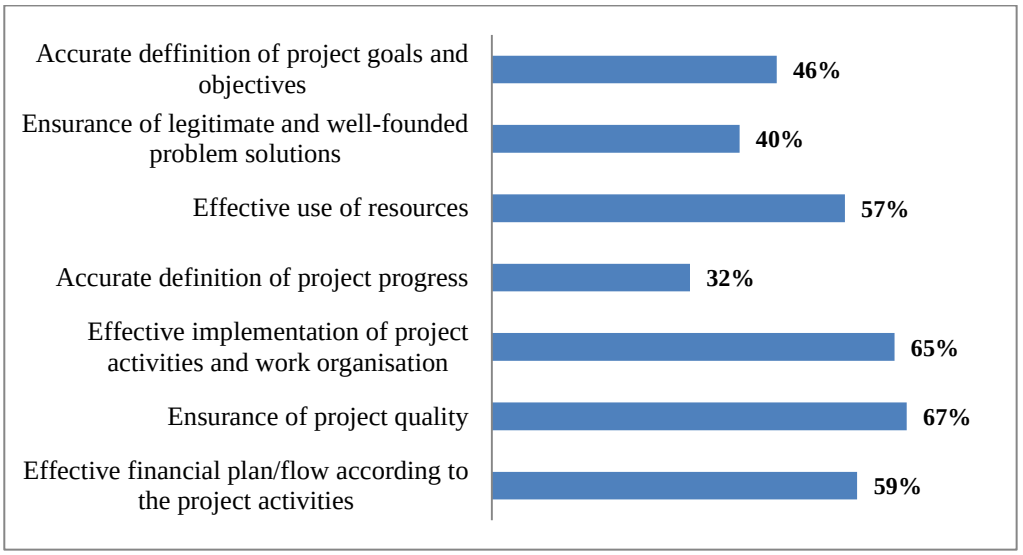
From institutional aspects Figure 1 shows practical project management fields in public administration (micro-economical perspective). Survey shows that there is still lack of such institution as project steering or monitoring committee which results in decision making process and its relation to political influence as it happens now days. Also research concludes that there is no detailed set of requirements for project management team and project manager and duties or responsibilities has been implemented on their main position not related to particular project. Meanwhile practitioners answered that do project feasibility studies e.g. cost-benefit analysis but author could explain that with obliged requirements when implementing donors financial instruments. Also not always those plans show relation to standard project management theory and practice.



Source: author's empirical research

Fig. 2. **Public project planning steps and activities in Latvia** (n=97)

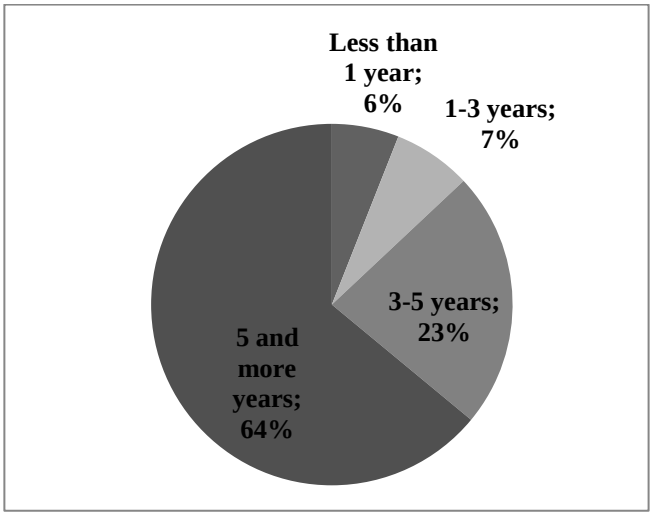
When analyse detailed steps and carried activities at the project planning stage research showed that mostly are prepared documentation which is stated in donors requirements but not what would be common project management practice according to standards. Still there is lack of detailed risk analysis and even responsible project outcome and impact definition. Author has analysed those aspects before and links it to political influence and project definition without detailed problem analysis and possible project alternative definition.



Source: author's empirical research

Fig. 3. **Benefits from the use of project management tools and methods at project planning stage** (n=97)

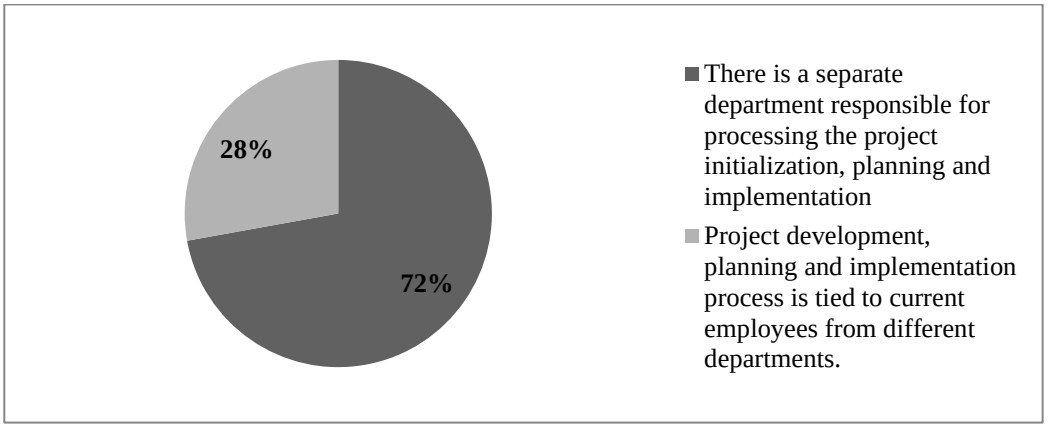
Figure 3 shows replies from public administration practitioners' and their stated benefits if they or organisations representatives would apply project management technics and tools. Answers show that project managers consider that practical project management methods would enhance quality of public funds spending and would ensure effective project implementation and allocation of responsibility.



Source: author's empirical research

Fig. 4. **Specialists experience in project management field** (n=97)

Research shows that staff involved in project management processes in public sector in Latvia is well experienced as 64% of respondents has project management experience five and more years. 23% of respondents have been involved in project management for three till five years, which is explained by the available different public funds (such as European Union structural funds, European Economic Zone and Norwegian cooperation programs, Latvian – Swiss cooperation program etc.).



Source: author's empirical research

Fig. 5. **Organizational structures of project management in public sector** (n=97)

In project management practice there can be identified different types of project organizational structures. Research shows that 72% of responds has pure organizational project management structure or signs of it. Meanwhile 28% of respondents has matrix or mixed project management organizational structure. Deeper analysis of matrix structures showed that we could say it's more so called "weak matrix" what sometimes arise many problems in project implementation. Pure project organisation structures are more suitable for project implementation but due to the specific of public projects and political decisions common practice is matrix structures. Even if we need to consider specific of public administration author concludes that there is still good ground to establish good pure project management organisation structures for public investment project implementation.

Case of Latvia shows that there is still misunderstanding between political decision making process and project management and implementation as there is not common practice to delegate all responsibility to project manager and good establishment of project steering committees and monitoring committees which usually responsible for strategic decisions within project frame.

Ultimately, project management directors seek organizational methods that facilitate teamwork, can maximize the use of limited resources, efficiency and quality in the way a project is completed and how goals and objectives are achieved. Public sector organizations are often complex with internal and external relationship intertwine with each other and difficult to apprehend.

The rational of organizational management is to facilitate the application of knowledge, skills, tools and techniques to project activities to meet project requirements in terms of Scope, Cost, Time, Quality, Participant satisfaction.

Organizational strategy is the way in which resources are used in the achievement of a purpose. Strategies are at the same time action plans for laying down instructions for the coordination of resource use through an employment program, projects, policies, procedures and organizational design, as well as the definition of execution standards. Organizational structure is the placing of human resources in the function of the organization. When speaking about project planning, it can be said that plans represent merely good intentions, until they degenerate at the moment they are transformed into hard work.

The author evaluated the public sector practice in project development and initialization process. In the frame of research evaluation of project problem and goal definition has been done.

Study shows that in public sector project management there is lack of deep problem and situation analysis. 45.78% of respondents elaborated project proposals based on local municipal development programs and policy planning documents and don't provide deep analysis of problems. 26.05% of respondents accepted that they don't use situation analysis methods but project proposals are elaborated based on desired situation. Still 28.17% of respondents showed that they used project management methods such as current situation analysis and research, case study methods by clarifying the factual situation and the desired situation.

Many traditional definitions of projects assume that the objectives of a project, and the methods of achieving them, are well understood throughout the project. For instance, in its body of knowledge, the UK Association of Project Managers defines a project as 'an undertaking to achieve a defined objective (GF Consulting, 2009), and goes on to state that 'generally all projects evolve through a similar "lifecycle" sequence during which there should be recognized start and finish points'.

Other definitions similarly imply clearly defined objectives and methods: 'an activity defined by a clear aim, appropriate objectives and supporting activities, undertaken to define start and completion criteria, and 'a human activity that achieves a clear objective against a time-scale (Morris, P W G (Ed.), 1992).

The author research has identified the problem aspects of project initialization and planning process in public sector in Latvia. As the minor problems respondents identified: frequent change of management official's decisions and initiatives, corruption, changes in responsible officials and political leaders. As the important or very important problem factors which could affect the ability and capacity of local government projects respondents defined: management official's lack of understanding of project management issues, inadequate staff motivation system, lack of human resources and lack of project management competencies and professional skills.

I would like to mention also Mark Langley report as President & CEO of the Project Management Institute (PMI). He presented PMI assessment of various studies related provided by Research Department which shows that the application of program and project management's practices can enhance the performance of public authorities. Furthermore, as the CPR has been established in order to improve coordination and harmonize the implementation of EU Funds, it is expected that it will simplify its use by recipients and reduce the potential risk of irregularities. However, building the capacity of local actors to develop and implement operations including fostering their project management capabilities, should be taken into account as a one of the effective management of the EU Funds though drivers. Managing EU Funds requires unique skills, capabilities, processes and practices, particularly project and

program management. The above mentioned critical disciplines that can be applied to EU Funds may ensure effective implementation success on the ground in the EU Member States. Furthermore, PMI's research carried out shows that organizations need to focus on the development and training of their talent in order to achieve superior project performance, successful strategic initiatives and become high performers in order to avoid high cost at the end. In addition, not only must focus on development of people and practices by which they do that, but also need to focus on managing people through rapid changes -strategic focus on people, processes and outcomes are crucial items. However, institutional capacity is not just a technical matter of training civil servants in the European Union and other markets across, but should be seen as component of good governance which is a basis for institutional capacity building, creating trust and social capital.

Successful organizations have a continued focus on the outcomes of the intended benefits of their projects and programs. Based on the mentioned, it's clear that once the organizations developed and deployed three focus areas (people, processes and outcomes), it would lead to increased success of both projects and strategic initiatives on the ground. Why project management practices are important for this theme? Because it gives analysis, competitive intelligence, market analysis and information gathering outcomes that EU Institutions not necessary are able to capture while analyzing the efficient implementation of policy objectives. Measures for reinforcing the administrative capacity of the authorities involved in the management and control of the programs in EU Member States will now finally be given the priority they deserve. And it is essential and timely to address it respectively.

Although there are differences in administrative and political tradition, the experiences of western countries can be useful for other countries in Europe. This note suggests the following recommendations for the transition countries as Latvia:

- Public investment strategies need to be closely linked to budgets. Strategies need to be periodically reviewed for relevance, including by relying on external experts.
- Capital projects need multi-year funding commitments that cover the duration of the project or the project phase.
- Cost-benefit assessments of competing projects should be the key tool for selecting individual projects to ensure value for money.
- Evaluation of past project experiences should be required and needs to be built into future planning, guidance and regulations. Evaluations could be undertaken by any number of institutions, including ministries of finance.
- Effective audit and reporting processes are needed to facilitate transparency and encourage feedback to improve the quality of the decision-making and management process.
- Project planning and management skills need to be enhanced and retained within the civil service.

Conclusions

Public sector project realization planning represents a project management phase that encompasses goal definition and the determination of ways and measures for achieving the set goals, i.e., that the project is realized in the planned time, at the planned cost.

The author research has identified the problem aspects of project initialization and planning process in public sector in Latvia. As the minor problems respondents identified: frequent change of management official's decisions and initiatives, corruption, changes in responsible officials and political leaders. As the important or very important problem factors which could affect the ability and capacity of local government projects respondents defined: management official's lack of understanding of project management issues, inadequate staff motivation system, lack of human resources and lack of project management competencies and professional skills.

Programs as it self of course shows impact to the industry or GDP growth in macro-economic level, but also micro-economical aspects of project implementation is important issue to ensure efficiency and sustainability in public funds spending and absorption.

Study shows that self-assessment of public sector organizations in Latvia is quite high. Project management specialists define them self as very experienced in Project management, but meanwhile the self-assessment of organization Project maturity levels shows that organizations is only at the beginning of setting up the appropriate Project management system. The public sectors project management usually is described as different kind of foreign financial instrument and program implementation.

To improve project management practice in public sector in Latvia, author can recommend:

1. To increase the capacity and professional skills level for local municipal project management staff (training programs, supervisions etc.);
2. Define the appropriate organizational structure for project elaboration and implementation (matrix or pure project organization structures);
3. Project management tools and techniques should be applied gradually (should be as an obligatory requirement in big scale public sector projects).

Bibliography

Abbasi, Y. G. & Al-Mharmah, 2000. "Project management practice by the public sector in a developing country", *International Journal of Project Management*, 18(3), pp. 105-109.

Arnaboldi M., Azzone G., & Savoldelli A., 2004. "Managing public sector project: the case of the Italian Treasury Ministry", *International Journal of Project management*, 22(3), pp. 213-223.

Baranskaya ,A., 2007. Project Management in Public Administration of Transitional Countries, *Moscow State University, School of Public Administration, Russia*.

Bradley J, et al., 2005. An Integrated Micro-Macro (IMM) Approach To The Evaluation Of Large- Scale Public Investment Programmes: The Case of EU Structural Funds. GEFRA, 2005, 98 p.

D.I. Clelan, 1999. *Project management: Strategic Design and Implementation*, McGraw-Hill.

Feasibility Study for a simplifying European Union fund management system, 2009. Ltd. GF Consulting, 62 p.

Gower, D. G., 1992. 'Project management – an overview' Association of Project Managers, UK (UK Institution of Electrical Engineers professional brief).

Grigorescu Adriana, 2011. *Management of public sector investment projects*, course support, National School of Politic and Administrative Studies (SNSPA) in Bucharest.

Langley, Mark, 2015. Administrative Reforms, Capacity-Building and Cohesion Policy. Challenges for the New Cohesion Policy in 2014-2020: An Academic and Policy Debate, European Union, 2015, 28 p., ISBN: 978-92-79-45233-8.

Morris, P W G (Ed.), 1992. *APM Body of Knowledge and Experience* Association of Project Managers, UK.

Philip, P., *Local public administration management – a practical approach*, Economic Publishing House, Bucharest, 2007, 241 p., 244 p.

Pūlmanis, Emīls, 2012. *Evaluation of Regional Development financial instruments funded project management*, First International Scientific Conference on Project Management in the Baltic Countries "Project Management Development – Practice and Perspectives": Riga, Latvia, February 8-9, 2012. Conference Proceedings. Riga: University of Latvia, 244 p.

Pūlmanis, Emīls, 2013. Polycentric Development Projects Initialisation Process Problems in Latvia/ Emils Pulmanis, Zaneta Ilmete. Bibliogr.: 224 p.// Integrated and sustainable regional development: proceedings of the International Scientific Conference "Economic Science for Rural Development" (Economic science for rural development; No. 31). Jelgava: Latvia Agriculture University, pp. 220-224.

Pūlmanis, Emīls, 2015. Challenges for the New Cohesion Policy in 2014-2020: An Academic and Policy Debate. // PM World Journal. ISSN 2330-4480. Vol. 3, No. 11 (2014), pp. 1-5: fig. *Databases of EBSCO Publishing, Inc*.

Pūlmanis, Emīls. Public sector project management application and sustainability problems: case of EU member state – Latvia / Emīls Pūlmanis. References: p.31-34 // PM World Journal. ISSN 2330-4480. Vol. 3, No. 11, 2014, pp. 1-35: fig. *Databases of EBSCO Publishing, Inc*.

Pūlmanis, Emīls. *Public sector project management efficiency problems and solutions, case of EU member state – Latvia* / Emīls Pūlmanis. bibliogr. // A business sustainability index – findings and framework: International Conference on Business and Management, June 17-19, 2014, Taipei, Taiwan: proceedings, 2014, 15 p.: fig.

Reiss, G. 1992. *Project Management Demystified* E & F Spon.

Scale Public Investment Programmes: The Case of EU Structural Funds. GEFRA, 2005, 98 p.

Soderlund, J., 2004. *Building theories of project management: past research, questions for the future*. International Journal of Project Management, 22, pp. 183-191.

Sprague, R. H. and Carlson, E. D., 1982. *Building Effective Decision Support Systems*, Englewood Cliffs, New Jersey: Prentice-Hall, 314 p.

State Government of Victoria, Department of Treasury and Finance, *Investment Management Standard*, 2010.

The Government Extension to a Guide to the Project Management Body of Knowledge (PMBOK® Guide). USA: Project Management Institute Inc., 2006.

Van Gundy, A. B. Jr., 1988. *Techniques of Structured Problem Solving*. 2nd ed. New York: Van Nostrand, R, 286 p.

Wostner, P., 2008. *The Micro-efficiency of EU Cohesion Policy*, European Policy Research Papers. No. 64, European Policies Research Centre, University of Strathclyde, Glasgow.

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THE COMMON ASPECTS OF CONTROLLING IN PROJECTS OF INNOVATIVE COMPANIES

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Abstract

In the knowledge-driven economy, innovation has become central to achievement in the business world. With this growth in importance, small organizations have begun to re-evaluate their products, their services, even their management culture in the attempt to maintain their competitiveness in the global markets of today. While new business models represent new opportunities, small and medium enterprises have recognized the advantage of these developments, which can help them to survive in the face of increasing competition. Controlling tools with their typical interaction of planning, information gathering and control in the controlling cycle are highly important for future success. Introduction of new technologies, creation of new products – there are business processes, they need in investments, and in fact, they are usually separate projects for companies. Therefore, the management of the companies is in need in relevant mechanisms of information and analytical support of the necessary system information to manage the business almost online mode. The purpose of this paper is to study the issues of application of the controlling of innovative projects in the Latvian enterprises. The author considers the theoretical and practical aspects, as well as the problems of application of the controlling of innovative projects based on the experience of Latvian companies.

Key words: *controlling, small and medium-sized enterprises, project management, innovations*

JEL codes: M10, M20

Introduction

In the knowledge-driven economy, innovation has become central to achievement in the business world. While new business models represent new opportunities, small and medium enterprises have recognized the advantage of these developments, which can help them to survive in the face of increasing competition. In October 2010, the European Commission launched a Europe 2020 flagship initiative, titled "Innovation union" which sets out a strategic approach to a range of challenges like climate change, energy and food security, health and an ageing population. The proposals seek to use public sector intervention to stimulate the private sector and to remove bottlenecks which stop ideas reaching the market (such as access to finance, fragmented research systems and markets, under-use of public procurement for innovation, and speeding-up harmonised standards and technical specifications).

The categorization follows of the value chain of the company: strategy-related problems and process-related problems. A strategy-related problem includes problems the company is positioning in the market, such as the search by application technology, pricing issues and the expansion of the company. Process-related problems. This includes both problems along the main processes of value chain, such as product development, procurement, production,

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marketing and sales, as well as problems in supporting processes such as organization, staffing and financing. (Porter, M. E., 2001) The highly important goals for innovative enterprises are an increase in turnover; a decrease in costs; an increase in profit margins; an increase in the market share. Sustainable development of the national economy of Latvia requires promotion of structural changes in the economy in favour of production of goods and services with a higher value added, including by increasing the role of manufacturing, modernizing manufacturing and services and export.

The purpose of this article is to study of the data of using of innovation in different functional areas of the companies. The attempt was made to identify the main difficulties faced by enterprises in this process and the possibilities of using controlling in the small and innovative enterprises.

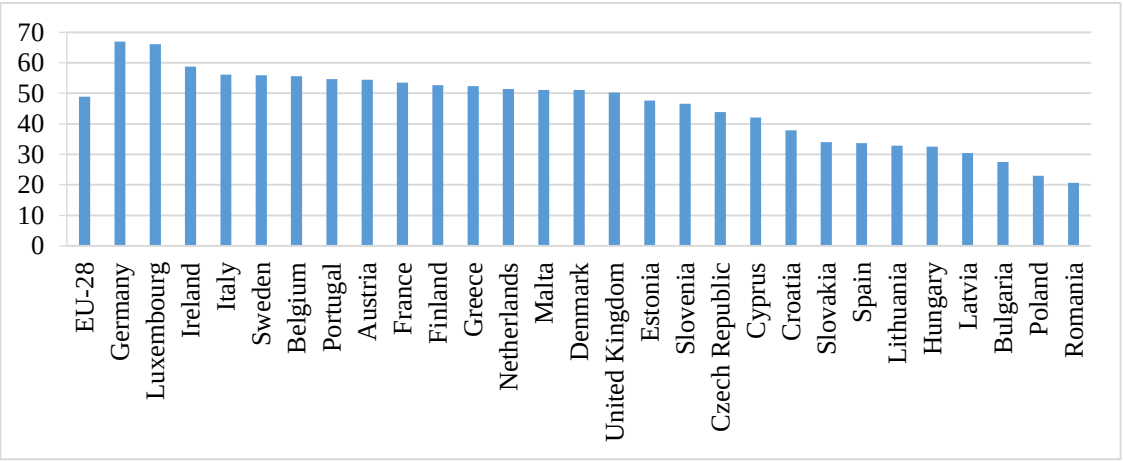
The methodological basis for the article is made up of the statistical data analysis, and the guidelines of the EU and the Republic of Latvia regulations as well as works of foreign authors, research carried out by the author. The listing of literature provides references to works of foreign authors, and sources of publicly available information.

1. The statistical data of innovation development in EU

In the context of economic globalisation, technology is a key factor in enhancing growth and competitiveness in business. High-tech industries are expanding most strongly in international trade and their dynamism helps to improve performance in other sectors. Research, development, science and technology have been acknowledged throughout the years since 2000 as factors of growing competitiveness, better and well-paid jobs, greater social cohesion and a smart, sustainable and inclusive economy. Investment in research, development, innovation and skills constitutes a key policy area for the EU, as it is essential to economic growth and to the development of a knowledge-based economy. Science is part of almost every aspect of our lives. Europe has a long tradition of excellence in research and innovation, having been the birthplace of the industrial revolution. The European Union (EU) is a world leader in a range of cutting-edge industrial sectors – for example, biotechnology, pharmaceuticals, telecommunications or aerospace. Research and development (R & D) is often considered as one of the driving forces behind growth and job creation. Information and communication technologies (ICT) affect people's everyday lives in many ways, both at work and in the home. In October 2010, the European Commission launched a Europe 2020 flagship initiative, titled "Innovation union" which sets out a strategic approach to a range of challenges like climate change, energy and food security, health and an ageing population. The proposals seek to use public sector intervention to stimulate the private sector and to remove bottlenecks which stop ideas reaching the market (such as access to finance, fragmented research systems and markets, under-use of public procurement for innovation, and speeding-up harmonised standards and technical specifications). In March 2013, the European Commission released the "State of the innovation union 2012 – accelerating change" which reviewed progress made with respect to the 34 commitments made in the innovation union. This review concluded that more than 80% of commitments were on track (at that time). The Europe 2020 Strategy sets out a vision of Europe's social market economy for the 21st century with the 3% R&D intensity goal as one of the five headline targets to be achieved by the EU by 2020. On 17 July 2012, the Commission adopted its Communication on "A Reinforced European Research Area (ERA) Partnership for

Excellence and Growth". The ERA is a unified research area open to the world and based on the internal market, in which researchers, scientific knowledge and technology circulate freely. EU Member States, the Commission and research organisations need to implement the measures in the Communication to ensure completion of the ERA by 2014 as called for by the European Council. (Science, technology and innovation in Europe Pocketbooks, 2013) European Innovation Partnerships (EIPs) also form part of the innovation union and are designed to act as a framework to address major societal challenges, bringing together activities and policies from basic research through to market-oriented solutions.

One of the five headline targets of Europe 2020 Strategy is to achieve an R&D intensity (R&D expenditure as a percentage of GDP) of 3% in the EU. In 2011, R&D intensity in the EU-27 stood at 2.03%. Despite an increase on the 2010 figure (2.01%), it was below the figures recorded in Japan (2009: 3.36%), South Korea (2010: 4%) and the United States (2009: 2.87%), but higher than in China (2009: 1.7%). Among the EU Member States, only Finland (3.78%), Sweden (3.37%) and Denmark (3.09%) exceeded the EU goal of devoting 3% of GDP to R&D, also outperforming the United States. Another seven Member States, namely Germany (2.84%), Austria (2.75%), Slovenia (2.47%), Estonia (2.38%), France (2.25%), the Netherlands and Belgium (both 2.04%) were above the EU-27 average although below the target figure of 3%. Between 2005 and 2011, R&D expenditure in the EU-27 increased by an average of 3% per year, reaching EUR 257 billion in 2011. Germany, France and the United Kingdom together accounted for more than half of all R&D expenditure in the EU-27.[2]



Source: Eurostat (online data code: inn_cis8_type). The survey reference period covers the three years from 2010 to 2012

Fig. 1. **Share of innovative enterprises, 2010-12, (percentage of all enterprises)**

In general, Member States with high overall shares of innovative enterprises reported higher shares for most types of innovation. In particular, Member States with a high share of product innovative enterprises also reported a high share of with process innovative enterprises,

[2] Science, technology and innovation in Europe Pocketbooks ISSN 1830-754X 2013 edition

with the notable exception of the United Kingdom. Regarding the specific types of innovation, Germany, the Netherlands, Belgium, Sweden, Finland and Luxembourg presented the highest shares of product innovative enterprises, all over 30.0% of all enterprises.

Table 1

Share of process innovative enterprises by implementation type, 2010-12 (percentage of all enterprises)

	Process innovative enterprises	Innovation by introducing new or improved logistics, delivery or distribution methods	Innovation by introducing new or improved methods to manufacture or produce goods or services	Process innovation by introducing new or improved supporting activities for processes
EU-28 (²)	21.4	34.9	65.5	58.9
Belgium	31.1	35.2	60.3	53.3
Bulgaria	9.3	28.1	61.7	48.7
Czech Republic	24.0	39.6	68.0	59.2
Denmark	22.9	37.7	41.9	77.8
Germany	25.5	44.1	74.9	53.3
Estonia	23.8	25.4	65.9	48.4
Ireland	25.9	40.5	59.9	70.0
Greece	25.6	28.3	59.7	63.3
Spain	15.1	20.3	61.8	56.1
France	24.1	35.9	72.4	48.0
Croatia	19.0	40.8	65.3	69.0
Italy	30.4	31.3	61.3	66.8
Cyprus	28.2	95.7	57.8	84.7
Latvia	12.7	32.6	71.9	42.3
Lithuania	13.1	25.4	70.1	58.3
Luxembourg	32.8	41.7	59.1	64.9
Hungary	8.3	19.6	58.9	55.1
Malta	26.4	52.4	57.8	74.8
Netherlands	25.9	32.7	62.1	55.4
Austria	28.7	32.5	55.4	72.8
Poland	11.0	29.2	61.7	54.1
Portugal	33.5	37.2	60.7	72.2
Romania	4.6	31.6	69.3	34.9
Slovenia	22.5	34.1	68.2	66.6
Slovakia	13.5	38.6	62.9	64.4
Finland	29.3	33.9	64.0	62.9
Sweden	23.9	32.0	57.2	61.2
United Kingdom	14.1	:	:	:

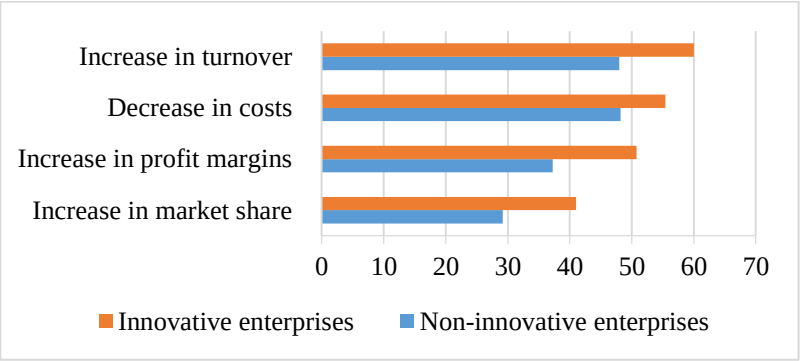
A greater share of enterprises implemented process innovation in Portugal, Luxembourg, Belgium and Italy, again all in excess of 30.0%. As regards the introduction of new organisational methods – introducing new practices or methods for organising procedures, external relations or for organising work responsibilities and decision making – the highest shares were reported for enterprises in Luxembourg, Austria, Malta, the United Kingdom and France, all over 34.0%; the share in Luxembourg was 46.8%, considerably higher than in any other EU Member State. As concerns marketing innovations, the highest shares of enterprises with such innovations were observed in Greece, Ireland and Germany, all in excess of 34.0%.

Table 2

Share of innovative enterprises by main type of innovation, 2010-12 (percentage of all enterprises)

	Innovative enterprises	Product innovative enterprises	Process innovative enterprises	Organisation innovative enterprises	Marketing innovative enterprises
EU-28	**48.9**	**23.7**	**21.4**	**27.5**	**24.3**
Belgium	55.6	31.5	31.1	29.3	21.9
Bulgaria	27.4	10.8	9.3	12.4	14.2
Czech Republic	43.9	25.3	24.0	20.5	22.4
Denmark	51.1	24.8	22.9	32.2	29.4
Germany	66.9	35.8	25.5	32.2	34.4
Estonia	47.6	20.7	23.8	21.7	21.9
Ireland	58.7	27.8	25.9	21.8	35.7
Greece	52.3	19.5	25.6	30.2	36.8
Spain	33.6	10.5	15.1	19.4	13.2
France	53.4	24.2	24.1	34.2	25.4
Croatia	37.9	16.4	19.0	22.9	23.5
Italy	56.1	29.1	30.4	33.5	31.0
Cyprus	42.1	20.9	28.2	26.2	29.5
Latvia	30.4	10.4	12.7	16.9	16.5
Lithuania	32.9	11.6	13.1	17.5	19.3
Luxembourg	66.1	30.3	32.8	46.8	32.4
Hungary	32.5	10.6	8.3	16.5	19.7
Malta	51.1	23.9	26.4	34.7	32.6
Netherlands	51.4	31.9	25.9	27.3	23.2
Austria	54.4	26.6	28.7	36.4	29.5
Poland	23.0	9.4	11.0	10.4	10.6
Portugal	54.6	26.0	33.5	32.8	32.8
Romania	20.7	3.4	4.6	14.1	13.8
Slovenia	46.5	23.6	22.5	26.3	28.5
Slovakia	34.0	14.4	13.5	18.6	19.3
Finland	52.6	31.0	29.3	29.7	26.5
Sweden	55.9	31.5	23.9	25.3	30.4
United Kingdom	50.3	24.0	14.1	34.2	16.8

In many of the countries under review, the "manufacturing" sector accounted for the greatest share of business enterprise R&D expenditure. This was notably the case in Germany, Slovenia, Finland and Sweden, where 75% or more of R&D expenditure by the business enterprise sector (BES) was devoted to manufacturing. However, eight other Member States (Bulgaria, Estonia, Ireland, Cyprus, Latvia, Lithuania, Portugal and the United Kingdom) saw more than half of their expenditure go on the services of the business economy. In 2011, the EU-27 counted 2.6 million people, expressed in full-time equivalents (FTEs), working in R&D. In the EU as a whole, the business enterprise sector was the largest sector, employing more than half of R&D personnel (1.4 million FTEs). However, this pattern differed at national level for certain countries. In Bulgaria, most of the R&D personnel were employed in the government sector, while the higher education sector accounted for the highest shares of R&D personnel in Estonia, Greece (2007), Cyprus, Latvia, Lithuania, Poland, Portugal, Slovakia, Croatia and the United Kingdom.

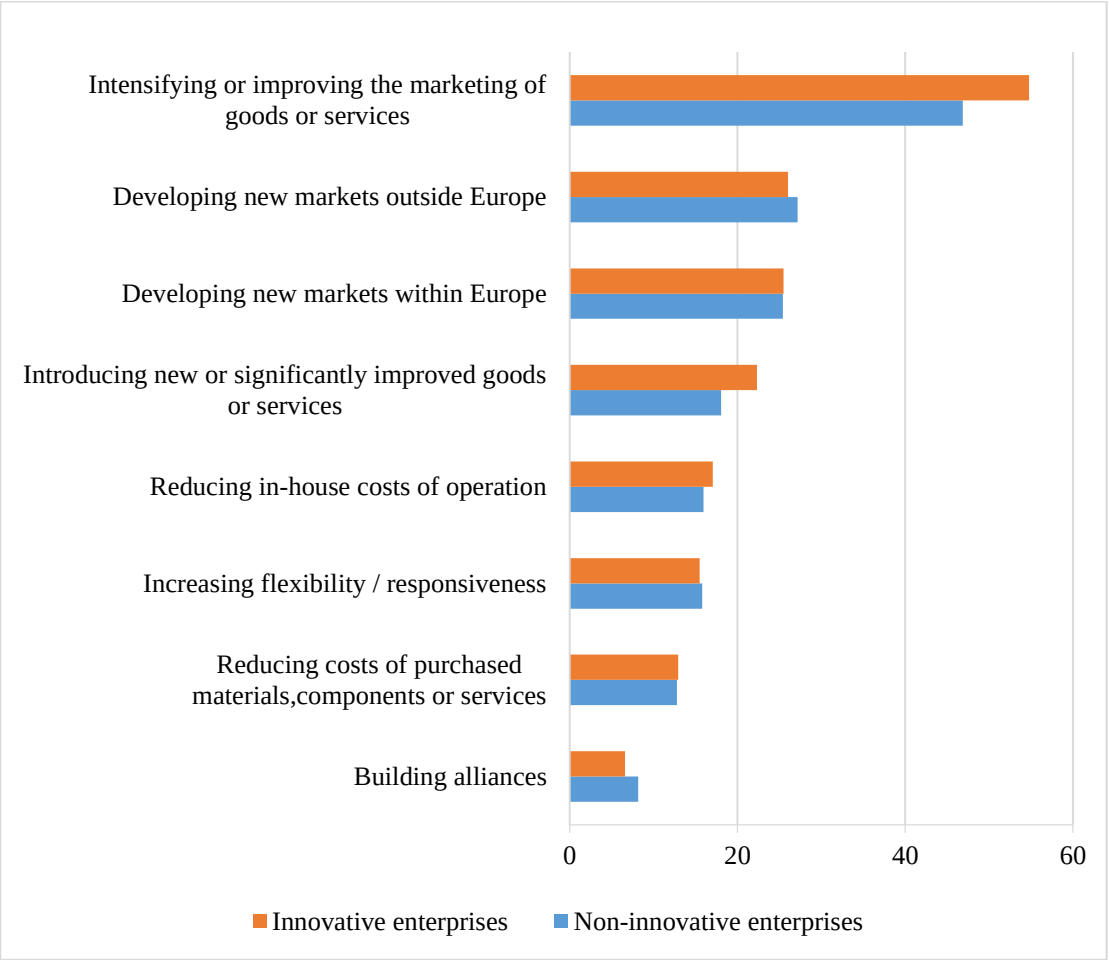


Source: Eurostat (inn_cis8_goals)

Fig. 2. **Highly important goals in innovative and non-innovative enterprises, EU-28, 2010-12 (% of all innovative and non-innovative enterprises)**

Figure 2 presents the goals considered to be highly important by innovative and non-innovative enterprises in the 20 EU Member States for which data are available. An increase in turnover was considered a highly important goal by 60.0% of innovative enterprises between 2010 and 2012, followed by a decrease in costs (55.4%) and an increase in profit margins (50.8%). An increase in the market share was reported as a highly important goal by 41.0% of innovative enterprises. For non-innovative enterprises, the ranking was quite similar to that for innovative enterprises, with one notable difference: the share of non-innovative enterprises reporting an increase in the turnover as a highly important goal was slightly less than the share reporting a decrease in costs.

The results show in Figure 3 the intensification or improvement of marketing of goods and services was the strategy most frequently regarded as being highly important between 2010 and 2012, both for innovative and non-innovative enterprises. The next two most common strategies are the strategy of new markets development and the strategy of building alliances with other enterprises and institutions are highly important for innovative and non-innovative enterprises.



Source: Eurostat (inn_cis8_strat)

Fig. 3. **Highly important strategies in innovative and non-innovative enterprises, EU-28, 2010–12 ([1]), (% of all innovative and non-innovative enterprises)**

The data shows the Total Venture capital expressed as a percentage of GDP. Venture capital investment is a subset of a private equity raised for investment in companies not quoted on stock market and developing new products and technologies. It is used to fund an early-stage, seed and start-up or expansion of venture, later stage venture.

The total venture capital investment decreased in 2009 compared to 2008 in the majority of countries under review. It dropped by 57% in the EU-15 from 2008 to 2009. Although investments increased sharply again in 2010 and 2011 in most of the countries, levels were still lower than in 2007 and 2008. In 2011, most of the investments were largely concentrated in buyouts and growth capital across the EU with the exception of Ireland and Greece. In 2010, the European Union had almost 50 000 enterprise in high-tech manufacturing and over 800 000 enterprises in knowledge-intensive services.

Table 3

Venture Capital Investment by detailed stage of development (million EUR) (from 2007, source: EVCA)

	2007	2008	2009	2010	2011	2012	2013
European Union (15 countries)	**70 275.9**	**51 635.5**	**22 816.3**	**40 019.1**	**44 570.3**	**35 274.7**	**35 710.1**
Belgium	1 047.5	636.0	1 018.2	475.7	590.3	521.9	920.1
Bulgaria	39.1	15.0	6.3	4.6	11.0	65.1	1.6
Czech Republic	69.5	39.7	61.4	36.5	192.6	16.6	23.9
Denmark	1 334.2	512.1	452.5	439.2	421.3	693.6	1 458.2
Germany	8 082.8	7 115.1	2 618.6	4 825.7	4 439.4	5 315.3	5 908.4
Ireland	321.1	75.3	59.0	48.4	64.8	92.6	94.0
Greece	89.6	233.7	39.2	15.0	9.3	0.0	1.1
Spain	2 923.5	1 680.7	959.2	2 479.7	1 973.9	1 475.3	750.5
France	12 724.8	8 551.1	3 456.8	5 958.5	9 264.1	5 247.3	5 943.9
Italy	2 838.6	3 399.6	1 384.7	905.2	1 210.9	1 191.9	1 078.7
Luxembourg	67.5	425.4	82.3	101.1	240.4	249.5	70.7
Hungary	48.1	33.9	191.3	45.2	78.1	104.3	22.7
Netherlands	2 842.8	1 763.2	805.4	1 326.5	2 101.1	1 362.2	988.8
Austria	393.8	214.3	140.2	129.6	124.1	154.9	88.0
Poland	435.2	727.3	482.2	504.4	692.2	540.6	351.5
Portugal	206.1	399.0	299.3	203.5	442.3	229.0	255.2
Romania	156.1	122.6	82.9	80.3	48.1	24.3	48.5
Finland	381.4	486.5	370.5	441.7	436.8	483.2	531.5
Sweden	3 010.3	3 330.3	1 337.1	3 134.9	2 166.4	2 021.8	1 545.9
United Kingdom	34 011.9	22 813.3	9 793.4	19 534.3	21 085.1	16 236.3	16 075.1
Norway	698.5	770.1	641.7	936.3	706.2	879.9	883.2
Switzerland	969.6	1 083.6	717.6	1 555.2	640.5	661.8	611.4

Source: prepared by the author based on the data of the Eurostat

2. The Economic development of Latvia

Over the past two years (2012-2013), funding from the EU structural funds of more than EUR 140 million has been paid to enterprises for the purpose of modernizing and increases their competitiveness. In the next EU funds period, funding will be available for the approximate amount of EUR 800 million for the activities of the Ministry of Economics aimed at business development within the framework of the NIP and Latvia should focus this funding on targeted investments in modernization and industrialization of its economy. From 2011 to 2013 growth of the Latvian economy on average amounted to 4.7% annually, which puts Latvia among the fastest growing economies in the EU. In 2014, the economic growth rate slowed down, which

was driven by trends in the external environment: slower than previously expected growth in the EU, as well as the weakening economic situation in Russia. Situation in the external environment affects the Latvian export capabilities – exports in the 3rd quarter increased by as little as 0.3% compared to the previous year. Exports of Latvian goods and services have been growing very fast since 2010 and have become the driver of economic growth. Export volumes have already exceeded the pre-crisis level by 20%. Further growth opportunities of exports will be affected not only by changes in external demand, but also by competitiveness of Latvian producers. It should be taken into account that the improvement of Latvian competitiveness so far has occurred mainly due to the cuts of labour costs, however, further improvement of competitiveness will depend on the ability to raise productivity. According to the forecasts of the Ministry of Economics, the overall growth of Latvian economics in 2015 may reach 2 per cent. (Economic Development of Latvia, Report, 2014)

Sustainable development of the national economy of Latvia requires promotion of structural changes in the economy in favour of production of goods and services with a higher value added, including by increasing the role of manufacturing, modernizing manufacturing and services and export. The National Industrial Policy (NIP) approved on May 28, 2013 lays a foundation for the above mentioned objective by promoting cross-sectoral changes in business environment and the education system and regional investment policy to ensure a targeted transition of the economic model from low profitability products and services produced by cheap labour to a highly productive and competitive economy that can afford to pay employees decent wages.

2.1. The state and dynamics of SMEs

Entrepreneurs are individuals who recognize opportunities where others see chaos, contradiction, and confusion. They are aggressive catalysts for change within the marketplace. The global economy has been revitalized because of their efforts and the world now embraces free enterprise as the most significant force for economic development. The passion and drive of entrepreneurs move the world of business forward. They challenge the unknown and continuously create breakthroughs for the future.

The terms entrepreneurs and small-business owner sometimes are used interchangeably. Although some situations encompass both terms, it is important to note the differences in the titles. Small businesses are independently owned and operated, are not dominant in their fields, and usually do not engage in many new or innovative practices. They many never grow large and the owners may prefer a more stable and less aggressive approach to running these businesses; in other words, they manage their businesses by expecting stable sales, profit and growth. On the other hand, entrepreneurial ventures are those for which entrepreneur's principal objectives are innovation, profitability, and growth. Thus, the business is characterized by innovative strategic practices and sustainable growth. Entrepreneurs and their financial backers are usually seeking rapid growth and immediate profits. They even seek the sale of their businesses if there is potential for large capital gains. Thus, entrepreneurs may be viewed as having a different perspective from small-business owners on the development of their firm. (Kuratko D., 2008)

The personal backgrounds of the individuals who undertake industrial activity are strongly influenced by several internal and external factors including the world situation,

political trends, etc. Thus, a multitude of factors affect people's entrepreneurial spirit and they, in turn, cast their influence on their environment (Pande J.2009).

Launched in 2010, the Europe 2020 strategy sets out a vision of Europe's social market economy for the 21st century underpinned by three mutually reinforcing priorities:

- Smart growth: developing an economy based on knowledge and innovation;
- Sustainable growth: promoting a more resource-efficient, greener and more competitive economy;
- Inclusive growth: fostering a high-employment economy, delivering social and geographical cohesion.

The European Commission is further boosting the Europe 2020 strategy with seven flagship initiatives. One of these is the "Innovation Union", supporting "smart growth". The Innovation Union initiative aims to improve the framework for research and innovation in the EU.

The main directions for improving the innovation system in Latvia are focused on:

- developing the scientific activity potential;
- establishing a long-term platform for cooperation between enterprises and scientists;
- supporting the development of innovative enterprises.

According to data of the CSB, the structure of innovative enterprises by size, it is obvious that the most active in the field of innovation are big enterprises with 64.6% out of all big companies. However, only 43.2% of all medium-scale enterprises can be considered active in the field of innovation, while in the group of small-scale enterprises only 26.5% are identified as innovative. Innovation performance of small- and medium-sized enterprises is affected both by the limited human resources and own financial resources available to these enterprises for the implementation of research, development and innovation activities, including a limited opportunity to attract funding due to the high technological and business risk. It must be noted that 64% enterprises out of 30.4% active in the field of innovation from 2010 until 2012, had implemented innovations of products and processes, while 36% of all innovative companies had implemented marketing or organizational innovations. According to data of the CSB, the total financing for research and development (R&D) in Latvia in 2013 decreased and was 0.6% of GDP or EUR 139.2 million (in 2012 – 0.66% or EUR 145.4 million).

In Latvia, just as elsewhere in Europe, SME form a major part of the national economy and play a significant role in building the GDP and in employment. According to the CSB preliminary data, there were 93 775 economically active individual merchants and commercial companies in Latvia in 2013 (excluding farms, and fish farms and self-employed persons, who perform economic activity), 99.6% of which belonged to the category of SMEs.

The breakdown of economically active SMEs in Latvia is the following: micro-enterprises – 86.2%, small enterprises – 11.1%, medium-sized enterprises – 2.3%, large enterprises – 0.4%.

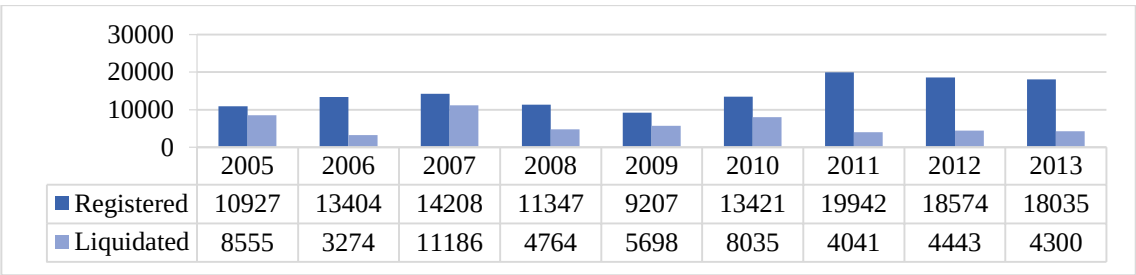
Table 4

Dynamics of active merchants and commercial companies in relation to the total number of registered subjects in Latvia (2005-2013), (percentage)

Category of enterprises	2005	2006	2007	2008	2009	2010	2011	2012	2013
Micro	78.1	77.7	76.9	78.6	82.5	83.9	84.94	85.5	86.2
Small	17.8	17.9	18.7	17.3	14.1	12.9	12.08	11.7	11.1
Medium	3.6	3.8	3.8	3.5	2.9	2.7	2.51	2.4	2.3
Large	0.5	0.6	0.6	0.6	0.5	0.5	0.47	0.47	0.4

Source: prepared by the author based on the data of the CSB

The data in the Table 4 demonstrates that the percentage of micro enterprises is increasing. An important indicator characterizing economic activity is the number of economically active merchants and commercial companies per 1000 inhabitants. This indicator in Latvia has grown constantly over the last 10 years.



Source: prepared by the author based on the data of the CSB

Fig. 4. **Dynamics of registered and liquidated subjects (2005-2013), units**

Figure 4 shows that the peak in the number of registered and closed enterprises are closest in 2007. That year 14208 subjects were registered and 11186 enterprises closed. In 2008 and 2009, there was a steady trend of reduction in the number of registration of new enterprises and the increase in the number of those closing.

In 2010, the registration of new enterprises increased, but so did the number of closed enterprises. This trend correlates with the growth in the number of micro-enterprises and also with the reducing numbers of the small and medium-sized companies. According to the statistics of the CSB 18 035 subjects were registered and 4 300 subjects were liquidated in the year 2013. The current practice of the responsible EU institutions shows that calculation of the number of enterprises per 1000 inhabitants includes not only individual merchants and commercial companies, but also performers of individual work, farms, and fish farms, etc. Therefore, by applying an analogous practice, in 2013 in Latvia there were 78 performers of economic activity per 1000 inhabitants.

The level of entrepreneurship and its nature vary widely between Member States, and there as ones for low enthusiasm for an entrepreneurial career are therefore diverse. Some Member States with higher levels of entrepreneurship are less successful than others at helping new and small enterprises to grow. Generally would-be entrepreneurs in Europe find themselves in a tough environment: education does not offer the right foundation for an entrepreneurial career, difficult access to credits and markets, difficulty in transferring businesses, the fear of punitive sanctions in case of failure, and burdensome administrative procedures. (Entrepreneurship 2020 Action Plan, 2013) According to the definition of small business by the Small Business Act of 1953 in the United States, a small business is one that is independently owned and operated and not dominant in its field of operation. The basis of national competitiveness is the existence of competitive businesses, whose success depends on the factors of entrepreneurship environment. For successful economic transition to a new stage of development, it is necessary to solve a series of questions, and first we need entrepreneurs who are ready to start their own business and to set up new companies. (Hodgetts R., Kuratko D., 2002) Enterprises are relatively stable organizations and institutions of the economy – the host in different countries and periods of history, various legal forms, especially ownership – which, thanks to its many outdoor and potentially autonomous abilities (goals) provide households with higher long-term utility owned by them capital (human, tangible, monetary, intellectual, social) than they themselves could achieve by their own management in a market economy, the state, or any thereof mix. More than 99% of businesses in Europe are SME that employ more than a half of the employed. (Noga A., 2009)

3. The main milestones of the controlling process

It is widely recognized that management's functions include planning, organizing, staffing, directing and leading, controlling, and coordinating. It is management's responsibility to put enterprise resources to use, sometimes taking risks, to achieve the goals of the organization, whether it be to earn a profit (in the private sector) or provide a social service (in the public sector). Management sets goals and formulating policies, developed plans to achieve goals within the framework of the entity's policy guidelines, implements programs of action designed in accordance with the plans, maintains information systems to report progress towards achieving the specified targets, and reviews the results of all of these activities, identifying needed changes to goals, policies and plans. (Garrison, R., 2003)

In each company, there are four hierarchical levels of management: material, operative, strategic and intellectual. These levels of management are responsible tasks connected with running the enterprise. The first two levels (material and operative) are concerned with operative controlling and the last two levels (strategic and intellectual) are concerned with strategic controlling. In German academics' understanding controlling is:

- a form of corporate management which is holistic, target-oriented, future-based and problem-solving in nature
- a system involving objectives and planning, organisation and implementation, supervision, steering and directing
- a method of corporate management which is contemporary, success-oriented and well-versed with targets and figures.

Controlling involves the action designed to ensure that an entity is successful in achieving its objectives. In an organization, this usually involves managing people in such a way as to elicit their best efforts on behalf of the organization. The controlling process consists of:

1. Goal-setting, governed by the overall objectives of the organization, its owners, members or managers; goals could be specified in terms of the expected behaviour of individuals or in terms of the expected outcome.
2. Performance monitoring and measurement, based on observation of behaviours and/or outcomes.
3. Comparison of goals and achievements and identification of variations between them, particularly significant under-achievements.
4. Seeking explanations for variations between goals and achievements, especially under-achievements.
5. Rewarding success and taking steps to reduce or eliminate causes of failures to achieve goals.
6. Following-up to ensure that actions taken in connection with problems are adequate.

Controlling hierarchical perspective:

- Strategic planning, carried out at the top levels of the organization, is a process of deciding on goals and selecting strategies for attaining those goals.
- Managerial control, carried out at the middle management levels of the organization, is a process of ensuring that departmental plans and programs designed to fulfil the strategic plans of the organization are carried out.
- Operational control, carried out at the operating levels of the organization, is a process of ensuring that specific tasks are carried out properly and efficiently.

The economic communications globalization, information technologies development, technological progress, competition and market requirements it processes, which characterize the present stage of the world economy development. The modern enterprise is a complex system that has developed on the basis of scientific and technical progress, the rapid changes in the external environment and highly competitive environment. In these conditions the achievement their strategic targets is not a simple task. For the operative decision-making, every manager need timely and relevant information about the changes occurring both in external and internal enterprise environment, therefore enterprise management system must be constantly improved. For the survival and development of the enterprises, especially small, they must adapt not only to rapidly changing environmental conditions, but also to the speed of changes.

Controlling enables management to adapt the enterprise to changes in the environment by the process of the planning and to carry out any coordination functions that may be necessary. Being on crossing of the accounting, a supply with information, the control and planning, controlling takes a special place in operation of business: it connects together all functions of the enterprise, integrates and coordinates them, and does not just substitutes for operation of business, but also gives it a qualitatively new level.

In the knowledge-driven economy, innovation has become central to achievement in the business world. Controlling tools with their typical interaction of planning, information gathering and control in the controlling cycle are highly important for future success.

4. Main aspects of the problems of young and innovative companies

The main part of the problems and its categories. The categorization follows of the value chain of the company according to M. Porter:

- Strategy-related problems. This includes problems the company is positioning in the market, such as the search by application technology, pricing issues and the expansion of the company.
- Process-related problems. This includes both problems along the main processes of value chain, such as product development, procurement, production, marketing and sales, as well as problems in supporting processes such as organization, staffing and financing. (Porter, M. E., 2001)

Strategy-related problems. According to Porter, new firms are one of three-market entry strategies follow:

- a niche strategy, under which it customers in a small market segment with tailor-made solutions operate;
- a differentiation strategy in which the company tries (by brand image, product design, product or service quality) of his to distinguish competitors to be the price leader in its market to gain;
- to strive for cost leadership ultimately means the cost structure of to optimize the company, thereby a competitive advantage gain. (Porter, M. E., 1999)

Process-related problems. Young and innovative companies are characterized by flat hierarchies and little differentiated processes and object distributions. "Many Ventures experience a sequence of functionally localized problems as each function faces the difficulty of building of efficient and effective task system". (Kazanjian, R. K., 1988) Problems in the procurement and production process as well as in research and development: problems in the procurement and production process as well as in research and development of young companies that are in the start-up phase, but there is no separation between a production process and a research and development process. The main task of the founders is to provide a functioning to develop prototypes, out of the then in succession a marketable product must arise. (Block, Z., MacMillan, I. C., 1985) The product and the production process for the preparation of the product should be in the first phase of life in a stage of development of an experimental nature. The smaller firm will be constrained in its R & D to emphasize low risk, near-to-market development to known customer's requirements, at the expense of more speculative longer-term research; to innovate on a very short time-scale, oft less than one year in duration; to avoid collaborative research and development projects. Personnel-related and organizational problems: many companies see themselves as they grow personnel on the founding team also want or need, confronted with various personnel-related problems. The industry experience of employees is a key success factor for young innovative companies. However, qualified and experienced staff is problematic for company in almost every phase. (Kazanjian, R. K., 1988) Problems of corporate finance: innovative companies are often faced with the problem that the implementation of a costly innovative product idea into a marketable product. Development activities are necessary. The growth of young, innovative companies is so strong broken. (Terpstra, D. E., Olson, P. D., 1993) This is especially true for companies in research and development-intensive areas where high expenses for the further development of needed products. (Westhead, P., Storey, D. J., 1997) The reasons for the

reluctance of venture capital to companies in the very early stages of development are in particularly high risks associated with an investment in very young company. Market risk: it is difficult to estimate the market potential for products it does not yet exist, especially when a new market for them still to be established must be. Technological risk: the innovative technology has in practice not yet proven and its development may require more time than predicted by the founders. Especially in fast moving markets where several technologies compete with each other, constantly threatening danger, that the company is overtaken by a competing technology. Valuation risk: the assessment of growth of young, innovative companies depends strongly on the value of intangible assets such as patents, trademarks, and employees. Growth risk: technology-based companies are subject to constant pressure to grow in a short time, its internationalize and to developing new products. This pressure makes high demands on corporate governance, particularly in the area of corporate finance and product development. (Mason, C. M., Harrison, R. T., 2004) In addition to the problems that can be assigned to individual processes can be found that one of the main reasons for the failure young company a general lack of management skills and industry experience.

Innovation is therefore a key business process and as such, innovative capabilities are by definition becoming key capabilities. The outcome of this is the high significance of importance for measuring innovative capabilities, identifying strengths and weaknesses and formulating strategies for maximising advantage whilst improving upon weaknesses, to key managerial activities. Innovation can be divided into three activities: innovation, development and commercialization. Innovation includes all activities that target the various observations connecting to create business ideas that can be turned into business concepts or models and further developed in a project or business plans. The development is associated with a business plan for the implementation and development of new products or services, creation, and other processes related to quality, time, cost and capacity. Commercialization includes activities necessary for the different stages of the product life cycle to maximize the products or services added market value. Pre-project phase management techniques must be completely different. This process is characterised by trial and error behavior with many feedback loops. These differences mean that the management of the processes in these phases has to be total different from each other. Whereas the commercialization phase is characterized by reasonably accurate prediction of sales and production and repetitive activities, the development phase is characterized by rough estimates of throughput times, costs and results of non-repetitive activities in which professionals are involved. In the pre-project phase, management must be completely different, more facilitating, coaching, and managing the key part of the innovation process. In the commercialization phase the classic management paradigm of planning and control dominates. In the development phase, project management is the dominant management approach. Innovation must be controlled, paying particular attention to value creation, risk and performance. Within innovation management, there are two clusters of management activities: controlling and supporting management activities. All these activities have an important role in the commercialization and development phase. However, in order to facilitate the transition between phases, all these activities should also be considered a pre-phase. Innovations have to be controlled with regards to value creation, risk and performance. Supporting management activities refer to process, competence and resource management. All these management activities play important roles in the development and in the commercialization phase. The innovation process in the first part of the pre-project phase from scanning the environment to creating new business

ideas is also named ideation and its management idea management. Ideation is followed by transforming the business idea into a business concept and next into a business- or project plan. To do this, one develops a business case and subsequently a plan. This is one of the most critical phases of the innovation process, and still one of the white spaces in management in a lot of companies. One of the main activities in this phase is building a set of linked models and validating them, what helps to estimate the technical, commercial and economic feasibility of the idea. The commercialization phase above all has to do with the commercial exploitation of the developed innovation. It is important that continuous monitoring takes place to determine whether the assumptions regarding customers, market and competitors are still valid. If there are observed changes in customer preferences, the introduction of competitive new products or technologies, the company's strategy should be adapted to these changes. When the innovation is implemented, managers of the project have to monitor constantly the environment and the activities inside the company to control the direction to goals and adjust the strategy.

In the methodology of controlling highlights, the fact that the management is very important to adhere to the principles of systemic evaluation of the results obtained in the individual phases of the project. In accordance with the concept and methodology of controlling, controlling not confined to accounting and control. Controlling methodical and information support as the planning process itself, and the other management functions. That is the main function of the controlling in the projects is information- analytical and methodological support for the planning, accounting, control and analysis of the parameters of the project and advice management when making decisions about further progress in the implementation phases of the project. Most of the work on project management focuses on the operational tasks of controlling. This is justified for projects with a low level of innovation. However, when it comes to innovative projects, it seems reasonable allocation, both operational and strategic levels of controlling functions and tasks are quite different. The strategic aspect of controlling support decision-making about the direction of innovation, based on the tools of strategic controlling. Based on the analysis of opportunities and risks, as well as the strengths and weaknesses of the company, controlling helps managers sift strategically unpromising ideas. Operative controlling is largely aimed at supporting the processes of planning, monitoring and adjustment of the current progress of events.

The management of the enterprise formulates the goals of the innovative project using the procedure of forming of the structural plan, which is divided, into separate objectives and actions. The controllers are responsible for developing methods and tools for planning, which are making available to the management of the project team. And then is planned the list of activities, based on the specification of works; the terms (time), of the implementation plans for the individual phases (functions, objects) project; resources determined from the plan of activities; the costs, determined in the budget. For complex innovative projects with high levels of innovations and uncertainty, it is proposed to use the principle of phase planning. Its essence lies in the fact that on earlier phases have to be provided with alternative options, the time for the alternative options and clear costs. This approach allows us to reduce the risks and cost overruns.

Conclusions

New technologies and innovation play an important role in the economic growth. Market oriented innovation has become especially important to the companies, there sustainable

development. The main tasks of the controlling of the projects of innovative companies are coordination and information supports of the company's management in the achievement the increase effectiveness of innovation. The commercialization of technology very complex process that requires at its different stages of various tools of controlling. As showed interview of Latvian entrepreneurs, who are engaged in the commercialization of technologies, conducted by the author, entrepreneurs often underestimate the possibility of integrating tools of controlling in the commercialization process. A high level of variability of management decisions under uncertainty makes the process of technology commercialization, despite the clear and specific objectives, the process with unpredictable results. Sometimes the process of commercialization of technology leads to the fact that it is not the technology, but only its core competence becomes the basis for the birth of innovation project. Controlling questions at different stages of innovation projects in the practice of Latvian innovative companies in need of detailed studies.

Bibliography

Block, Z. und MacMillan, I. C., 1985. Milestones for Successful Venture Planning. in: Harvard Business Review 63 (5), pp. 184-196.

Economic Development of Latvia, 2014. Report of Ministry of Economics republic of Latvia.

European Commission. Entrepreneurship 2020 Action Plan Brussels, 9.1.2013. COM (2012) 795 final Entrepreneurship: Theory, Process, and Practice. Donald F. Kuratko, 9 th. ed., 2008, 592 p.

Garrison, R., Noreen, E. Seal, W. Management Accounting, London, McGraw-Hill, 2003, 48 p.

Hodgetts, R.M., Kuratko D.F., 2002. Effective Small Business Management. 7 th. ed., 658 p.

Kazanjian, R. K., 1988. Relation of Dominant Problems to Stages of Growth in Technology-Based New Ventures. in: Academy of Management Journal 31 (2), pp. 257-279.

Mason, C. M. und Harrison, R. T., 2004. Does Investing in Technology-Based Firms Involve Higher Risk? An Exploratory Study of the Performance of Technology and Non-technology Investments by Business Angels. in: Venture Capital, pp. 313-332.

Noga, A., Teorie przedsiębiorstw, Warszawa, PWE, 2009, 360 p.

Pande, J., 2009. Enterprising Entrepreneurship: Concepts and Guidelines. Delhi, IND: Global Media, 137 p.

Porter, M. E., 1999. Wettbewerbsstrategie – Methoden zur Analyse von Branchen und Konkurrenten, 10. Aufl, Frankfurt a. M., New York, Campus.

Porter, M. E., 2001. Strategy and the Internet. In: Harvard Business Review 79 (3), pp. 62-78.

Ratanova I., Gross E.. The Controlling System in Management of SMEs Enterprises Projects in Latvia: Issues of Formation. Conference proceedings. Project Management Development – Practice and Perspectives, 2014, 199-214 p.

Ratanova I., Reshina G., Bruna S., Gross E., 2013. Development of Small and Medium-Sized Enterprises in Regions of Latvia. Region Formation & Development Studies, Issue 11, pp. 189-198. 10 p., ISSN 2029-9370.

Ratanova I., Žukovska J., 2011. "Controlling as a tool for increasing the efficiency of business management of small and medium-sized enterprises in Latvia". Conference proceedings. Riga: University of Latvia, 546 p., pp. 233-239.

Science, technology and innovation in Europe Pocketbooks. ISSN 1830-754X, 2013 edition.

Terpstra, D. E. und Olson, P. D., 1993. Entrepreneurial Start-Up and Growth: A Classification of Problems. in: Entrepreneurship: Theory & Practice 17 (3), pp. 5-29.

Westhead, P. und Storey, D. J., 1997. Financial Constraints on the Growth of High Technology Small Firms in the United Kingdom. In: Applied Financial Economics 7 (2), pp. 197-201.

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EXTENDING PROJECT MANAGEMENT PROCESSES AND INTRODUCING NEW PROCESSES FOR SUSTAINABILITY

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Abstract

The development of processes is important to improve project management. We need extensions of processes described and derived from PMBOK® (Project Management Institute (PMI), 2013) and we need additional processes for several knowledge areas and process groups. We also need contributions in new areas like sustainability. In this paper we focus on 2 aspects of process extensions:

- Extension of processes where inputs must be split. We show cases in the context of "Enterprise Environmental Factors/Organizational Process Assets".
- Introduction of processes for sustainability in project management.

Key words: *project management, project management processes, project management standards, PMBOK®*

JEL codes: O21, O22

Introduction

The development of processes is one of the core issues of project management. PMBOK® is an important standard with 46 processes supporting project management in project phases and across knowledge areas (Project Management Institute (PMI), 2013). Regarding the processes in PMBOK® there are many weaknesses:

1. Many processes are missing. Most parts of the table on knowledge areas and process groups are empty – as shown in figure 3. In the initialling phase processes checking lessons learned and discovering preconditions for the processes of the knowledge area are missing for example.
2. The set of knowledge areas is not complete. The knowledge area on stakeholder management had been introduced in the last edition of PMBOK®. Processes from the knowledge area of communication management moved to the new knowledge area.
   A knowledge area on project finance is missing in PMBOK® – there are some contributions in the program guide of PMI® – but a bridge to PMBOK® is missing.
   Now a new knowledge area on sustainability should be introduced as discussed below.
3. Many processes are fuzzy – a core problem is the fact that the description of inputs, tools and techniques and outputs are very open. One important input of several processes is "Enterprise Environmental Factors/Organizational Process Assets". This input type must be subdivided to specify and separate issues like:
   - Legal aspects;

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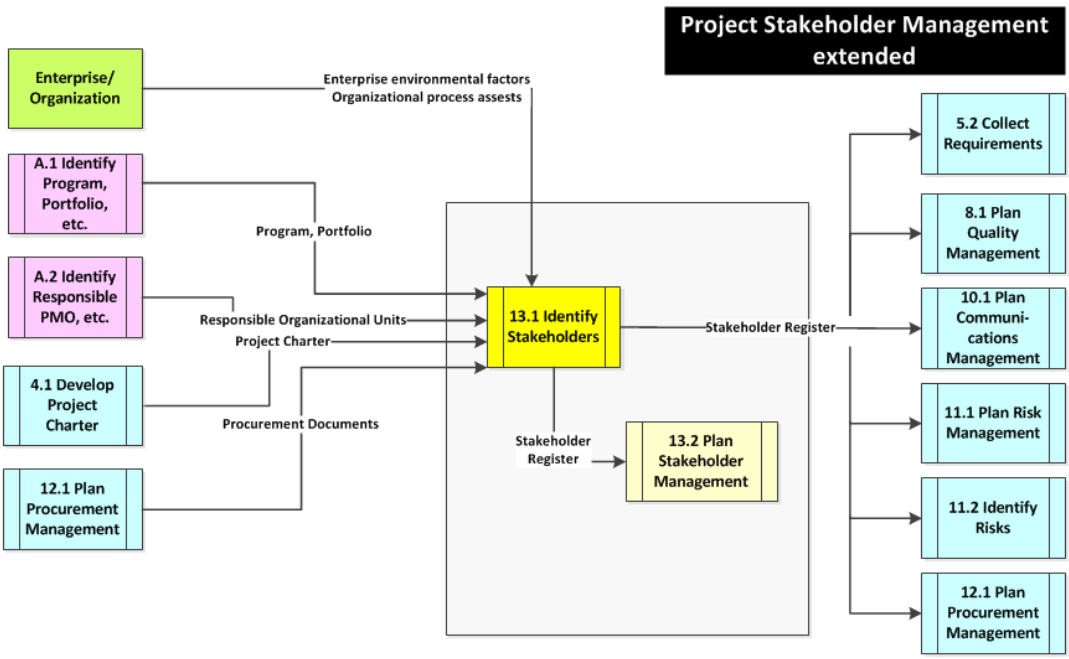
- Norms and general standards;
- Application standards;
- Given enterprise standards and strategies.

Without a subdivision here a clear specification of control processes for example is not possible – as shown below.

In this paper we start with the extension of processes where inputs must be split. We show cases in the context of "Enterprise Environmental Factors/Organizational Process Assets". Then we deal with the introduction of processes for sustainability in project management. All contributions on process improvement and process extensions lead to a new representation of processes – web-based, multilingual, and open to magnify the view on processes. This cannot be discussed in detail here.

Process Extensions

Here we focus on a process extension related to the input "Enterprise Environmental Factors/Organizational Process Assets" of PMBOK® – a fuzzy input for several processes. It includes very general "organizational or environmental factors" like labour law, or trade regulations, and other "organizational or environmental factors" that are really linked to a project like the responsible project management office (PMO) or the program the project belongs to. We take out all such factors with a direct link to the project out of the "PMBOK®" – box as shown in figure 1 below.



Source: Project Management Institute (PMI), 2013

Fig. 1. **Process Extension of "Identify Stakeholders" of PMBOK®**

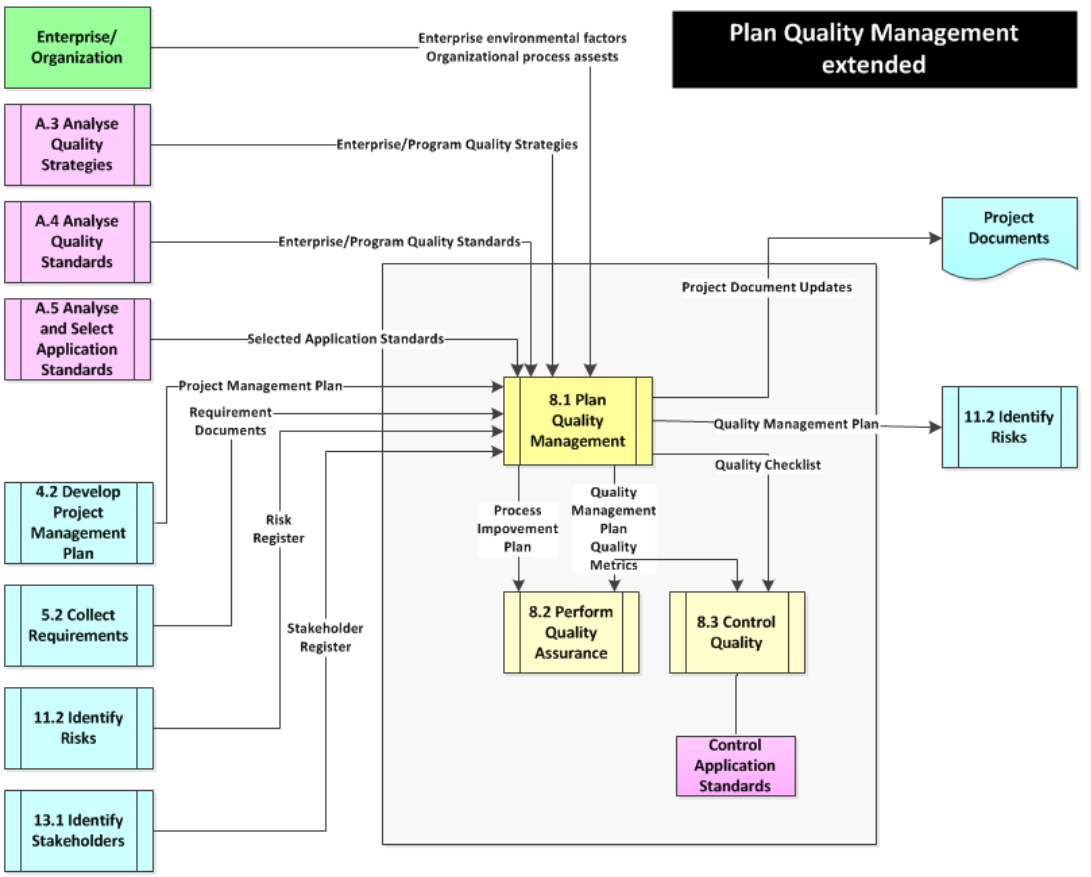
We take out the identification of the program and portfolio, and the identification of the responsible PMO to give additional information to the process 13.1 "Identify Stakeholders". The program of the project and the responsible PMO should not be regarded as an anonymous Enterprise "Environmental Factors" or "Organizational Process Assets". We need clear project related information on the program and the responsible PMO to start the identification of stakeholders.

In figure 2 we extend the inputs of process 8.1 to "Plan Quality Management" by:

- Analyse quality strategies;
- Analyse quality standards;
- Analyse and select applications standards.

The input is delivered by new processes. Without the information on strategies and standards a quality management plan cannot be established.

And with the additional information we can also improve quality control by a submodule on the control of application standards – as shown in figure 2.



Source: Project Management Institute (PMI), 2013

Fig. 2. **Process Extension of "Plan Quality Management" of PMBOK®**

With the new process A.3 we analyse the quality strategy of an organization and define the impact of this strategy on the project. In A.4 we define a process to analyse existing quality management standards and to select and define those to be applied in the project. And we define a process to analyse and define application standards for the project. Application standards are used very often, for example for software development. With the extended diagram we want to make important aspects of processes more visible – aspects that are lost in the "blackboxes" in PMBOK® today. The information we need anyway in projects. And we need such process extensions in many areas of project management – and on many PMBOK-processes. The figure above just shows a few aspects of Project Quality Management.

Process extensions for sustainability project management

In PMBOK® so far we have no significant contributions on sustainability. In figure 3 we introduce a new knowledge area on managing sustainability in project management with a core set of processes.

Project Management including Sustainability

Sustainable Project Management

Must be based upon the strategic and operational aspects of sustainable management

ISO 14000, 26000, GRI, ESD, ...
Sustainability issues of the program
Application standards
Organizational standards regarding sustainability

GRI Global Reporting Initiative
ESD Education for Sustainable Development

Initiating	Planning	Executing	Monitoring Control	Closing	Process Groups / Knowledge Areas
Project Charter	Project Management Plan	Manage Work	Monitor, Control	Close Project	Integration Management
	Scope, Requirements, WBS		Control Scope		Scope Management
	Plan Schedules, Resources, ...		Control Schedule		Time Management
	Plan Costs		Control Cost		Cost Management
Analyse and determine Strategies and Standards to use	Plan Quality Management	Perform Quality Assurance	Control Quality		Quality Management
Analyse and determine Strategies and Standards to use	Plan Sustainable Management	Perform Sustainable Project Execution	Control Sustainable Project Execution	Collect and submit lessons learned	Sustainability Management
	Plan HR Management	Perform HR Management			Human Resource Management
	Plan Communications Management	Manage Communications	Control Comunication		Communicati o Management
	Identify Risks, Plan Risk Management, Analyse Risks		Control Risks		Risk Management
	Plan Procurements	Peform Procurements	Control Procurement	Close Procurements	Procurement Management
Identify Stakeholders	Plan Stakeholder Management	Manage Stakeholers	Control Stakeholders		Stakeholder Management

Fig. 3. **New knowledge area for sustainability in project management**

The new knowledge area also has a strong link to quality management. We include a new process on the analysis and determination of strategies and standards to be applied – in quality management and in project sustainability management.

Sustainability management is based upon standards – some mentioned in the figure – further more on sustainability issues of the program the project belongs to, on application standards, on organizational standards, etc..

Figure 4 shows the flow diagram for the first processes of the new knowledge area.

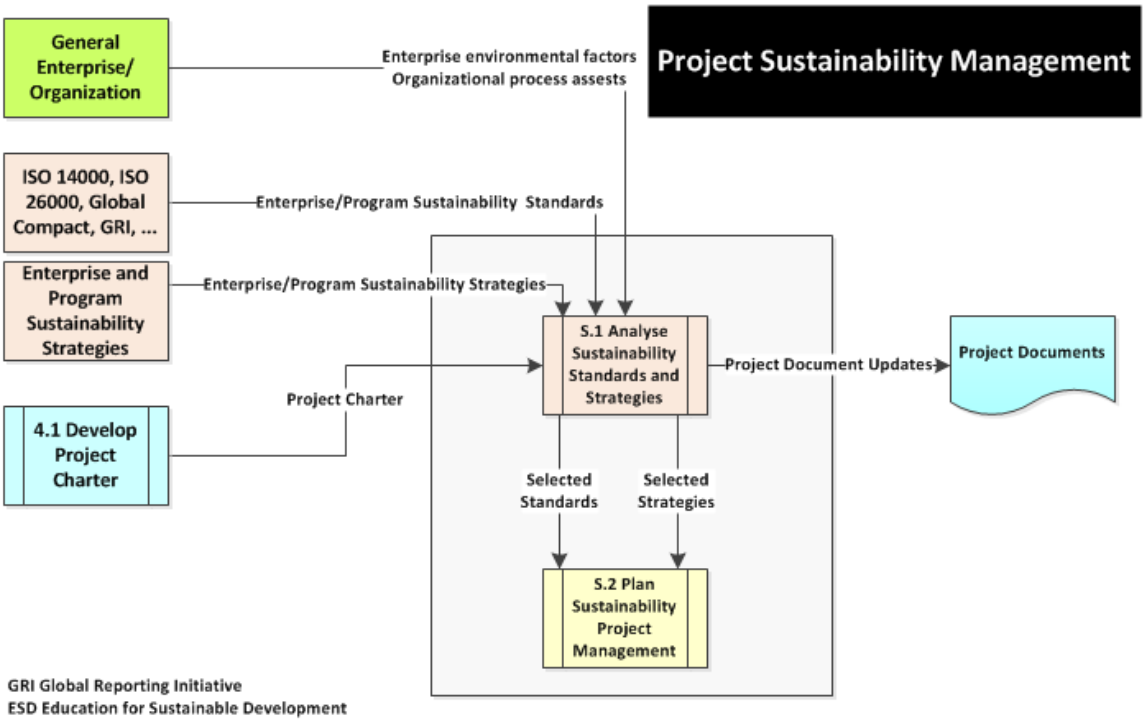


Fig. 4. **Selected processes of the new knowledge area for sustainability in project management**

Results and conclusions

The author works on the extension of project management processes since many years. Here only a short introduction is possible. The first case – to split "Enterprise Environmental Factors/Organizational Process Assets" – is an important step to improve PMBOK® processes significantly. The second case introduces a new knowledge that we need soon – more information is available in complementary conference contributions and lecture notes (Reusch, Peter J. A).

For the processes a graphical representation was first developed on Microsoft Visio. Based on these process models we introduced a multilingual approach also of extended processes. In the next step the multi-lingual graphical representation with additional information

will be put on a web-portal where process maps are based on Scalable Vector Graphics (SVG) (Deependra Prasad Acharya, Kamal Marasini, 2015).

Bibliography

Reusch, Peter J. A., 2015. Sustainability in Project Management, International Research Conference at the University of Applied Sciences and Arts in Dortmund, Germany, 2015.

Reusch, Peter J. A., 2015. Project Management Processes, EuroMPM lecture notes, Dortmund/Bilbao.

Reusch, Peter J. A., 2014. Dependency Management in Projects, Third International Scientific Conference on Project Management in the Baltic Countries – Riga.

Reusch, Peter J. A.; Reusch, Pascal, 2013. How to Develop Lean Project Management?, Intelligent Data Acquisition and Advanced Computing Systems – IEEE-IDAACS – Berlin.

Reusch, Peter J. A.; Ojeda, Omarly, 2013. Sustainable Procurement – Extending Project Procurement Concepts and Processes Based on PMBOK, Intelligent Data Acquisition and Advanced Computing Systems – IEEE-IDAACS – Berlin.

Reusch, Peter J. A., 2013. Responsibility and Sustainability in Projects, International Research Conference at the University of Applied Sciences and Arts in Dortmund.

Deependra Prasad Acharya, Kamal Marasini, 2015. Multilingual and multidimensional graphical representation of project management processes, Master Theses, Dortmund.

Project Management Institute (PMI), 2013. A Guide to the Project Management Body of Knowledge – PMBOK, New Town Square, Pennsylvania.

Project Management Development – Practice and Perspectives
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TRIZ IN PROJECT MANAGEMENT

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Maria Zadnepryanets, University of Applied Sciences and Arts, Dortmund, Germany[1]

Abstract

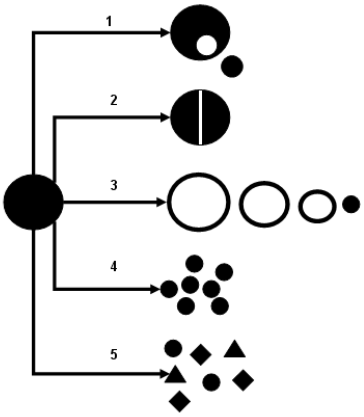
In projects we need concepts, methods and tools to support creativity with respect to creative problem solving, to improve management and to stimulate innovation. TRIZ can help here in many aspects. We show how TRIZ principles can be shaped and used in project management. And we show how TRIZ can help to develop sustainability in project management.

Key words: *project management, TRIZ, problem solving, creativity, innovation, sustainability*

JEL codes: O21, O22, O31

Introduction

TRIZ – *теория решения изобретательских задач* – the theory of inventive problem solving – was created by Genrich Altshuller (Altshuller, Genrich, 2001) in 1946 based on the analysis patents. He detected that many innovations in patents were based upon 40 principles like segmentation, preliminary action, skipping, etc. (R.Langevin, 2013, TRIZ40). TRIZ was recognized as one of the most powerful tools to support creative problem solving – first in the technology sector where TRIZ had been created – but later in many other areas like management (M.Darrell, 1999, 2007).



Source: Reusch, Peter J. A, 2009

Fig. 1. **Perspectives of segmentation**

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One reason for the success of TRIZ is the fact that the principles are very strong and stimulate problem solving. The first principle on segmentation gives not only the hint to put a system or an organization into pieces to improve operations; it also stimulates further considerations on different kinds of segmentation – segmentation into similar parts, different kinds of parts, etc. as illustrated in the figure below. It is the question what, how, why, and when to put something into pieces.

TRIZ has also been used in project management as discussed in (Reusch, Peter J.A, 2009), (Bersano Giacomo, Riches Tony, Bhushan Navneet; Iyer, Karthikeyan, 2008) for example.

1. TRIZ in Project Management

In project management we need creativity to support creative problem solving and support innovation. Creativity is one of the competences for project management according to the International Competence Baseline – ICB – of the International Project Management Association – IPMA – and introduced the following way:

"Creativity is the ability to think and act in original and imaginative ways. The project manager exploits the creativity of individuals, the collective creativity of the project team and the organization." (ICB – IPMA Competence Baseline, 2006) IPMA ICB3 page 100.

Advanced concepts and methods to support creativity and creative problem solving are not mentioned in ICB3 – ICB3 only gives a general introduction and refers to brainstorming and other basic approaches. TRIZ is not mentioned in ICB3, but there are other proposals to use TRIZ in project management since many years – like (Bersano Giacomo, Riches Tony, Bhushan Navneet; Iyer, Karthikeyan, 2008).

TRIZ is a complex concept with various methods and tools. Here we focus on the first module of TRIZ – TRIZ principles describing actions to solve problems and influence parameters. The table below lists the classical TRIZ principles created by Genrich Altshuller. In many cases these principles contributed to innovations Genrich Altshuller detecting in patents. In the realm of patents the principles were described and applied successfully.

Table 1

Classical TRIZ Principles

1. Segmentation.	24. Mediator, intermediary.
2. Extraction, Separation, Removal, Segregation.	25. Self-service, self-organization.
3. Local Quality.	26. Copying.
4. Asymmetry.	27. Cheap, disposable objects.
5. Combining, Integration, Merging.	28. Replacement of a mechanical system with "fields".
6. Universality, Multi-functionality.	
7. Nesting.	29. Pneumatics or hydraulics.
8. Counterweight, Levitation.	30. Flexible membranes or thin film.
9. Preliminary anti-action, Prior counteraction.	31. Use of porous materials.
10. Prior action.	32. Changing colour or optical properties.
11. Cushion in advance, compensate before.	33. Homogeneity.
12. Equipotentiality, remove stress.	34. Rejection and regeneration, Discarding and recovering.
13. Inversion, The other way around.	

14. Spheroidality, Curvilinearity. 15. Dynamicity, Optimization. 16. Partial or excessive action. 17. Moving to a new dimension. 18. Mechanical vibration/oscillation. 19. Periodic action. 20. Continuity of a useful action. 21. Rushing through. 22. Convert harm into benefit, "Blessing in disguise". 23. Feedback.	35. Transformation of the physical and chemical states of an object, parameter change, changing properties. 36. Phase transformation. 37. Thermal expansion. 38. Use strong oxidizers, enriched atmospheres, accelerated oxidation. 39. Inert environment or atmosphere. 40. Composite materials.

Source: Altshuller, Genrich, 2001

Some of these principles can be used in many areas – like segmentation, extraction, local quality, asymmetry, universality, or feedback. Here a direct application of TRIZ is possible – shaped by typical perspectives of project management. Other principles like phase transition or thermal expansion must be adapted.

2. Shaping TRIZ Principles for Project Management

The derivation of TRIZ principles for business and management by Darell Mann (Mann, Darrell, 2007) can be used as a starting point for the derivation of TRIZ principles for project management in general as shown in this section.

In the last 2 years the authors organized workshops to shape TRIZ principles for project management. The results are mainly based on project management experience of participants. 11 out of 40 principles are discussed below – more information is available in lecture notes (Reusch, Peter J.A.; Zadnepryanets, Maria, 2015) and further conference contributions (Reusch, Peter J.A.; Zadnepryanets, Maria, 2015).

Proposals to shape **principle 1 on segmentation** include:

- Identify and develop competences;
- Define roles and responsibilities;
- Assign work based on roles, responsibilities, and competences;
- Take care of disposals, and wishes;
- Communicate and explain distribution of work, improve acceptance, reduce resistance;
- Improve distribution of work;
- Avoid double work / avoid doing the same work twice.

Proposals here are mainly focused on human resource management. There are often problems in project management when roles and responsibilities are not well defined. The proposals above can help to avoid or reduce such problems.

Proposals to shape **principle 3 on local quality** include:

- Develop competence centre for project management in general and for special tasks like procurement, or risk management;
- Use synergies and lessons learned;
- Develop compensation based on results, competences and responsibilities;

- Develop trust in the project – among all stakeholders;
- Develop tolerance and the appreciation of staff.

Proposals here are mainly focused on project organization. Competence centre can be organized as project management offices or as enterprise project management offices. Furthermore the development of trust and tolerance in project management is important.

Proposals to shape **principle 4 on asymmetry** include:
- Develop communication according to the needs and expectations of stakeholders;
- Communicate in a way that stakeholders can follow and can be involved;
- Use front office concepts for direct communication that can be managed directly and use back office concepts for complex requests that need more time;
- Develop complaints management;
- Develop a wide variety of competences in project;
- Develop diversity management.

Uniform approaches for communication and stakeholder management often fail because they do not meet the needs and expectations. The recognition of diversity among stakeholders is important in project management. Complaints management supports feedback.

Proposals to shape **principle 8 on antiweight** include:
- Detect and compensate strengths and weaknesses in teams;
- Develop cooperation among experts and novices;
- Develop networks;
- Include novices in projects.

Such proposals are focused on aspects of human resource development. In project management one can introduce an antiweight with novices with respect to the experienced experts – and so one can prepare the experts for future experts.

Proposals to shape **principle 10 on preliminary action** include:
- Develop project culture;
- Create a mission statement of the project;
- Develop identification and involvement of people in projects;
- Stimulate and discuss proposals of people in projects;
- Integrate people in communication and decision making.

Such proposals can improve leadership and can increase the power of project teams.

Proposals to shape **principle 17 another dimension** include:
- Develop external reviews and audits for the project;
- Stimulate and analyse feedback;
- Integrate customers and suppliers;
- Compare own concepts, approaches, and results with others – benchmarking;
- Develop organizational structures.

The “other dimension” or perspectives of reviewers and auditors are often underdeveloped and standards for project audit are rather young so far (Reusch, Peter J. A., 2011). Benchmarking can also help and can support the management of changes for example.

Proposals to improve **principle 21 on skipping** consist of several clusters, one on **reducing waiting time**

- Fast execution of processes;
- Improve interfaces and standardize interfaces;
- Reduce waiting time, queue time – esp. waiting time on occupied communication lines;
- Reduce inactive period due to sick leave;
- Install deputies, substitutes;
- Accelerate reoccupation;
- Reduce time experts spend on standard jobs – check options for outsourcing;
- Reduce bureaucracy.

Proposals to improve **principle 23 on feedback** include:

- Develop various kinds of feedback – from internal and external stakeholders, from customers and suppliers;
- Develop different kinds of feedback channels;
- Develop anonymous actions – questionnaires, complaints boxes, suggestion boxes, etc.;
- Develop surveys on various perspectives – health and safety, stress, job satisfaction, issues in leadership.

Feedback is a big issue in project management and continuous improvement of feedback should be on the agenda of project managers. Often there are people in teams and organizations that hesitate to give feedback because they are afraid of negative consequences. Some people have their barriers – they avoid any kind of communication. It is hard to dig for feedback here. In many cases anonymous actions can help.

Proposals to shape **principle 24 on mediator, intermediary** include:

- Install mentors, coaches and mediators;
- Train conflict management;
- Communicate conflicts.

The installation of mentors to support novices or mentees can improve human resource development and can stimulate team work. In all teams and organizations are conflicts – at least from time to time. So conflict management support project management – and is also a competence in ICB 3 (ICB –IPMA Competence Baseline, 2006).

Proposals to shape **principle 31 porous materials** include:

- Improve collection and dissemination of information;
- Develop appropriate tools for sharing information and knowledge immediately;
- Develop a culture of free communication;
- Open doors.

The application of "porous materials" is a very technical principle at first sight. But the examples above show that a transfer to project management is possible and can help to improve project management.

Proposals to shape **principle 40 composite materials** include:

- Collect and develop a broad variety of competences;

- Install multicultural and multidisciplinary teams;
- Stimulate ideas and suggestions for improvements.

Again there are possibilities to transfer the technical principle to project management. This principle is also overlapping with other principles.

The proposals for reshaping and transferring TRIZ principles to project management were developed in workshops with participants with extended project management experience. The proposals were applied and discussed many times. The principles were recognized as useful and appropriate.

The proposals above are much closer to project management than the proposals of Darrell Mann on systematic innovation for business and management (Mann, Darrell, 2007).

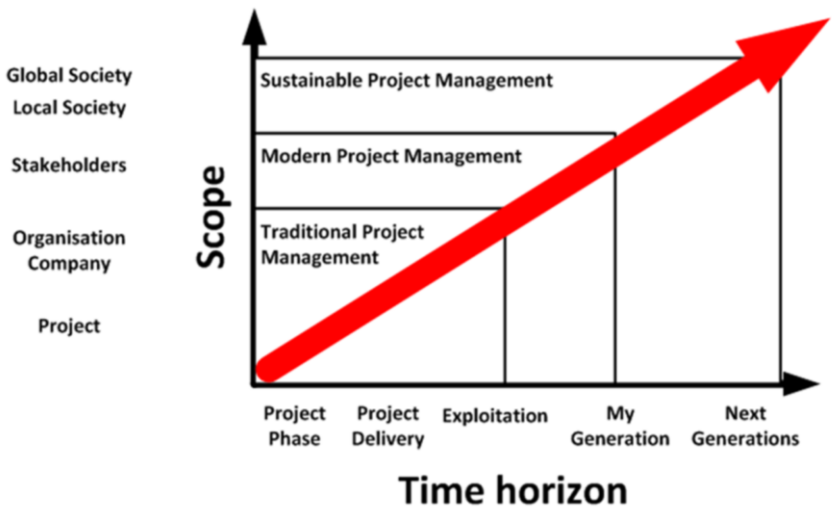
Our proposals are used to extend project management standards like PMBOK and contribute to the development of knowledge areas in project management. There are complementary conference contributions like, and our lecture notes (Reusch, Peter J.A.; Zadnepryanets, Maria, 2015).

The reshaped TRIZ principles for project management can also help to develop sustainability in project management – as shown in the next section.

3. TRIZ Principles support Sustainability in Project Management

Sustainability is one of the most important challenges of our time. We are looking for a balance among economic, environmental, and social and human issues – a long term balance. The integration of sustainability in project management is very important because projects initiate changes – and changes must be shaped by sustainability criteria.

The figure below shows how sustainability extends the scope and the horizon on project management.



Source: Reusch, Peter J. A, 2013

Fig. 1. **Horizon and Scope of Sustainable Project Management**

TRIZ principles can support sustainability because they can help to extend the scope and the horizon in project management.

Improved feedback for example leads to a better understanding of needs and expectations of stakeholders.

A clear definition of roles and responsibilities reduces project risk and improves the results. The whole project life-cycle must be taken into account – from the initiation of the project even beyond the installation of the new products or services created in the project.

Most principles discussed here improve stakeholder management. Principles on environmental protection, on the consumption of water and energy, and on further issues can be added.

Conclusions, proposals, recommendations

The transformation of TRIZ principles for project management is possible and could be applied in real projects. The sets of principles should be extended to take care of various kinds of projects (construction, service, IT, etc.). TRIZ can support sustainability in project management.

Bibliography

Altshuller, Genrich, 2001. And Suddenly the Inventor Appeared: TRIZ, the Theory of Inventive Problem Solving, Worcester, Massachusetts.

http://www.triz.org/triz/principles.

http://www.triz40.com/aff_Principles_TRIZ.php.

International Project Management Association "ICB – IPMA Competence Baseline Version 3.0", International Project Management Association, 2006. [Online] Available at: http://ipma.ch/resources/ipma-publications/ipma-competence-baseline/.

Mann, Darrell; Domb, Ellen, 1999. 40 Inventive (business) Principles with Examples. [Online] Available at: http://www.triz-journal.com/40-inventive-business-principles-examples/.

Mann, Darrell, 2007. Hands on Systematic Innovation for Business and Management, Lazarus Press, UK.

Reusch, Peter J. A., Ntais, Ilias, 2009. Stimulation of Creativity in Projects based on TRIZ, 23rd IPMA World Congress on Project Management, Helsinki.

Reusch, Peter J. A, Ntais, Ilias; Khushnood, Muhammad, 2009. Improving Creativity and Creative Problem Solving in Business Administration, International Business Research Conference, University of Southern Florida, Jacksonville, Florida.

Reusch, Peter J. A., Khushnood, Muhammad, 2008. TRIZ – a Powerful Method to Improve Creativity and Creative Problem Solving, in: S. Hotho, E. Juerke. (eds). Creativity, Competence and the International Dimension: Knowledge Transfer in a Changing World. Dundee: Abertay University Press.

Reusch, Peter J. A., 2011. New Standards for Project Audit and Project and Program Management, International Conference on Current Issues of Business and Society Development, University of Latvia, Riga.

Reusch, Peter J. A, 2013. Responsibility and Sustainability in Projects, International Research Conference Dortmund.

Reusch, Peter J. A, 2015. Sustainability in Project Management, 4th International Conference on Project Management in the Baltic Countries, Riga.

Reusch, Peter J.A., Zadnepryanets, Maria, 2015. Extending Project Management with TRIZ, IEEE-IDAACS.

Reusch, Peter J.A., Zadnepryanets, Maria, 2015. Lecture Notes on Creativity in Project Management, EuroMPM, Dortmund, Germany.

Bersano, Giacomo, 2008. TRIZ As a Catalyst for Project Management Excellence. [Online] Available at: http://www.triz-journal.com/triz-as-a-catalyst-for-project-management-excellence/.

Riches, Tony Agile Project Management Part One. [Online] Available at: http://www.triz-journal.com/innovation-best-practices/innovation-general/agile-project-management-part-one/ – plus 3 more articles in the same journal.

Bhushan, Navneet; Iyer, Karthikeyan, Strategic Project Management in Gsd Scenarios Part 1. [Online] Available at: http://www.triz-journal.com/innovation-methods/innovation-general/strategic-project-management-gsd-scenarios-part-1/ – plus 3 more articles in the same journal.

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PROJECT MANAGERS: A TEAM MEMBERS' PERSPECTIVE

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Abstract

While the Project Manager role and competencies has been addressed in various studies (PMI, 2007, Brill, Bishop, and Walker, 2006, El-Sabaa, 2001, Crawford, 2000, Patterson, 1991), none of them were based on the answers provided by project team members. This is peculiar since, the relevant contribution of project team members toward project success is widely recognized (Shenhar et al., 2002) but at the same no or limited attention has been devoted to listening team members' voices.

In order to answer to this shortcoming, a study focused on how project team members evaluate the project manager role and project managers behaviours has been carried out. A questionnaire was sent to more than 1000 people, 108 were considered valid.

Among the findings we can mention that team members consider the project manager role very important but many of the project managers they worked with were not considered suitable for that role. In addition, the more team members are senior, the less consider the project manager role important. This is especially true for male respondents. As expected, receiving clear objectives from the project manager is considered fundamental by team members but contrary to the dominant project management literature, team members also consider fundamental that project managers possess technical skills aligned to the project domain.

Key words: *project team members, project manager appraisal, project followership*

JEL code: M54

Introduction

By screening books and papers addressing project management topics, it can be noted that most publications are aimed at project managers and, more generally, the people responsible for coordinating complex and innovative initiatives. In project management literature it was understood that without the support of senior management a project manager has greater difficulty in managing the project (Kerzner H., 1987, Pinto J.K. and Slevin D.P., 1987). For this reason other publications, targeted to senior management which commissions and sponsors the projects, appeared. By limiting our analysis to books we can mention Archibald R. D. and Archibald S. C., 2013, West D., 2010, Englund R. L. and Bucero A., 2006, Love A. L. and Love J. B. 2000.

Other publications, instead, recognize the importance of the project team as key variable in project environments. What these latter publications have in common is that they are still addressed to Project Managers since they provide hints to the project managers on how to lead, motivate, and manage project teams (DeMarco T. and Lister T., 2013, Brown K. and Hyer N., 2009, Wong Z., 2007, Loo R., 2003).

To date, the relevant contribution of project team members toward project success is widely recognized (see Shenhar et al., 2002, that linked the project team to project success) but

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at the same time project teams and team members are considered like "objects" that the project manager should manage properly. No or limited attention has been devoted to listening team members' voices. (Sampietro M. and Villa T., 2014).

Since team members are at least the executors of the project tasks, understanding how they evaluate the project environments in which they operate is important, in fact, misalignments between project sponsors, project managers, and project team members may lead to poor project performance and not satisfying organizational climate thus limiting the ability to consistently repeat project success in future initiatives.

As a first step in this direction, a study focused on how project team members evaluate the project manager role and project managers' behaviours has been carried out. In the current literature there are several studies related to the role and competencies of project managers (PMI, 2007, Brill, Bishop, and Walker, 2006, El-Sabaa, 2001, Crawford, 2000, Patterson, 1991) but none of them are based on the perceptions/evaluations of team members.

A questionnaire composed of 38 variables in form of statements and additional 9 control variables was sent to more than 1000 people. A convenience sample method was used. 312 persons answered to the survey but only 140 questionnaires were considered valuable for our study. In fact, only questionnaire filled by pure team members (i.e. people that never had the opportunity to be project managers) were considered aligned with the purpose of the research. Among them, 108 were considered valid given that the others were too incomplete. In this paper we will discuss the part of the survey related to how team members consider the role of the project manager and how they evaluate them. This part was composed of 14 statements and 5 control variables (age, working experience, gender, percentage of time working in project environments, and if the respondent supervised other people). Respondents had to rate the agreement with the proposed statements on a 1 to 7 scale (1 completely disagree, 7 completely agree).

Research results and discussion

Of the 108 respondents, 59 were males and 49 females. The average age was 33.77 years while the average working experience was 8.14 years. It was also asked if they had the responsibility over other subordinates: 51 answered positively while 56 declared they had no subordinates. Finally, it was asked to estimate the percentage of time devoted to work as team members in project environments. On average respondents dedicated 60% of their time working as team members.

The core of the survey presented statements related to how team members evaluated the project manager role and the project managers they worked with. The statements together with the number of valid cases, the mean score, and standard deviation are reported in table 1.

As mentioned in the introduction, there is a vast body of knowledge targeted to project managers but by looking at the literature related to success factors in project environments (Shenhar, Tishler, Dvir, Lipovetsky, and Lechler, 2002, Baker, Murphey, and Fisher, 1998, Black, 1996, Pinto and Mantel, 1990, Pinto and Slevin 1988), it emerges that project managers are rarely mentioned as part of the variables that contribute to project success. As Turner and Müller (2005, 59 p.) pointed out: "The literature on project success factors has largely ignored the impact of the project manager, and his or her leadership style and competencies, on project success. This maybe because most of the studies ask their opinion and the respondents have not given due consideration to their own impact on project success. Or, it maybe because the studies

have not measured the impact of the project managers and, thus, not recorded it. Or, it maybe because of the project manager has not impact. However, that last conclusion is in direct contrast with the general management literature, which postulates that the leadership style and the competence of the manager have a direct and measurable impact on the performance of the organization or business".

Table 1

Statements, mean score and standard deviation

ID	Statement	N	Mean	Std. Deviation
1.	Having a Project Manager (PM) is critical for project success	108	5.36	1.683
2.	PMs that I have been working with were critical for project success	108	4.28	1.64
3.	The role of the PM is not easy at all	107	5.68	1.233
4.	To me, roles and responsibilities of PMs are clear	105	4.60	1.644
5.	The PM should clearly define my roles and responsibilities	107	5.36	1.348
6.	The PM should communicate clear objectives	108	6.15	0.975
7.	The PM should be able to motivate me	107	5.89	1.102
8.	A PM should have technical skills related to the project	106	5.63	1.19
9.	A PM should know my job	106	5.63	1.245
10.	The PM does not take time to listen my ideas	106	3.16	1.461
11.	The PM asks (expects) too much from me	107	3.20	1.383
12.	The PM uses my ideas without giving credits to me	107	3.19	1.689
13.	The PM decides my deadlines without taking into consideration my agenda/schedule	107	3.79	1.775
14.	The PM does not give me freedom to select the best way to solve a problem	106	3.29	1.561

Source: author calculations based on survey data

By looking at statement 1 it seems that team members agree on the importance of the project manager role since the mean score is 5.34 with 69% of the respondents providing scores equal to 6 or 7.

However results are quite different if we move from theory to practice. In fact, while there is consensus on the importance of the PM role to achieve project success, real word experiences lead to a different evaluation. Statement 2, in fact, reported a mean score equal to 4.28. Interesting is to note the frequency distribution of the responses (Figure 1). It can be noticed that there is a polarization on how team members evaluate project managers they had worked with. In fact, 39% of the respondents disagreed with the statement (score <4) while 49% agreed with the statement (score >4), only 13% reported a neutral evaluation (total does not equal to 100 due to rounding).

It emerges an interesting scenario where team members do not need to be convinced of the importance of the project manager role while the current characteristics of the people in charge of the management of the project only partially fit to the potentiality of the role.

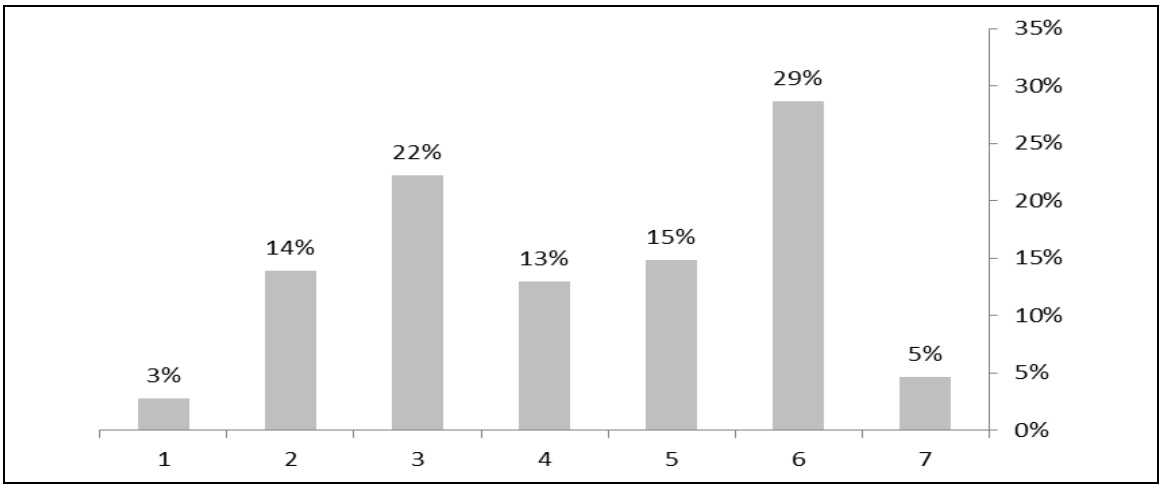


Fig. 1. **PMs that I have been working with were critical for project success**

While the result of statement 2 does not depict an ideal or satisfactory situation, team members also recognized that being project managers (statement 3) is not an easy task (M=5.68).

If needed, these results stress the importance of carefully selecting project managers that are able to effectively fulfil their role. In addition, room for improvement can be also seen by considering statement 4, in fact, while team members recognize the importance of the project manager role, on the other side the role is not clear for 30% of the respondents (score<4). For this reason, organisations may benefits from clearly defining what team members should expect from a project manager in general and for specific projects.

Focusing on what a project manager should do, statements 5, 6, and 7 confirm what is well known in the project management literature. It is worth to mention the highest mean score of statement 6 "The PM should communicate clear objectives" (M=6.15), statistically different ($p<0.05$) from all the other mean score values. This is aligned with studies related to Critical Success Factors in project environments that very often mention clear objectives among the most important factors to achieve project success.

Statement 8, "A PM should have technical skills related to the project", is quite interesting since the high mean score value reported in our study (M=5.63) differs from the mean score reported in similar statements in other studies on the competencies of the project manager. For example, Brill, Bishop, and Walker (2006) in their study related to the competencies of effective project managers, reported that "Understand fields related to the project" had a mean score value of 3.38 on a scale from 1 to 5, ranking 74th out of 78 variables, and "Understand the industry in which he/she work" had a mean score of 3.71. Converting this value on a 1 to 7 scale, the resulting mean score values are respectively 4.73 and 5.2, quite below the score 5.63 reported in our study. It has to be noticed that the sample was composed of project managers that had to rate how much specific competencies and characteristics of project managers were important to be effective in that role. Since in our study team members were the respondent, it seems that team members pose greater attention to the technical competencies of project managers compared to what project managers believe. Statement 9, "A PM should know my job" (M=5.63), with 71% of the respondents providing scores equal to 6 and 7, reinforces this interpretation.

Table 2

Correlation analysis between statements 10, 11, 12, 13, and 14

		The PM does not take time to listen my ideas	The PM asks (expects) too much from me	The PM uses my ideas without giving credits to me	The PM decides my deadlines without taking into consideration my agenda/ schedule	The PM does not give me freedom to select the best way to solve a problem
The PM does not take time to listen my ideas	Pearson Correlation	1	0.407**	0.453**	0.365**	0.524**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000
	N	106	106	106	106	105
The PM asks (expects) too much from me	Pearson Correlation	0.407**	1	0.263**	0.117	0.241*
	Sig. (2-tailed)	0.000		0.006	0.229	0.013
	N	106	107	107	107	106
The PM uses my ideas without giving credits to me	Pearson Correlation	0.453**	0.263**	1	0.508**	0.543**
	Sig. (2-tailed)	0.000	0.006		0.000	0.000
	N	106	107	107	107	106
The PM decides my deadlines without taking into consideration my agenda/ schedule	Pearson Correlation	0.365**	0.117	0.508**	1	0.514**
	Sig. (2-tailed)	0.000	0.229	0.000		0.000
	N	106	107	107	107	106
The PM does not give me freedom to select the best way to solve a problem	Pearson Correlation	0.524**	0.241*	0.543**	0.514**	1
	Sig. (2-tailed)	0.000	0.013	0.000	0.000	
	N	105	106	106	106	106

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Source: author calculations based on survey data

Finally, the part of the survey devoted to studying how team members evaluated the role of the project managers and their behaviours, was focused on non-virtuous behaviours that project managers may implement. Mean score values seem suggesting a quite positive situation but by looking at the frequency tables emerges that 29% of the project team members reported that project managers used their ideas without giving credits to them (statement 12). Finally

40% of the respondents agreed (scores>4) that project managers set deadlines without taking into consideration their agenda/schedule (statement 13). This result is particular interesting since it emerges a quite frequent top-down approach in project schedule where the project manager define the schedule and team members have just to comply with it. This behaviour is in contrast with project management good practices that suggest to develop the project schedule with project team members.

It should be noted that "bad practices" go together, in fact, the statistical analysis shows a medium to large correlation among statements 10, 12, 13, 14 and mixed correlations (from no correlation to small and medium correlation) between statement 11 and the others (see Table 2).

Based on the correlation matrix, it emerges that possibility that statements 10 to 14 can be considered part of a single item. For this reason a Factor Analysis has been performed.

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and the Barlett's Test of Sphericity (Table 3) indicate that the data set is suitable for factor analysis.

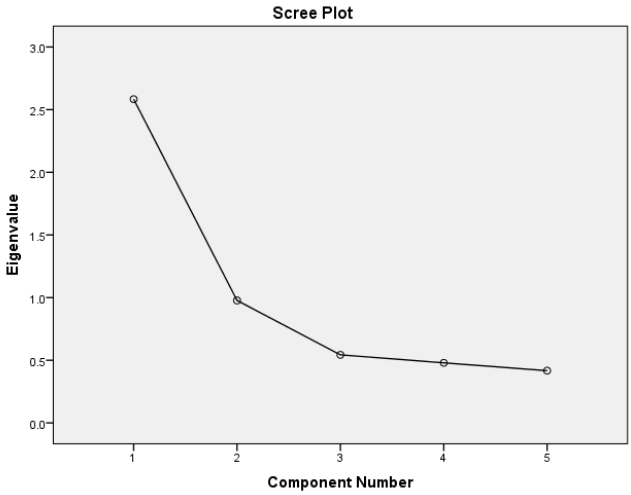
Table 3

Kaiser-Meyer-Olkin Measure of Sampling Adequacy and the Barlett's Test of Sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.771
Bartlett's Test of Sphericity	Approx. Chi-Square	131.463
	Df	10
	Sig.	0

Source: author calculations based on survey data

The Kaiser's criterion suggests that only one component have to be extracted (Figure 2) explaining 51.7% of variance (Table 4).



Source: author calculations based on survey data

Fig. 2. **Scree plot of the components related to statements 10 to 14**

Table 4

Total Variance Explained by the component

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	2.584	51.675	51.675

Extraction Method: Principal Component Analysis.

Source: author calculations based on survey data

From the Component Matrix (Table 5) emerges that all the variables strongly load on the on the component.

Table 5

Component Matrix

	Component
	1
The PM does not take time to listen my ideas	0.760
The PM asks (expects) too much from me	0.466
The PM uses my ideas without giving credits to me	0.783
The PM decides my deadlines without taking into consideration my agenda/schedule	0.713
The PM does not give me freedom to select the best way to solve a problem	0.817

Extraction Method: Principal Component Analysis
a. 1 components extracted.

Source: author calculations based on survey data

The survey included five control variables. One asked if the respondent, in his/her daily job, supervised other people. An independent t-test has been conducted to test if people with subordinates, given their role as coordinators, provided different answers compared to people with no subordinates. For all the 14 variables no statistically significant mean score differences have been found. This result was unexpected, in fact, it seemed reasonable to assume that people used to lead other people have a different perception of the project manager role, especially when it comes to rate the difficulty of the role or its importance.

Another control variable was the working experience in years. By performing a correlation analysis this variable had a medium correlation (r=-0.328) with the statement 1 (Having a Project Manager is critical for project success), indicating that the more a team member is experienced, the more he/she thinks that project managers do not increase the ability

to attain project success. In this case gender differences exist, in fact, males and females show different results (Table 6) showing that females believe more in project managers even when they are experienced professionals.

Table 6

Correlation between Work experience and Having a Project Manager is critical for project success

			Having a Project Manager (PM) is critical for project success
Males	Work Experience	Pearson Correlation	-0.397*
		Sig. (2-tailed)	0.002
		N	57
Females	Work Experience	Pearson Correlation	-0.190
		Sig. (2-tailed)	0.197
		N	48

* Correlation is significant at the 0.01 level (2-tailed).

Source: author calculations based on survey data

This difference among males and females is even stronger if the age of the respondents is used a control variable. While it is obvious that Age and Work experience are correlated ($r=0.943$, $p<0.01$), not so obvious is to notice that age creates more differences in the evaluation of the usefulness of project managers than working experience (Table 7), that means that age by itself has a negative influence on how male team members consider project managers.

Table 7

Correlation between Age and Having a Project Manager is critical for project success

			Having a Project Manager (PM) is critical for project success
Males	Age	Pearson Correlation	-0.422*
		Sig. (2-tailed)	0.001
		N	58
Females	Age	Pearson Correlation	-0.012
		Sig. (2-tailed)	0.937
		N	49

* Correlation is significant at the 0.01 level (2-tailed).

Source: author calculations based on survey data

The same analysis has been performed with gender as control variable. In this case only item 9 (A PM should know my job) reported a statistically significant mean score differences. In table 8 test results are provided.

Table 8

Independent sample t-test between genders for the variable "A PM should know my job"

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference	
									Lower	Upper
A PM should know my job	Equal variances assumed	7.992	0.006	-2.37	103	0.020	-0.555	0.235	-1.020	-0.090
	Equal variances not assumed			-2.43	100.304	0.017	-0.555	0.228	-1.007	-0.103

Source: author calculations based on survey data

Table 9

Correlation Analysis between the variables "The PM should be able to motivate me" and "A PM should know my job"

Gender			The PM should be able to motivate me	A PM should know my job
Male	The PM should be able to motivate me	Pearson Correlation	1	0.160
		Sig. (2-tailed)		0.233
		N	58	57
	A PM should know my job	Pearson Correlation	0.160	1
		Sig. (2-tailed)	0.233	
		N	57	57
Female	The PM should be able to motivate me	Pearson Correlation	1	0.593
		Sig. (2-tailed)		0.000
		N	48	48
	A PM should know my job	Pearson Correlation	0.593	1
		Sig. (2-tailed)	0.000	
		N	48	48

Source: author calculations based on survey data

It seems that females prefer project managers that try to know better their team members. This result might be explained by suggesting that asking to know more about project team members may ease the creation of good relationships with the project manager and by noticing that gender and workplace literature report that females are more sensitive on workplace relationships compared to males. This interpretation seems supported by the Correlation Analysis (Table 9) between "The PM should be able to motivate me" and "A PM should know my job". At the sample level the correlation is moderate ($r=0.356$, $p<0.01$) while by splitting the sample by gender results are quite different. In fact, males do not report statistically significant correlation between the two variables while females show a high correlation ($r=.0.593$, $p<0.01$).

Conclusions, proposals, recommendations

The point of view of project team members has almost been neglected in the project management literature. This research started to contribute to fill this gap.

The main research findings can be summarized as follow:

- project team members consider the role of the project manager critical to reach project success. In addition, they think that the role of the project manager is difficult. These results can be considered positive since opposite results would have questioned the effort of project management researchers, trainers, professors, and organizations (e.g. PMI, IPMA etc.) in studying, developing, and certifying the project manager role.
- Many project team members are not satisfied of the project managers they have worked with. This result suggests that organisations should increase their effort in carefully selecting and developing project managers.
- Project team members expect to receive clear objectives from project managers. Having clear objectives is very often cited as top priority in the literature related to project success factors, this study confirms that also team members believe so.
- Team members ask for project managers with technical competencies. This result is particular interesting since the current literature related to the competencies of the project managers seems underestimating the importance of the technical skills. Maybe the role of the project manager should be better explained to them.
- Male and seasoned team members are more skeptical about the ability of the project managers to contribute to project success. Maybe they think that having a long experience substitute the need for a project manager or maybe is just a question of not accepting to be supervised after a long career or maybe is just envy for a role they wish to have.

This study has some limitations. The first limitation is related to the sample size, in fact, 108 valid cases cannot be considered a large sample, for this reason generalizations have to be careful. The second limitation is in the sampling method (convenience sample) that increases the importance of having large samples to generalize the results. The third limitation is that statements from 10 to 14 are only a very partial list of "non virtuous" behaviours that project managers might adopt. This shortcoming reduces the possibility to fully implement Factor Analysis and Regression Analysis thus limiting the ability to discover interesting relationships among the variables.

Given the novelty of the topics addressed in this study, future researches are needed in order to validate the results. In general, research efforts are needed in the field of project followership (this term has been used by some authors and trainers to indicate project management considered by the point of view of team members) since team members are scarcely considered in the current project management literature.

Bibliography

Anantatmula, V., S. Project Manager Leadership Role in Improving Project Performance. *Engineering Management Journal*, 22, 1, pp. 13-22.

Archibald, R. D. & Archibald, S. C. 2013. *Leading & Managing Innovation. What Every Executive Team Must Know about Project, Program & Portfolio Management*. West Conshohocken: Infinity Publishing.

Baker, B. N., Murphey, P. C., Fisher, D. 1988. *Factors affecting project success*. In D. I. Cleland & W. R. King (Eds.) Project Management Handbook, 2nd edition. New York: Van Nostrand Reinhold.

Bazzocchi, G. 2013. *Project Manager e Project Team Member. Come i progetti vengono visti da due ruoli differenti*. Unpublished Thesis. Milan: Bocconi University.

Belout, A., & Gauvreau, C. 2004. Factors affecting project success: The impact of human resource management. *International Journal of Project Management*, 22, 1, pp. 1-12.

Black K. 1996. Causes of Project Failure: A Survey of Professional Engineers. *PM Network*, 10, 5, pp. 21-24.

Brill, J. M., Bishop, M. J., Walker, A. E. 2006. The Competencies and Characteristics Required of an Effective Project Manager: A Web-Based Delphi Study. *ETR&D*, 54, 2, pp. 115-140.

Brown, K. & Hyer, N. 2009. *Managing Projects: A Team-Based Approach with Student CD*. Columbus: McGraw-Hill/Irwin.

Chaleff, I. 1995. *The courageous follower: Standing up to and for our leaders*. San Francisco: Berrett-Koehler Publishers.

Conger, J.A. & Kanungo, R.N. 1988. *The empowerment process: Integrating theory and practice*. Academy of Management Review 13, 3, pp. 471-483.

Cooke-Davies, T. 2001. The "real" project success factors. *International Journal of Project Management*, 20, 3, pp. 185-190.

Crawford, L. 2000. *Profiling the Competent Project Manager*. Proceedings of PMI Research Conference: Project Management Research at the Turn of the Millenium.

Crawford, L. 2000. *Profiling the Competent Project Manager*. Proceedings of PMI Research Conference: Project Management Research at the Turn of the Millenium.

DeMarco, T. & Lister, T. 2013. *Peopleware: Productive Projects and Teams*. Second Edition. New York: Dorset House Publishing Company, Inc.

El-Sabaa, S. 2001. The skills and career path of an effective project manager. *International Journal of Project Management*, 19, 1, pp. 1-7.

Englund, R.L. & Bucero, A. 2006. *Project Sponsorship: Achieving Management Commitment for Project Success*. San Francisco: Jossey-Bass.

Ford, R.C. & Fottler, M. D. 1995. Empowerment: A matter of degree. *The Academy of Management Executive*, 9, 3, pp. 21-32.

Kelley, R. E. 1988. In praise of followers. *Harvard Business Review*, 66, 6, pp. 142-148.

Kelley, R. E. 1992. *The power of followership*. New York: Doubleday.

Kerzner, H. 1987. In search of excellence in project management. *Journal of Systems Management*, 38, 2, pp. 30-39.

Keung, J. 2007. *Software Engineers' View of Software Metrics in Australia: A Survey*. Paper presented at the International Workshop on Accountability and Traceability in Global Software Engineering.

Loo, R. 2003. Assessing "team climate" in project teams. *International Journal of Project Management*, 21, 7, pp. 511-517.

Love, A.L. and Love, J. B. 2000. *The Project Sponsor Guide*. Pennsylvania: Project Management Institute.

May, D.R. & Flannery, B.L. 1999. Cutting Waste with Employee Involvement Teams. *Business Horizons*, 38, pp. 28-39.

Murphy, P. R. & Jackson, S.E. 1999. *Managing work-role performance: Challenges for 21st century organizations and employees*. In The changing nature of work performance. Eds. D.R. Ilgen and E.D. Pulakos, pp. 325-365. San Francisco: Jossey-Bass.

Patterson N. 1991. Selecting project managers: an integrated list of predictors. *Project Management Journal*, 22, 2, pp. 21-26.

Pearce, C.P & Sims, H.P. Jr. 2002. Vertical Versus Shared Leadership as Predictors of the effectiveness of Change Management Teams: An Examination of Aversive, Directive, Transactional, Transformational, and Empowering Leader Behaviors. *Group Dynamics: Theory, Research, and Practice*, 6, 2, pp. 172-197.

Pinto, J. K and Mantel, S. J. 1990. The causes of project failure. *IEEE Transactions on Engineering Management*, 37, 4, pp. 269-276.

Pinto, J. K. & Slevin, D.P. 1988. Project Success: Definitions and Measurement Techniques. *Project Management Journal*, 19, 1, pp. 67-72.

Project Management Institute. 2007. *Project Manager Competency Development Framework, 2nd edition*. Newtown Square: Project Management Institute, Inc.

Project Management Institute. 2013. *A guide to the Project Management Body of Knowledge*. Fifth Edition. Newtown Square: Project Management Institute, Inc.

Sampietro, M. & Villa, T. 2014. *Empowering Project Teams. Using Project Followership to Improve Performance*. Boca Raton: CRC Press – Taylor & Francis Group.

Shenhar, A. J., Tishler, A., Dvir, D., Lipovetsky, S., Lechler, T. 2002. Refining the search for project success factors: a multivariate, typological approach. *R&D Management*, 32, 2, pp. 111-126.

Turner, R., J., Müller, R. 2005. The Project Manager's Leadership Style as a Success Factor on Projects: A Literature Review. *Project Management Journal*, 36, 2, pp. 49-61.

West, D. 2010. *Project Sponsorship*. Burlington: Gower Publishing Company.

Wolinsky, H. 2010. *B for bureaucracy*. EMBO Reports. 11, pp. 664-666.

Wong, Z. 2007. *Human Factors in Project Management: Concepts, Tools, and Techniques for Inspiring Teamwork and Motivation*. San Francisco: John Wiley & Sons, Inc.

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USING TWITTER AS A PROJECT MANAGEMENT LEARNING INTERVENTION #PSCMCHAT

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Abstract

There are currently a number of diverse technologies being used in learning and teaching for a variety of subject matters such as Facebook, VLE's (i.e. Blackboard and Moodle), Turning Point, and Twitter (Thomas M., Thomas H., 2012). There are currently some studies which explore the use of Twitter to enhance student learning on a module with varied results (Evans C., 2014, Wright K et al., 2014), however there are no current published enquiries that explore how practitioners from industry can form part of the academic learning process using Twitter social media as a platform.

In line with Coventry University's (UK) strategy of trialling different disruptive technologies in a variety of settings, a pilot project was set up to allow exchange of ideas and communication between academics, students and industry partners using Twitter as a vehicle for communication exchange. Currently, industry partners are involved in the learning process by delivering guest lectures to students, however the limitation of this is that it is a one way delivery process, and currently benefits the students more than the practitioners.

As a result, a pilot project was set up which gave 11 students the opportunity to answer direct challenges/problem-based questions from Project Managers and Operations Managers. It also gives the opportunity for students to get an insight into how some of the theoretical elements taught on a Project Management module reflect the real world. Over the two weeks, there were #PSCMChat sessions run which saw practitioners pose questions to students on real challenges that they have faced (encouraging problem based learning), and the following week gives students the opportunity to ask questions related to what they have learned on the module and how it relates to practice "from the experts" perspective.

This paper will discuss the outcomes and findings from an evaluation on the project to discover:

- Whether Twitter was an effective platform for the discussions to take place;
- How the intervention affected students learning about project management;
- Whether the intervention was beneficial to industry partners.

The pilot generated some interesting lessons learned and will be adapted to research on a larger scale during the Autumn semester (September – December 2015). It is intended that it will subsequently lead to being integrated into two level two modules (project management and supply chain management), and form a component of the module assessments.

Key words: *social media, project management, learning and teaching*

JEL code: M1

Introduction

Social media is increasingly being used in higher education in seeking out more innovative and useful means of collaborating with students (Mugahe, W., Rahmi, A., Shahizan

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Othman, M., 2013). More specifically, Twitter as a social media platform has been rapidly growing since its inception in 2007 and currently has approximately 284 million active users each month (Twitter, 2015). Recently, educators have started to realise the value of using this social media tool as a means of conversing with students. Examples have included studies by Junco, R., Elavsky, M., and Heiberger, G., (2013) in using twitter to increase student engagement, and Wakefield, J.S., Warren, S.J., and Alsobrook, M., (2011) in using twitter to encourage student discourse and reflective thinking.

Additionally, in relation to project management education, the agenda to involve employers in the learning and teaching that takes place is imperative to ensuring that challenges and issues are authentic and reflect the views of industry specialists. A recent paper by the Chartered Management Institute (2014) suggests that whilst excellence is growing within UK Business Schools, more needs to be done to actively engage employers in shaping students educational experience. There have been several initiatives to make project management education more interactive, for example using role play in an online environment (Tachikawa, Y et al., 2013 and Rolstadås, A., 2013). However, whilst the studies aforementioned evaluate the use of twitter as a learning and teaching intervention to improve student engagement and collaboration, there are no current studies sourced where this has been evaluated in the context of integrating project and operations managers into the dialogue with students and academics using Twitter.

In previous semesters, the UK University involved in this pilot study used project and operations management guest lecturers from industry to come in and talk to students about real projects they have been working on and how the theoretical nature of their learning relates to practice. Whilst the benefits of engaging guest speakers at Universities are apparent to students (Young SM., Edwards HM., and Thompson JB., 2006), this intervention in its current form carries some limitations. Guest speakers come into the University and carve out time from their busy schedules to deliver a one hour lecture which can sometimes take a day out of their normal duties (especially when having to travel). Additionally, it is very much a one way communication process (guest speaker to student), with some questions that may be asked by students at the end of the lecture.

There are several reasons for the pilot study which is described in detail in the following section. Firstly, the University concerned has an increasing agenda to adopt new learning technologies within the classroom where research has proved students respond well (Deepwell F., Malik S., 2008). Secondly, it was assumed that techniques which make it more flexible for industry would encourage a greater and more diverse participation (including internationally), if those concerned could share their experiences using a different platform which would allow for asynchronous discussion. Finally, and most significant to the project, the researchers wanted to evaluate the benefits of engaging in a two way discourse about project and operations management rather than receiving a traditional lecture.

It was anticipated that on completion of this study, the evaluation would provide a basis for making decisions about the future tools used in the subject areas of project management and supply chain management modules at undergraduate levels.

The findings may be of interest to educators interested in using social media as a platform for encouraging practitioner, academic and student interactions in the field of project and operations management.

Project outline and methodology

Two industry professionals volunteered to participate in this project whose expertise would be relevant for the aims of the project. One was a Project Manager working in technical facilities management for the care sector with over 9 years experience in various roles, more recently in project management. The other was a Food Commercial Manager with supply chain and logistics experience, working in a top 100 food hall within a major UK retailer. Both were located in the U.K and were approached due to their previous connections with the institution. Both managers had previous experience of using Twitter therefore no training was required.

The researchers intention was to recruit 15 students from the BA Business Administration programme at the University using a random sampling approach which would target 10% of the 2nd and 3rd year population (approximately 150 are presently undertaking 2nd and 3rd year modules). Random sampling gives every member of the population a chance of being chosen for the project (Collis, J & Hussey, R 2009). Although the sample size is relatively small in comparison to the number of students on the module, the researchers considered that this was an initial pilot project that would lead to more representative sample size following initial results. The pre-requisites for participation was to have had some exposure to project management and/or supply chain teaching during their time at University, and felt comfortable using Twitter as a social media tool. 11 students volunteered for the pilot and attended a short 30 minute briefing session on the requirements of the project.

The project ran over two weeks and was structured as follows:

- **Week one**: Each working day (Monday – Friday), both industry professionals would post a real scenario/problem or challenge that they were currently, or had previously faced within their roles. In order to provide anonymity for both organisations involved (as Twitter is a publically viewable platform), the specific organisations that the managers worked for were not disclosed to students. Instead, students were given short biographies of each manager which described their role and the type of organisation that they worked for.

  Each day, it was expected that students would respond to these challenges with ideas on how they would solve them, using their experience of the modules that they had partook at University. All participants were asked to use the hash tag #PSCMChat in order for the conversation to be logically followed. Both managers were asked to choose the best solution of the week with a small prize incentive being offered.
- **Week two**: The following week, it was the students turn to participate in a question and answer session. In order to regulate this session, it was agreed it would take place as a synchronous one hour online twitter chat. Students were asked to reflect on what they had learned on the modules and to ask appropriate questions on how aspects of their learning reflected practice in organisations.

Full ethical approval for the project was sought due to the public nature of the discussions and in asking both the students and industry professionals to formally evaluate it. In addition, an online code of conduct was drawn up and sent to all parties involved in the discussions to protect the reputation of the University, managers and students involved.

The following week (after the online trial had concluded), an evaluation of the pilot took place. Students were asked to complete a short anonymous survey based on their experiences of the project, and to attend a short 40 minute focus group to discuss the benefits and drawbacks of

engaging in the conversations with managers and on using Twitter. A focus group was chosen to prompt further discussion on the project and in capturing lessons learned. Krishnaswami, O., & Satyaprasad, BG., (2010) suggest that the benefits of this approach are that the researchers can look for common attitudes and beliefs to a particular experience whilst recognizing that single respondents may offer significant individual contributions.

Online techniques for data collection are becoming gradually more popular in qualitative research methods (Aborisade, OP., 2013). A qualitative data collection technique was adopted to gather the perceptions of the project from a manager perspective. Both managers were interviewed via email and were required to answer 5 questions related to their experiences of the 2 week period. The advantages to this approach as suggested by Meho, L., (2006) include convenience to the participants where geographically dispersed, and in saving costs of transcription.

The data collected was analyzed and split into themes relevant to the student and manager objectives. The next section of the paper considers the findings from the survey, focus group and interviews and is discussed primarily into two parts to reflect the views from both the students and the managers.

Discussion

1. Student perspectives

Eleven students in total participated at varying levels across the two week period, and nine took part in the evaluation. This section of the paper draws upon the data collected both through the short survey results and focus group conducted, and is split into two themes (use of social media and student learning).

Student Learning – Opportunities

There was a significant trend in feedback from the students in relation to what they had gained from a practical perspective in engaging in discussions with managers and each other (see table 1). Students fed back that they had learned something new in responding to issues presented by the managers, and it provided a window of opportunity to see how some of what they had learned on the modules reflected real life issues, making them think differently about the practicalities of project management and operations. Additionally, there was a majority concensus that frequent feedback and interaction with peers was particularly valuable. Wakefield, J., (2011), and Bicen, H., (2013) also found this to be a beneficial outcome of using Twitter in encouraging reflective thinking. Students generally disagreed that the interactions added no value to their learning.

Student also indicated that the scenarios posted by managers allowed students to think about aspects of organizational life and the skills required by project and operational managers in a different way. For example, in one question to the managers, students found that responding to work related problems fundamentally required soft skills above project management or operational technical skills (see Figure 1). In another example, students found that project management tools taught in the lectures were being actively used by the practitioners (see fig.2). The value generated from these types of discussions is two-fold. Students are able to understand that there is more to project management and operational tools and techniques when having to

solve work-related issues, whilst also being reassured that the techniques being taught in the classroom are actively used by managers.

Table 1

Results of student learning

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
This project has given me a better insight into day to day operations and project management from an industry perspective			2	4	3
I have learnt something new about project or supply chain management having taken part in this project			2	5	2
This project has made me think about project management and operations differently		1	1	5	2
I feel I have benefited from discussions with industry professionals			2	5	2
This project hasn't taught me anything I didn't already know about project management and operations	2	6	1		

Source: authors' construction



Source: authors' construction

Fig. 1. **Question and Answer Example**



Source: authors' construction

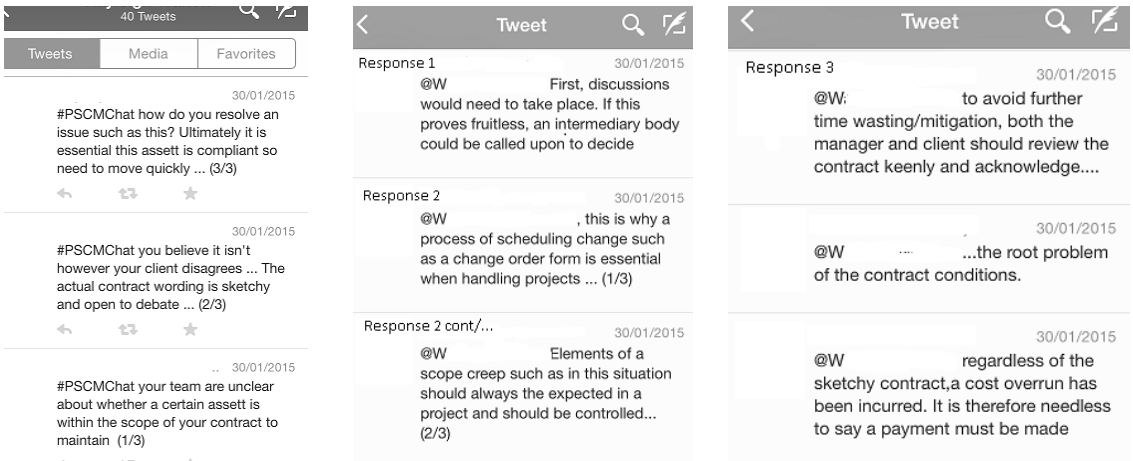
Fig. 2. **Question and Answer Example**

This was also emphasized in student feedback:

"*Soft skill development is what I realized was the most important. You can have all the theory but you need to be able to back up your idea*" [4]

"*It gives students a chance to see how it's done in practice, to learn something which isn't in the textbooks*" [3]

The survey indicated that students learned something new about how project management and operations were carried out on a daily basis and that they had gained new knowledge. An example of one of the problems posed and several responses are illustrated in fig. 3.



Source: authors construction

Fig. 3. **Typical weekday scenario and sample responses**

Several students commented on the usefulness of responding to problems in particular.

"*When you are faced with problems it makes you realize if you can't respond it is probably not the industry for you*." [4]

"Coming up with ideas on how to solve the problem gets you thinking about different ways of doing it" [1]

The literature on involvement of project managers in student learning and teaching is sparse. However, the benefits were realized in a study conducted by Gibb, J., and Twiname, L., (2012) where involvement of industry 'mentors' in students learning about project management skills using an e-learning approach were considered beneficial. More specifically, the students involved in this study valued working as part of a group on the project with their industry mentor. As the students involved in the twitter project gave their individual ideas and input on solving project and operational issues, a group approach is something to contemplate for future designs, especially when involving large groups of students. This is something which was highlighted by the students in the focus groups as a factor for consideration, and discussed under the use of social media in this paper.

Student Learning – Barriers

On the whole the feedback on the value of interacting with project and operations managers was positive. However several students discussed possible complications when using this approach on a larger scale. It was suggested that student motivation is key to engagement, and that there would need to be some significant value in participating such as linking discussions with assessments.

"*If the postings are not assessed some students may not do it"* [1]
"Would be great to use something like this as an assessment tool" [3]
"*There has to be payoff so we can use it in job interviews*" [5]
"You will always get the better students participating" [2]

Junco, R., et al (2013) suggest that an important factor when designing curriculum which uses different learning technologies is the fundamental essential requirement for students to use the technology. Their comparative study found that benefits for the student in relation to learning outcomes achieved were richer with the student sample who were required to use the media as part of their studies as oppose to those where it was optional.

In relation to student learning, the positive feedback on what students obtained from the interactions with managers was in no doubt valuable. There are considerations outlined on how this could be refined for the future (including how students may be assessed), however it is clear to see that engaging in discourse about the subject students have learned, with the managers who are undertaking the role carries a multitude of advantages.

Use of Social Media

The participants involved in the pilot project evaluated the use of twitter as the main platform for engaging in discourse with the industry managers. The results from the short survey are illustrated in table 2.

Table 2

Results of use of social media

	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I feel that I have been able to partake in meaningful discussions throughout this twitter project			4	3	2
This way of learning is better than listening to guest lectures		1	1	6	1
I feel that Twitter can be an effective medium for learning	1	1	3	2	2
Other social media tools would be more effective for this type of learning			1	2	6
I was limited to what I could say on Twitter			1	5	3

Source: authors' construction

Whilst participants were overwhelmingly supportive of the project from a learning perspective, the use of Twitter as a platform for discussion clearly had some limitations. There was a general consensus both in the survey and the focus group that there could be better, more effective ways to conduct discussions. The 140 character restriction was a big frustration for students, and some students fed back that they had forgotten to use the hash tag and therefore could not always follow discussions between students and managers in a meaningful way. This is a limitation described as "information overload" and is supported in other twitter based research (Blaschke, L., 2014 and Wakefield, J.S et al., 2011).

"*Discussion forums give more freedom to write points of view*" [6]

"*Lost interest occasionally as I had to find another students page to follow the discussion*" [1]

"*Tricky to see the continuation of points if split postings*" [4]

Participants felt that adopting a different tool to have these discussions may be a better choice, however also noted that it was positive to have the discussions in an open forum as it also provided an opportunity to market the way in which the University conducted some of its teaching in a public format, and to encourage others to participate. LinkedIn was discussed as an option during the focus group, however it was acknowledged that there would be limitations in using this media as it is important to the managers to be able to protect the organizational identity and potentially sensitive and commercial in confidence information.

One student noted an unintentional benefit of engaging in discussions with the managers using Twitter, stating that a number of job agencies had started to follow them online. It could be suggested that by using open social media (whilst protecting organizational identities) could possibly provide opportunities for students to promote themselves online and to create networking prospects, something which may not be as easily accessed if using other types of media.

In comparison to guest lectures, there were mixed feelings about the value of both interactions. Whilst some students recognised that having a two way conversation with a manager rather than listening to a 45 minute guest lecture provided opportunities for more interaction and questioning, other students felt that they needed more organizational context and background before engaging in the discussion.

"*Better than a guest lecture. We get to speak as well in this way. We may also get some personal feedback from the managers*" [4]

"*Might be good to link it to a short online lecture, then have the discussion*" [3]

"Needed to understand what resources the organization had at their disposal" [1]

A number of ideas emerged in the focus group on enhancing the value of the discussions which were clearly evident. Blogs, wikis or exploring other technology was suggested, or to create short online learning objects where students could listen to a short audio lecture followed up with a question and answer session on Twitter. Additionally, one student suggested using face to face seminar groups to explore the issues posted, generate ideas and collate the best responses which would be posted by nominated twitter representatives on behalf of the group. This viewpoint is support by Thomas, M., & Thomas, H., (2012), who suggests that social media and learning technologies are currently better, used to enhance students face to face experiences.

Overall, the focus group feedback indicated that the learning gained from participating in this project was particularly valuable to the students and that they would welcome the opportunity to engage with this type of intervention.

2. Manager perspectives

The managers involved in the project provided some valuable feedback to the project in relation to the benefits from an industry perspective and some of the opportunities and barriers to consider for the future.

Opportunities

Both managers fed back positively in engaging with the twitter project, highlighting the benefits to practitioners from a personal and professional perspective:

> *"It was great to get a fresh perspective on issues from someone who is currently studying frameworks and tools which you may have forgotten about*" [1].
>
> *"It allowed me as a professional to think critically and objectively about the work I do day to day"* [2]

The opportunities for practitioners to engage in discussions with students are not only beneficial from a student perspective but can also create opportunities for the managers to use the intervention as an opportunity for reflection on working life. Additionally, both managers suggested that students enabled them to recap on tools and models that they may not have used recently but would help them in their day to day role, as well as being able to hear different ideas about the problems posted:

> *"There is an opportunity to hear different ideas of how to deal with problems which people involved in the project are too engaged to see"* [1]
>
> *"It can offer a good tool for reflecting on situations in your working life"* [2]

It was also highlighted that if rolled out, it would give managers the opportunity to identify potential graduate material, and also continue to network with students once the project was finished, potentially for making business contacts and engaging in work experience.

Both managers suggested that the opportunities for students were vast if the medium, time and format was suitable.

> *"There is the potential to identify the talent of the future"* [1]
>
> *"There is a huge opportunity to document and discuss with peers in academia the situations and suggestions given and would awaken some students to life past university and potentially prep them for the real world."* [2]

This is consistent with the feedback given from the students, in that by participating in discussion with the managers it not only provides a subject based discussion, but also enables them to ask questions about real working life and what qualities companies are looking for in an ideal graduate.

Barriers

The barriers identified on this project from a practitioner perspective was partly time to dedicate each day to posting and checking tweets, however, it was also acknowledged that it was more convenient to build the tweets around priorities in the workplace rather

than taking part in synchronous discussions. Both managers also shared the student frustrations in the character restriction on twitter, wanting to provide more context to the issues and including important information to enable the students to grasp, however it was also noted that by using a restricted character count it *"forced both sides of the project to carefully consider their entries and replies"* [2]. The selection of a media that allows a clear concise message, whilst limiting long posts is an area that needs to be deliberated in the design of the intervention.

Additionally, the managers wanted to provide realistic issues, however also needed to ensure that they were not sharing any commercially sensitive information about the organization whilst giving authentic and real-life problems to discuss. It is therefore important that the researchers consider this as from the student perspective it was important to them to discuss real industry issues rather than fictitious case studies.

Finally, both managers shared the student view in that motivation could be a potential barrier, stating:

"Students would need to have the drive and want to participate – they will only get out of it what they put in" [1]

"Level of engagement from students would need to be higher" [2]

Additionally it was also highlighted that if rolled out to larger numbers, it could be a problem in being able to respond to every student: *"high volumes of different individuals replying would be difficult"* [2].

This emphasizes the importance of how modules are designed to allow the use of technology effectively, encouraging discourse with practitioners, but also in encouraging peer discussion. Integrating the design of the interactions with face to face student seminars may provide a possible solution to this as explained earlier in the paper.

The feedback given from both managers was overall supportive of the intervention, highlighting some considerations to be made for the future. The most valuable aspect of this pilot project however is that there were some gains from the industry perspective in enabling reflection and consideration of working life and how this may differ from University. This is particularly important and worthy of further investigation, as the traditional guest lectures delivered at the institution are limited in enabling a rich dialogue between students, managers and academics.

Conclusions and next steps

Junco, R.C., (2013:285) states that "*the incorporation of new technologies into the classroom remains an important and compelling development with regard to producing more effective learning strategies and outcomes*".

The aim of this project was to discover what a small number of students and industry professionals thought about an idea before implementing it on a larger scale. Additionally, it is fundamentally clear that the value in discussing theoretical concepts and solving real problems presented in industry, and in involving practitioners in the field offers real value to students, in providing immediate feedback and offering students the opportunity to informally network with practitioners.

A number of considerations have been identified following this pilot and are summarized below:

- **Number of students:** The size of the student group engaging in discussions is a key consideration for designing pedagogy using of learning technologies. Additionally, it needs to be considered from the practitioners perspective. Integrating the online discussions in a face to face environment might provide a good opportunity for students to work within project teams to discuss and generate ideas to problem based scenarios in groups, and having nominated twitter users that post the responses and/or ask the questions.
- **Character restriction and social media selection:** The character restriction on twitter is clearly a frustration for some as it limits the amount of information or feedback that they can access. On the other hand, an important point was made that the longer the postings, the more time from an industry professional will be required to read and respond. There is also the idea that if a positing is limitless, this can also increase the chance of moving 'off point' or losing focus in the discussion. It is important to get a good balance of depth vs. succinct and 'on point' messages that are effective. In order for any learning technology to be used effectively, it requires participation and regular interaction, and therefore academics should consider how the intervention is built into the design of the module/course and assessment to be truly valuable.
- **Practice based learning:** Participants in this project were inordinately supportive of the value of learning undertaken in this short pilot. Being able to actively engage in generating ideas to solve real project and operational issues for organizations gave students the opportunity to apply theory to practice, whilst understanding what it takes to deal with problems that emerge on day to day projects in real life. This value added learning clearly cannot be found in the more traditional learning and teaching in higher education where although case studies are useful, do not provide a live situation for students to deal with, whilst discussing directly with the experts involved.
- **Manager involvement:** Traditionally, communication with industry guest speakers and students has been a one way process, with limited questions and on a single particular subject. By getting involved in discussions with students, it was clear that both managers involved in the pilot felt that they had gained some value from a personal and professional development perspective.
- **'Accidental' opportunities:** It was unanticipated that by having conversations in a public arena using Twitter would lead to benefits such as being able to showcase problem solving skills and promoting oneself as a career seeking graduate. This is something that could be formalized further on future occurrences, where an increased number of managers from organizations offering graduate positions can get involved.

Clearly, there are limitations in this study in relation to the sample size and use of one social media technology. However, the pilot was intended to highlight some initial lessons to enable the project to be adapted, redefined and tested on a larger scale to involve approximately 150 students in September – December 2015. As a result of this pilot, the researchers will be working with a dedicated Disruptive Media Learning Lab within the University which has expertise in innovative approaches to learning and teaching, in order to redefine the intervention for future use.

Bibliography

Aborisade, P.O., 2013. Data Collection and New Technology. *International Journal of Emerging Technologies in Learning (iJET), 8*(2), 48.

Blaschke., L., 2014. Using social media to engage and develop the online learner in self-determined learning. *Research in Learning Technology*, *22.*

Bicen, H., 2013. Student opinions regarding twitter usage with mobile applications for educational purposes. *Procedia Social and Behavioral Sciences, 136,* pp. 385-390.

Chartered Management Institute, 2014. *21st Century Leaders: Building practice into the curriculum to boost employability.* http://www.managers.org.uk/Insights/Research/Current-research/2014/June/21st-Century-Leaders.aspx [Accessed 27 January 2015].

Collis, J. & Hussey, R., 2009. *Business Research*. London: Palgrave Macmillan.

Deepwell, F., Malik, S., 2008. On campus, but out of class: An investigation into students experiences of learning technologies in their self-directed study. *Research in Learning Technology, 16* (1), pp. 5-14.

Evans, C., 2014. Twitter for teaching: Can social media be used to enhance the process of learning? *British Journal of Educational Technology,* 45(5), pp. 902-915.

Gibb, J., & Twiname, L., 2012. Information technology risk management teaching exercise: Integrating online and offline communication techniques. *Journal of Project, Program & Portfolio Management,* 2(2), 66 p.

Junco, R., Elavsky, M., Heiberger G., 2013. Putting twitter to the test: Assessing outcomes for student collaboration, engagement and success. *British Journal of Education Technology,* 44(2), pp. 273-287

Krishnaswami, O., & Satyaprasad, B.G., 2010. *Business Research Methods*. New Delhi: Himalaya Publishing House.

Meho, L. I., 2006. E-mail interviewing in qualitative research: A methodological discussion. *Journal of the American Society for Information Science and Technology,* 57(10).

Mugahe, W., Rahmi, A., Shahizan Othman, M., 2013. Evaluating student satisfaction of using social media through collaborative learning in higher education. *International Journal of Advances in Engineering and Technology*, 6(4).

Rolstadås, A., 2013. Experience from continuing education using e-learning. *Journal of Intelligent Manufacturing, 24*(3), pp. 511-516.

Tachikawa, Y., Maruyama, H., & Nakamura, T., 2013. Project management education using role-play training in an on-line group-work environment. *Interactive Collaborative Learning (ICL), 2013 International Conference,* pp. 238-245.

Thomas, M., Thomas, H., 2012. Using new social media and Web 2.0 technologies in business school teaching and learning. *Journal of Management Development,* 31(4), pp. 358-367.

Twitter., 2015. *About Twitter Inc.* [Online] Available at: https://about.twitter.com/company [Accessed 27 January 2015].

Wakefield, J.S., Warren, S.J., and Alsobrook, M. 2011. Learning and Teaching as Communicative Actions: A Mixed-Methods Twitter Study. *Knowledge Management & E-Learning: An International Journal*, *3*(4), pp. 563-580.

Wright, K., Frame, T., Hartzler, M., 2014. Student perceptions of a Self-Care course taught exclusively by team-based learning and utilizing Twitter. *Currents in Pharmacy and Teaching,* 6, pp. 842-848.

Young, S., Edwards, H., & Thompson, J., 2006. University Reachout – The Role of Guest Speakers in Communicating with Industry and Other Institutions A Position Paper. *Software Engineering Education and Training Workshops, 2006. CSEETW '06. 19th Conference 2006.*

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AN INVESTIGATION INTO CHALLENGES FACING DISTRIBUTED TEAMS: CASE OF SOUTH AUSTRALIAN CONSTRUCTION PROJECTS

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Abstract

There is increasing momentum within the construction industry to deploy distributed teams on projects, yet the major challenges that companies face for managing teams in distributed arrangements have yet to be explored in the construction context. Driven by such need, this study is intended to present an account of the major challenges encountered throughout the life cycle of offshore outsourcing arrangements within the South Australian construction industry. To this end, the study describes the observations made within the natural contexts of one construction project in terms of the challenges to the success of deploying distributed teams for outsourcing of works. Discussions remain in dialogue with relevant theories and the pertinent literature to explain the interpretations and lessons learned and to underpin the conclusions made. It is contended that this study contributes to the field by providing an illuminating insight into potential challenges facing distributed teams being implemented in outsourcing tasks in construction projects. Discussions also offer practical guidelines for construction project managers and assist them in dealing with potential challenges of offshore outsourcing through the lenses of distributed team working principles.

Key words: *Challenges, Distributed teams, Virtual teams, Construction industry, Project management*

JEL code: O33

Introduction

Construction project teams are increasingly utilising distributed teams for delivering projects ((Henderson, 2008; Ramalingam et al., 2014) inasmuch as the construction industry is not a local industry anymore due to the pressure from globalisation. As such, a large number of construction firms specifically in developed countries are moving towards higher levels of internationalisation in order to benefit from the global opportunities. Consequently, construction companies in developed economies (e.g. Australia) are transferring their operations to the developing countries, with lower running costs and much more opportunities in terms of skills and talents (Horta et al., 2013). In essence, it is becoming imperative for construction

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organisations to adopt distributed teams in order to deal with the challenges of the contemporary business environment (Chen and Messner, 2010).

Given such growing prominence of distributed teams in construction projects, possessing the scientific know-how pertinent to implementation of distributed teams becomes very relevant as urged by Vorakulpipat et al. (2010). That is, for achieving the desirable outcomes out of deploying distributed teams organisations have to predict and overcome the challenges through implementing effective managerial strategies (Yen et al., 2002). On the other hand, implementing distributed teams successfully within the construction context requires an in-depth understanding of the unique challenges that are not necessarily akin to the challenges encountered in face-to-face teams (Hosseini and Chileshe, 2013).

Against this backdrop, construction litearture has been criticized for the scarcity of studies conducted about distbuted teams ((Chinowsky and Rojas, 2003; Hosseini and Chileshe, 2013). Moreover, practitioners cannot rely on the results of the studies from other sectors of the industry due to the obvious specific approach of the construction industry towards innovative methods (Love et al., 2001) such as distrbuted team working. This implies that knowledge on distibuted teams should be created within the natural context of the construction industry. As a result, the constrcution industry has remained in need of creating knowledge to supply the industry with essential information of the challenges faced in deploying distrbuted teams on construction projects (Hosseini and Chileshe, 2013). This has been the driving force behind conducting this study as described next.

Literature review

Peters and Manz (2007) defined distrbuted teams as teams in which members are located in more than one site and their work is extensively dependent on information communication technology (ICT) as the main channels of communications. For the construction industry, distrusted teams could be defined as "groups of geographically, organisationally and/or time dispersed intelligent workers with different skills and in different positions of the hierarchy heavily relied on ICTs to accomplish engineering tasks which for all are held accountable" (Hosseini and Chileshe, 2013, 1103 p.). Distributed teams within the construction industry have been treated as the suppliers of the projects in the form of a number of offices scattered around the globe supporting the central lead office (Chen and Messner, 2010; Iorio et al., 2011). Due to the specific attributes of distrbuted team arrangements including their dispersed structure and heavy reliance on informatin communication technology, organisations should have a deep appreciation of the potential chalenges facing their implementation prior to adopting them in their working procedures e.g in offshore outsourcing projects. Evidence has demonstrated that overlooking the challenges facing distrbuted teams and failure in tackling such challenges would end up in disappointing results with distrbuted teams (Mukherjee et al., 2012).

Against this backdrop, very few studies have investigated the challenges facing distrbuted teams within the construction context as pointed out by Hosseini and Chileshe (2013). Noneteheless, there is consensus among majority of available studies e.g. (Chinowsky and Rojas, 2003; Joseph, 2005; Chen and Messner, 2010; Hosseini and Chileshe, 2013) in regards to the prominence of a number of general challenging areas affecting disrtubuted teams in offshore outsourcing porjects as the items illustrated in Table 1.

Table 1

General challenging areas facing distributed teams in the construction industry

General challenging areas	References
• Provision and selection of appropriate tools, software, and devices • Communications • Cooperation/collaboration within members • Leadership style • Team development • Training • Building trust, team identity and team cohesiveness • Control and supervision • Member selection • Defining the location, the number and the relationship maps between all the offices and members	(Chinowsky and Rojas, 2003) (Chen and Messner, 2010) (Joseph, 2005) (Hosseini and Chileshe, 2013)

Source: authors after Hosseini and Chileshe (2013)

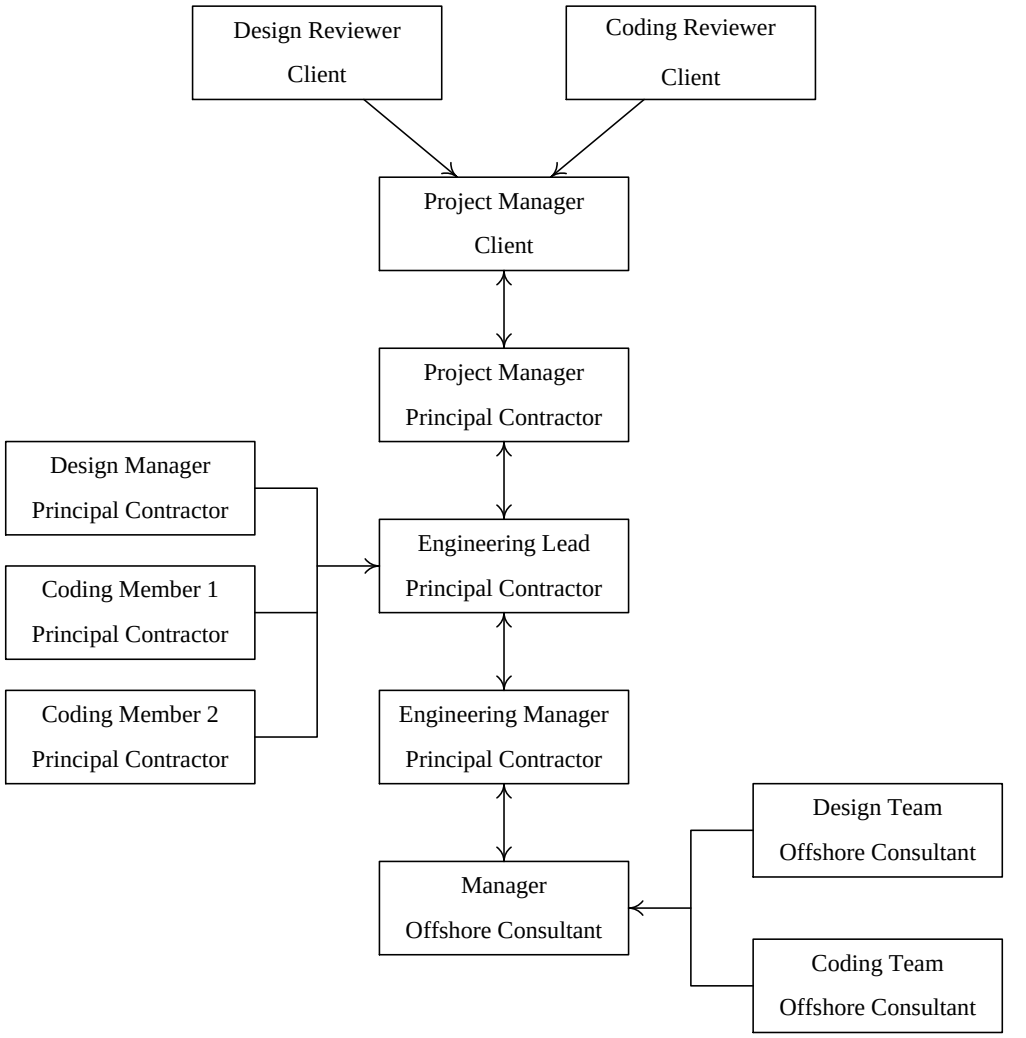
In essence, inherent idiosyncrasies of distrusted teams such as geographical, temporal, organisational and cultural dispersions between members make them to be entities with unique challenges different from the ones of face-to-face teams (Chen and Messner, 2010). This has made exploring such challenges very relevant in view of the lack of studies on the topic as the driving force behind conducting the present study.

Research methods

Case study was chosen as the main method alongside a review of literature. The justification for selecting case study was due to the fact that offshore outsourcing is inherently a complex practice, restricted to a certain time period, locations and embedded in particular cultures. Thus, taking a holistic approach rather than a reducible approach for research becomes relevant as described by Verschuren (2003). Case study research findings provide insight into an issue through examining and observation of incidents, events and settings in a particular case by reflecting experiences. The definition for case study strategy in this paper conforms to the definition proposed by the authoritative work of Creswell (2003). As such, case study in this paper encompasses exploring one project confined by activity and time boundaries for collecting comprehensive information during a certain period of time. This entailed involvement with project team members within the natural context of the project to observe the challenges encountered for delivering the project. The first author was an employee in the project. This added great value to the information gathered in the present study as pointed out by Tribelsky and Sacks (2011). That is, researchers became able to overcome many issues facing researchers in terms of access to project documents, attending meetings and recording exchanges.

The context of the study

The case adopted for this research hereafter referred to as Project A was carried out in 2013 within the South Australian construction industry and entailed offshore automation consultancy. The client was a state government department and the principal contractor for automation of a government facility was one of the prominent local automation companies. After winning the project, the principal contractor closely cooperated with the client team and defined the scope of work. At the outset, the principal contractor's engineering team developed the basis of design that was afterwards approved by the client. To cut off the cost of engineering resources and to make South Australian engineering team more focused on other aspects of the work, the principal contractor decided to engage an offshore automation service.



Source: authors' construction

Fig. 1. **Project A communication chart**

An offshore consultant company (OCC) was assigned with the task of reviewing the basis of design, providing comments, finalising the design after discussion with the principal contractor's engineering team, developing codes based on the standards supplied by the client and submitting the codes by a nominated deadline to the principal contractor for review. Besides, OCC was supposed to revise the codes based on the collective comments from the client's representatives and the principal contractor's engineering team.

The principal contractor's engineering team accordingly maintained a close cooperation with the client's representatives to ensure that the product delivered by OCC is in accordance with the client's requirements. Prior to inception of this cooperation arrangement, a corporate risk analysis was undertaken to identify any major risks associated with this cooperative approach. To avoid or mitigate some major risks, a manager was appointed in OCC, who became in charge of regular communication with the principal contractor's engineering manager as illustrated in Figure 1.

To provide full access to the documents, drawings, photos and standards, all files were shared via a virtual service (i.e. Dropbox).

Challenges

Temporal distance

As the time zones of OCC and the principal contractor were different, some critical communications via phone, email, and videoconference were not efficiently made. For instance, a significant milestone was due to be completed by a Tuesday and OCC agreed to utilise extra resources over the weekend to ensure the timely completion. Crucial information was requested by the offshore team at 6 pm, South Australian time, four days prior to the completion date, after working hours of all key engineering team members. Even though the engineering manager of the principal contractor had received the notification, there was no qualified engineering resource in South Australia to support the offshore team. As a result, the milestone was delayed by two days. This specific incident delayed the project as the milestone was on the project critical path. The clear message of this observation was:

Temporal distance becomes a major barrier to distributed team working in large distances by reducing the potential for real-time problem solving. This challenge becomes highly detrimental to effective team working in distributed teams when there is a glaring difference in terms of time zone among team members. This results was closely in alignment with observations made in construction teams by Nayak and Taylor (2009) in regards to distrusted team working challenges with members located in large distances from each other such as in the UK and Australia. This also acknowledged the discussions of O'Leary and Cummings (2007, 437 p.) opining "…at distances larger than those triggering reductions in spontaneous synchronous communication, interaction decreases and, thus, reduces the potential for real-time problem solving…".

Delayed and ineffective Communications

Some technical issues were identified by the offshore team members, which required external input. Thus, the offshore manager had to communicate the issues to the South

Australian team. Due to unavailability of the South Australian resources on specific occasions and time-consuming process of communication, resolution and receiving feedbacks, milestones were frequently delayed.

This was exacerbated by the fact that due to lack of rich communications, offshore engineers and programmers struggled to understand some requirements defined by the client. Whenever such an issue was raised by the offshore team, the resolution took a significant time due to both communication related causes and technical malfunctions. In some instances, to avoid any delay, the offshore team manager decided to direct the offshore team on his own assumptions. As a result, some products were not on specification due to the incorrect assumptions as a problem observed frequently in offshore outsourcing projects (Nayak and Taylor, 2009). The South Australian team had to spend further time and energy to rectify the faulty product. This is fathomable because maintaining low quality of communications in distributed teams has been discovered as a source of poor quality of products, low productivity and serious risks as asserted by Bovee et al. (2003).

It could be inferred that communications in distrusted team working are time consuming and by far lower in terms of quality, richness and bi-directionality. Hence, such issues should be factored in for scheduling of work and defining milestones for distributed team arrangements. Otherwise, team members would resort to act on their assumptions to offset the effects of delayed communications.

Lack of full commitment and accountability

Lack of full commitment was also observed among a majority of the offshore engineers and programmers. Due to not having direct communications with South Australian counterparts, the sense of urgency; that was a key driver in South Australia, was not fully understood by the offshore staff members, thus no synergy was achieved over the lifecycle of Project A. This could be justified in terms of lack of accountability due to lack of direct and continuous communications with team members in South Australia alongside the absence of an effective supervision and performance evaluation policy as a problem in distributed teams identified by Hosseini et al. (2013). According to Ferris et al. (2008, 229 p.), "…accountability is critical to the success of organisations and the ability to establish its antecedents and outcomes should be of utmost importance…". In addition, as observed by Nayak and Taylor (2009) team members in distributed teams have different work-related perspectives as a major challenge to distributed team working in the construction context. This explains the discrepancy in the level of priority assigned to tasks in OCC and in South Australia.

Due to different levels of priority put on one project for different organisations involved in distributed team working, level of commitments becomes different. This gets worth by the lack of direct supervision and performance evaluation in distributed arrangements. Therefore, lower levels of productivity and performance should be considered in designing distrusted teams and scheduling of tasks.

Lack of an integrated resource allocation

Unavailability of resources at critical times is a contributor to an unsuccessful offshore service. In some occasions, a critical decision required some detailed technical information from the South Australian office and there was no qualified resource available to provide the OCC team

with such information due to South Australian public holidays, annual leave or even non-working hours. As a result, the communication among the two teams became more time-consuming and accordingly delayed the project. As argued by Nayak and Taylor (2009), lack of an integrated resource allocation might end up in duplication of roles and responsibilities, which results in redundancy of human resources. This also points to the prominence of continuous monitoring of workloads of team members across all organisations as stated by Chinowsky and Rojas (2003).

An integrated resource allocation is necessary among different organisations involved in offshore outsourcing to prevent lack of resources. In essence, resource allocation in each organisation should factor in the requirements of other organisations and milestones.

Difference of working norms and codes

Certain working practices and norms become embedded in the work practices of particular locations due to the codes and regulations enforced in the location. This might end up in conflicts, reworks and dissatisfaction with products in offshore outsourcing projects (Nayak and Taylor, 2009). This was the case for Project A. That is, lack of familiarity with Australian standards; particularly, if an Australian client customises the standard, was a major challenge for the offshore services. In two different occasions, the OCC team of Project A refused to continue working on a specific product design as the client's in-house standard did not satisfy the international standard that was being followed by the OCC team. It ended up in a conflict because the offshore team believed that the client's standards are obsolete and do not meet international requirements. Such issues created relationship friction among the two different management teams. Hence, further time and energy was spent to increase level of agreement among the client, the principal contractor and the OCC.

To resolve the issues stemmed from difference in working practices and working regulation, a clear structured governance to clarify the objectives (Nayak and Taylor, 2009) alongside regular training and visits (Chinowsky and Rojas, 2003) should be considered.

Lack of face-to-face meetings

Evidence has demonstrated that despite advancement in technology, maintaining face-to-face meetings is indispensable to the success of distributed team working arrangements (Henderson, 2008; Wang et al., 2014). On Project A, the strategy of having one point of contact from each company was opted, however no team meeting was organised to introduce the design and coding members of both teams to each other. No team member in South Australia knew any OCC resources and there was no sense of team work among these resources. To South Australian engineering team, the product was created by "some" overseas resources, who may not know what the South Australians require. This was a source of frequent challenges, because as stated by Chinowsky and Rojas (2003, p.102) *"virtual teaming requires initial face-to-face meetings to develop a sense of "team"."*

Discussions

As per the discussions presented above, findings of previous studies on challenges facing distributed teams in the construction context were replicated in the present study. This

comprised challenges due to temporal distance among team members (O'Leary and Cummings, 2007; Nayak and Taylor, 2009). Besides, problems with communications, lack of cohesion and commitment in teams and necessity of face-to-face meetings were acknowledged as previously identified by Chinowsky and Rojas (2003) and Nayak and Taylor (2009). Lack of commitment and accountability reconfirmed the arguments by Hosseini et al. (2013) indicating the crucial role of continuous supervision and performance control in distributed arrangements. Such replication of findings enhances the external validity of the challenges identified in the present study through providing a theoretical triangulation. Nevertheless, the present study contributes to the field by drawing attention to the crucial role of implementing an integrated system of resource allocation and scheduling. Such an integrated system should factor in a productivity level for distributed teams in lower levels in comparison to collocated arrangements. Additionally, the study outlines below a number of guidelines to minimise the detrimental effects of the identified challenges as the practical contribution of the study.

- Senior management shall justify the aims and objectives of the relationship and set company's priorities in this relationship at the outset.
- A preliminary budget should be allocated to provide the infrastructure required for supporting the relationship. Level of such infrastructure to be determined by senior management.
- At least one or two trips to project location and the main management office should be organised to make sure that the key members of both parties meet each other in person and a minimum level of familiarity among the key members is achieved.
- Regular meetings should be arranged among the key technical members of both teams to avoid any misinterpretation of the requirements and to reach mutual understanding
- Occasional video conferencing meetings should be organised for all team members to increase the level of synergy.
- Availability of all key resources in critical times (e.g. project falling behind the schedule) should be secured through introducing an integrated system of resource allocation among all the parties involved.

Conclusion

With advancements in information and communication technology, distributed team working for harnessing the benefits of globally distrusted resources and overcoming the challenges of globalisations is receiving growing attention for companies active in the construction context. Such method of team working however is fraught with inherent challenges that should be considered prior to making any decision about adopting such an arrangement. The present study identified a number of challenges through observing one case of offshore outsourcing in South Australia. Considering the replication of the findings of previous studies, some guidelines were presented to facilitate tackling the challenges as identified. Beside, as the contribution of the study, the crucial role of implementing an integrated resource allocation and scheduling system for involved organisations came to light. It is noteworthy of mentioning that the findings should be considered in view of the limitation of the study. These include collecting data from one state in a developed economy (i.e. Australia), thus any generalisation of the

findings to developing economies and context glaringly different in terms of socio-economic aspects should be treated with caution.

Nevertheless, the study opens the door for future research studies by providing a fertile ground for further investigation. As such, one ground for future inquiries should be investigating the strategies and operational aspects and exploring the best practices for establishing an effective integrated resource allocation and scheduling system among organisations in a distributed team arrangement.

Bibliography

Bovee, M., Srivastava, R.P. & Mak, B., 2003. A conceptual framework and belief-function approach to assessing overall information quality, International journal of intelligent systems, 18 (1), pp. 51-74.

Chen, C. & Messner, J.I., 2010. A Recommended Practices System for a Global Virtual Engineering Team, Architectural Engineering and Design Management, 6 (3), pp. 207-221.

Chinowsky, P.S. & Rojas, E.M., 2003. Virtual teams: Guide to successful implementation, Journal of Management in Engineering, 19 (3), pp. 98-106.

Creswell, J.W., 2003. Research design: qualitative, quantitative, and mixed methods approaches, 2nd edn, Sage Publications, Thousand Oaks, Calif.

Ferris, G.R., Perryman, A.A., Frink, D.D., Royle, M.T., Hochwarter, W.A., Hall, A.T. & Ranft, A.L., 2008. Meso-level theory of accountability in organizations, in JJ Martocchio (ed), Research in personnel and human resources management, Vol. 27, Emerald Group Publishing Limited, pp. 177-245.

Henderson, L.S., 2008. The impact of project managers' communication competencies: Validation and extension of a research model for virtuality, satisfaction, and productivity on project teams, Project Management Journal, 39 (2), pp. 48-59.

Horta, I.M., Camanho, A.S., Johnes, J. & Johnes, G., 2013. Performance trends in the construction industry worldwide: an overview of the turn of the century, Journal of Productivity Analysis, 39 (1), pp. 89-99.

Hosseini, M.R. & Chileshe, N., 2013. Global Virtual Engineering Teams (GVETs): A fertile ground for research in Australian construction projects context, International Journal of Project Management, 31 (8), pp. 1101-1117.

Hosseini, M.R., Chileshe, N., Ghoddousi, P., Jahanshahloo, G.R., Katebi, A. & Saeedi, M., 2013. Performance Evaluation for Global Virtual Teams (GVTs): Application of Data Envelopment Analysis (DEA), International Journal of Business and Management, 8 (19), pp. 122-136.

Iorio, J., Peschiera, G., Taylor, J.E. & Korpela, L., 2011. Factors impacting usage patterns of collaborative tools designed to support global virtual design project networks, ITcon 16 (Special Issue Use of virtual world technology in architecture, engineering and construction), pp. 209-230.

Joseph, G., 2005. Global Virtual Engineering Team Utilization in the Engineering, Procurement, and Construction (EPC) Industry, Pennsylvania State University.

Love, PED, Irani, Z, Li, H, Cheng, EWL & Raymond, Y., 2001. An empirical analysis of the barriers to implementing e-commerce in small-medium sized construction contractors in the state of Victoria, Australia, Construction Innovation: Information, Process, Management, 1 (1), pp. 31-41.

Mukherjee, D., Lahiri, S. & Billing, T.K., 2012. Leading virtual teams: How do social, cognitive, and behavioral capabilities matter?, Management Decision, 50 (2), 6 p.

Nayak, N.V. & Taylor, J.E., 2009. Offshore outsourcing in global design networks, Journal of Management in Engineering, 25 (4), pp. 177-184.

O'Leary, M.B. & Cummings, J.N., 2007. The spatial, temporal, and configurational characteristics of geographic dispersion in teams, MIS quarterly, 31 (3), pp. 433-452.

Peters, L.M. & Manz, C.C., 2007. Identifying antecedents of virtual team collaboration, Team Performance Management, 13 (3/4), pp. 117-129.

Ramalingam, S., Lobo, S., Mahalingam, A. & Whyte, J., 2014. Achieving reliability in transnational work on complex projects: new directions for research, Engineering Project Organization Journal, 4 (4), pp. 193-208.

Tribelsky, E. & Sacks, R., 2011. An Empirical Study of Information Flows in Multidisciplinary Civil Engineering Design Teams using Lean Measures, Architectural Engineering and Design Management, 7 (2), pp. 85-101.

Verschuren, P., 2003. Case study as a research strategy: some ambiguities and opportunities, International Journal of Social Research Methodology, 6 (2), pp. 121-139.

Vorakulpipat, C., Rezgui, Y. & Hopfe, C.J., 2010. Value creating construction virtual teams: A case study in the construction sector, Automation in Construction, 19 (2), pp. 142-147.

Wang, X., Love, P.E.D., Kim, M.J. & Wang, W., 2014. Mutual awareness in collaborative design: An Augmented Reality integrated telepresence system, Computers in Industry, 65 (2), pp. 314-324.

Yen, D., Chou, D.C., Chen., T. & Chen, H.-G., 2002. Becoming a virtual organisation: a strategic approach, International journal of networking and virtual organisations, 1 (2), pp. 184-198.

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FUTURE-PROOF: FORESIGHT AS A TOOL TOWARDS PROJECT LEGACY SUSTAINABILITY

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Abstract

The topic of sustainability has experienced a growing interest in the general academic and professional community recently. However, literature shows that it is still incipiently explored within the project management field, where the scope of research is limited mainly to construction and development projects. Moreover, since projects are a way of bringing a vision of the future into reality, and sustainability has at its core an orientation towards the future, it is surprisingly to note that links between the discipline of Foresight and Sustainability are scarce in project management literature.

This paper will thus review the existing literature linking foresight and sustainability, and explore its relationship with project management in order to assess whether foresight can be a useful tool to sustain project legacy over time. Drawing on conclusions reached, this paper will also propose a practical approach to incorporate foresight into project management methodology, and concludes with managerial implications, limitations, and recommendations for further research.

Key words: *project management, foresight, sustainability, project legacy*

JEL codes: M11, M19

Introduction

In a world where markets are characterized by a fast pace of change and unpredictable events, complex interdependencies and extreme volatility, planning for the long-term and building a lasting legacy presents itself ever more as an challenge for organizations. In view of this scenario, to demonstrate abilities of agility, anticipation and resilience is to hold clear competitive advantages, and if in the past following a strategy by trial and error could be a successful approach, nowadays fail to think the future is to condemn the survival of an organization.

It is in this context of extreme uncertainty and complexity that different approaches to deal with uncertainty are beginning to be introduced and that the discipline of Foresight, also referred as Future Studies, has gain recent interest amongst academia and business players. Despite the growing awareness for this subject, the element of Foresight is elusively described in the Project Management field, and literature review conducted shows that there is a clear insufficiency of Foresight research in Project Management literature. Since projects play a pivotal role in shaping and building the future and are by nature delimited by uncertainty, it is thus surprisingly to note the little attention devoted to this topic so far. Hence, the aim of this paper to identify how Foresight fits in the context of Project Management and its value to the discipline, following preliminary work produced by Pich et al (2002), when exploring approaches to cope with uncertainty and complexity in Project Management, and expanded by

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Taleb (2010) and Flyvbjerg (2003). For this purpose, particular emphasis is put in the legacy of a project, since while a project is a one-off endeavour intended to deliver a set of outputs and outcome, intended for the short-term, it is the legacy of a project which is oriented towards the future, intended for the long-term, that might benefit strongly from using Foresight as a future-proof tool.

Further to this point, the paper addresses the project legacy from a view of sustainability, here comprising both the act of embedding and building on the legacy over time (to sustain change), and the alignment to principles of sustainability that allow current needs to be satisfied without neglecting the needs of following generations. Although the author acknowledges important differences between the two perspectives, both should be part of the responsibilities of a professional project manager and are represented together due to this fact and to the close relationship with the concept of Foresight, where all concepts express a common concern about the future.

Since data on the relationship between Project Management, legacy sustainability, and Foresight, is loose and not yet robust, the methodology used in the paper consists of review of relevant literature available and builds upon anecdotal evidence to support examples provided, drawing from the epistemological basis of interpretivism, that is, a qualitative and theoretical perspective that aims to provide a comprehensive yet exploratory review of the topic being analysed. Although constrained by availability of sources and lacking empirical testing, the author believes that the paper represents a solid theoretical starting point for anyone interested in how the future is perceived and acted upon in relation to Project Management. From a practical point of view, it is argued that the framework here described can contribute to increased gains of resilience in the management of projects.

Regarding the structure of the paper, it starts with a literature review on the concepts of project legacy, and sustainability, where the relationship between Project Management and sustainability is lightly presented. Later, it is given an introduction to the concept of Foresight and to Scenario Planning, where Scenario Planning is described not just as a decision-support tool but as a multidisciplinary discipline that helps to make sense of the future and be better prepared for it. Examples of corporate successful cases where scenario planning was used and those where scenario planning could help avoid failure are also presented.

The paper concludes by exploring how Scenario Planning can be a valuable tool to sustain a project legacy over time. To support this premise the author proposes a scenario planning framework that could be applied to Project Management.

Finally, conclusions and managerial implications are provided as well as limitations and recommendations for further research.

Literature review

What is a project's legacy?

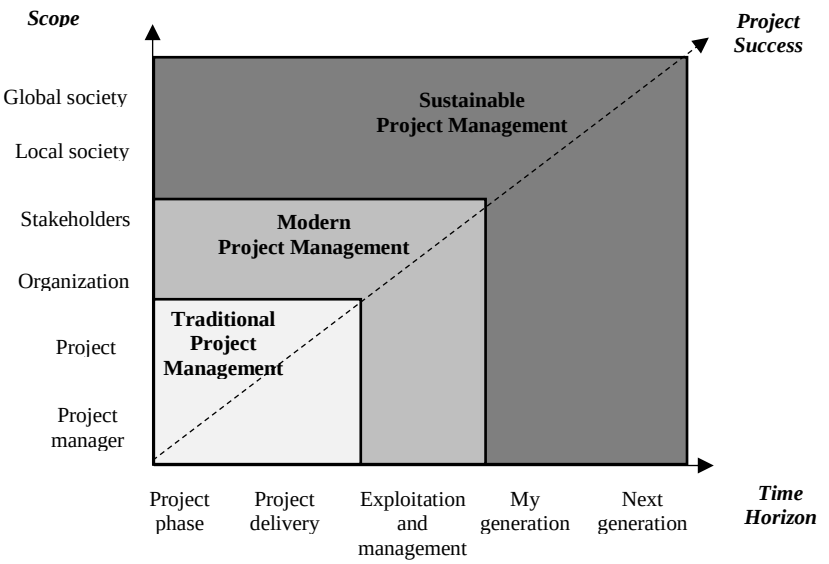
In broad sense, legacy is represented by a distinctive positive impact one leaves behind and can be handed to others, that is, what one learned for the past and built for others to use and to benefit from in the future.

In the context of projects, it can be said that, conceptually, all projects carry an element of legacy as they are aimed to "create a unique product, service, or result" (PMBOK® Guide,

2013), which will realize benefits over time and enhance the organization capabilities. The question should be posed, however, if this view is complete. In fact, the definition on what constitutes a project legacy has been scarcely explored in the literature or is often narrowed to knowledge generation, whose main benefit would rely on the potential knowledge re-use and the enhancement of capabilities towards a learning organization (Senge, 1990). Yet, being the de-facto vehicle for change, projects are by nature well placed to shape not just the organization but the legacy organizations want to leave in the world.

Cooper et al (2003), defined project legacy as including "not just the design products and leftover parts, but new processes, relationships, technology, skills, planning data, and performance metrics." According to these authors, a project's legacy is composed of three broad categories: the product legacy, the process legacy, and the people legacy. The authors have also identified three primary players for the legacy process – the current project, the organization, and a future project –, where (potential) benefits, primarily related to knowledge re-use, can be gained to the project, the individuals who worked in the project, and the organization.

While the organization is, ultimately, the closest and immediate receiver of the project legacy through the realization of benefits for the business, it is worth noting that the reach of actors that might benefit from the project goes beyond the boundaries of the organizational environment. Although this might sound like an acknowledged fact, where according to common best practices internal and external stakeholders should be identified and engaged throughout the project lifecycle, it is not unusual to find projects where the scope of impact is not being fully considered or where it is limited to the impact to the organization and a reduced number of actors, hence, reducing the potential for far-reaching legacy to be effectively built.



Source: adapted from Shenhar and Dvir, 2007

Fig. 1. **Project success timeframe**

Applying the same rational, a paradox can be observed since the preservation of the project legacy often ends at project closure, consisting most of the times of no other activities than ensuring handover and support, archiving project documentation, conducting contractual and administrative closure of the project, and collecting and distributing lessons learned from the project, in order to facilitate knowledge transfer and re-use in future projects.

Further to the previous points, although without using the term "legacy", Shenhar and Dvir (2007) advocate that the success of a project can be measured overtime, having illustrated the need to consider the full impact of the project timeframe and not just focusing on the immediacy of delivery, as represented in the Figure 1.

As displayed above, the legacy of a project does not end when the project is delivered but actually extends beyond the project lifecycle. Also, it has the potential to reach a wider scope than just the organization and its current stakeholders, and has the power to impact more than just the business as usual but also ours and next generations. If this was a utopia a couple of years ago, now, in an era where new megaprojects are starting every day and affecting wider audiences, to be aware of that fact and to incorporate principles of sustainability at the heart of a project inception is key as part of the responsibilities of a professional project manager (Silvius, A. G., and van den Brink, J., 2014). The attentiveness to the future of a project legacy calls for a new paradigm in the discipline of project management, where legacy is oriented towards sustainability – Sustainable Project Management.

What is sustainability and how does it relate to project management?

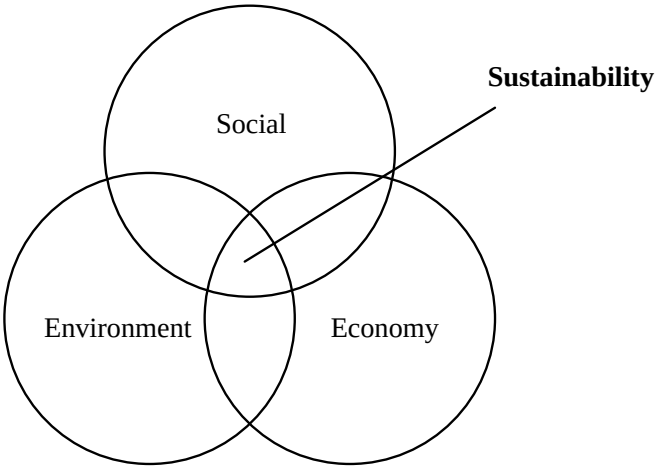
Despite several different variations on the concept of sustainability, it can be said that all derive from the same key idea – how can we develop prosperity without compromising the needs of future generations (United Nations General Assembly, 1987)? This idea implies three interrelated development dimensions which demand balance – social sustainability, environmental sustainability, and economic sustainability –, coined by Elkington (1994) as the "triple bottom line" or "triple-P" concept (People, Planet, Profit) when in a business context:

Sustainability should not be addressed in a simplistic way though, and it should be remarked that there are a set of principles that enrich the meaning of sustainability, including accountability, transparency, ethics, and value orientation, amongst others (ISO 26000; Gareis et al., 2009; Silvius et al, 2012).

Although the topic of sustainability has been subject to increasing interest from the academic community, the relationship between sustainability and project management is still an emerging field of study (Gareis et al, 2009; Silvius, 2014). Given the fact that projects are conducted with the aim to achieve a desired future (the legacy to-be), and that sustainability has at its core a forward-looking orientation, it is thus of interest to analyse the links between these concepts, and what role do projects and the discipline of Project Management play towards a more sustainable world.

A general growing awareness to the topic of sustainability can be observed in recent years, where several companies worldwide now share their sustainability strategy, and produce sustainability plans and annual sustainability reports as part of their governance strategies. However, with few exceptions (e.g. London's 2012 Olympic Games, UK Crossrail, Heathrow Terminal 5, 2014 FIFA World Cup™), this practice has not extended to projects in a consistent manner yet or is been only applicable to megaprojects with public visibility. Also, project

management practitioners are not yet full knowledgeable about what sustainability entails and how to integrate it within projects (Ebbesen, and Hope, 2013), which might help to understand why, in a study conducted in 2013, an overall average of only 25.9% of organizations were currently considering the concepts of sustainability in the initiation, development, and management of theirs projects (Silvius et al., 2013).



Source: adapted from Elkington, 1994

Fig. 2. **The triple bottom line**

In view of this scenario, a starting point is to compare the characteristics of sustainable development and Project Management, which were summarised by Silvius and Schipper (2014) as illustrated below.

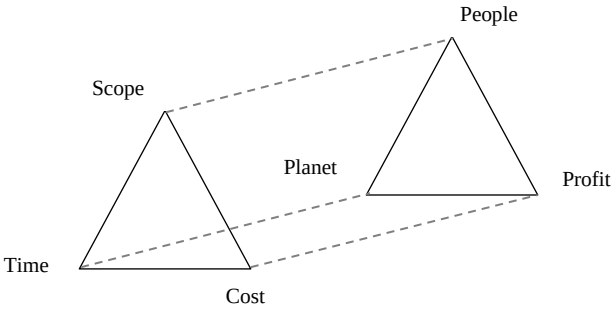
Sustainable Development	Project Management
Long term + short term oriented	Short term oriented
In the interest of this generation and future generations	In the interest of sponsor / stakeholders
Life-cycle oriented	Deliverable / result oriented
People, Planet, Profit	Scope, Time, Budget
Increasing complexity	Reduced complexity

Source: adapted from Silvius and Schipper, 2014

Fig. 4. **Characteristics of Sustainable Development and Project Management**

It is evident that there is a conceptual contrast between the two perspectives, particularly in regards to the time horizon that is at stake since, while projects are typically oriented to short-term, sustainable development involves a wider timeframe that goes beyond the project lifecycle. Despite this difference, Project Management and sustainability are intrinsically linked, as projects are essential to build a more sustainable world, and sustainable practices are essential to deliver better project legacies. Sustainability starts with Project Management, in the sense that

"when a product or service is conceived and translated into requirements there are social, fiscal, and environment impacts that should be measured and accounted for in terms of development, life-span, servicing, maturity of process, efficiency etc." (J. Carboni, 2013). Hence, the responsibility to also factor in requirements around sustainability and look beyond the classical tripe constraint requires project managers to now change both their scope and their mindset (Silvius et al, 2014) in order to actively respond to the challenges of the scarcity of resources at a wider scale.



Source: authors' construction

Fig. 5. **Linking the Triple Constraint with the Triple Bottom Line**

With this in mind, it can be said that, ultimately, the legacy of the project (and its planning) represents the link bridging the present and the future of the idea (need or opportunity) that originated the project, thus, thinking about sustainability implies, by derivation, thinking about the project legacy. The challenge arises however on how to think about and plan today for a lasting legacy that is distant in time and set to be part of the future. How to ensure that what is being built today will still be relevant, suitable, and aligned with the sustainability principles of tomorrow? For that purpose, this paper will in the following sections suggest the use of Foresight and Scenario Planning as a future-proof tool towards project legacy sustainability.

Discussion

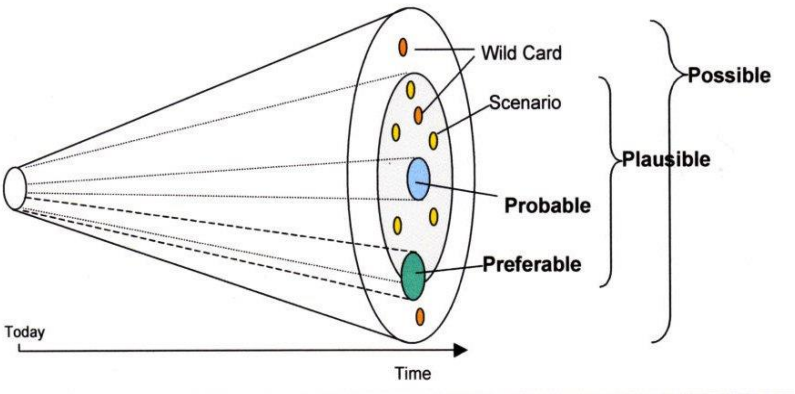
The case for Foresight as tool for the project's legacy future

Foresight can be described as the discipline, skill or process of engaging the future in order to "provide challenging visions of alternative futures which can be acted upon today in order to shape the best possible tomorrow" (Jackson, 2013). This definition carries two distinctive characteristics of the concept of Foresight: first, that thinking about the future is thinking about not just one version of the future but several versions; second, it calls for decisions to be made in the present in order to influence the future.

The idea that the future is not one but many may seem difficult to embrace at first yet, if we think about the numerous and unpredictable factors that form it, it is reasonable to consider its different possibilities. In fact, Foresight theorists agree that the future is not known but is not

completely unknown either, as most of the times it is possible to bound uncertainty at a certain extent allowing to foresight different ways of how the future might unfold, that is, there is room for several possible futures, ones more plausible than others to occur. This idea is expressed in the cone of plausibility, which distinguish different views of the future:

1. *Probable or Official future*: in the centre in the cone of plausibility lies the probable or official future meaning the one that is most likely to reveal should the environment proceeds as usual; it represents a collective view of what is going to happen as expected.
2. *Preferable Future*: the preferable future sits close to the probable future since it is variation of this latter representing what is desirable by an organisation and/or individual to happen.
3. *Plausible Future*: the range of alternative futures that may be reasonably anticipated represent a plausible future, this is, what could happen instead.
4. *Possible Future*: by broadening the scope of potential futures, even if not conceivable to take place, we then include possible futures, which represents what might happen, the thinking of the unthinkable.

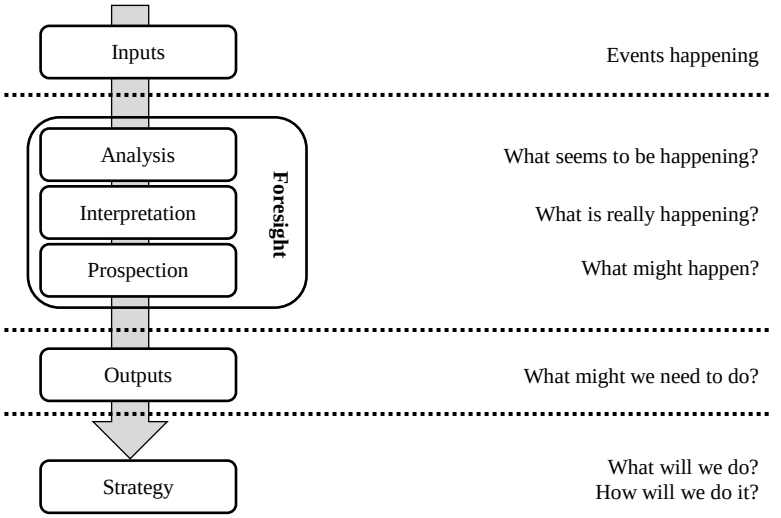


Source: adapted from Taylor, 1993; image retrieved from http://thinkingfutures.net/

Fig. 6. **The cone of plausibility**

Foresight consists of a multidisciplinary and holistic perspective of an organization's environment and uses a set of methods and tools that enable decision-makers to make a sense of driving forces of change, emerging trends or weak signals, and get an understanding of the complexity that results from the interactions amongst them. By envisioning different versions of what the future might look like and exploring its implications, Foresight also discloses opportunities and threats that are not always easily perceived, allowing for an anticipatory awareness to risks and challenges and enabling better informed decisions.

According to Rohrbeck et al. (2009), "top performing companies do not only use their Strategic Foresight insights to anticipate the future, but they strongly take actions in actively shaping it." In fact the effectiveness and usefulness of foresight lies in its call-to-action, this is, its ability to influence decisions and trigger management reactions that ultimately could drive the company's strategy towards its preferable future.



Source: adapted from Voros, J., 2000

Fig. 7. **Foresight process**

Among the techniques that form Foresight, one of the most well-known is Scenario Planning which has been subject of an emergent popularity. Pioneered by Herman Kahn in the '40s and followed by Royal Dutch Shell in the early '70s, Scenario Planning has been used by this company in a systematic way since then and nowadays other organizations (e.g Siemens[2], Airbus[3]), including governmental bodies, have also successfully implemented this methodology.

A scenario can be described as a narrative description of a future that focus attention on causal processes and decisions points (Kahn, 1967), providing a context in which managers can make decisions. It should not be misinterpreted as a forecast or a prediction though. While a prediction intends to calculate the chances of a particular outcome as accurately as possible, scenarios are not about whether a plotted future turn out to be right or wrong or neither about sensitive analysis; scenarios suggest plausibility, not probability and its objective is to lead to better decisions, not better predictions.

Exploring the different shapes that can be taken by an uncertainty that is critical for the success or failure of an organization is the basis for scenario planning thus. An effective scenario displays the following characteristics:

- It challenges the dominant paradigm (the official future) and yet is plausible within the cone of plausibility;
- Is internally consistent in the way that alternative scenarios address the same critical uncertainty;
- Is clearly and explicitly distinguishable from other scenarios as they do not represent slight variations but divergent options;
- Is described in a credible and exciting manner able to affect and/or conduct towards action.

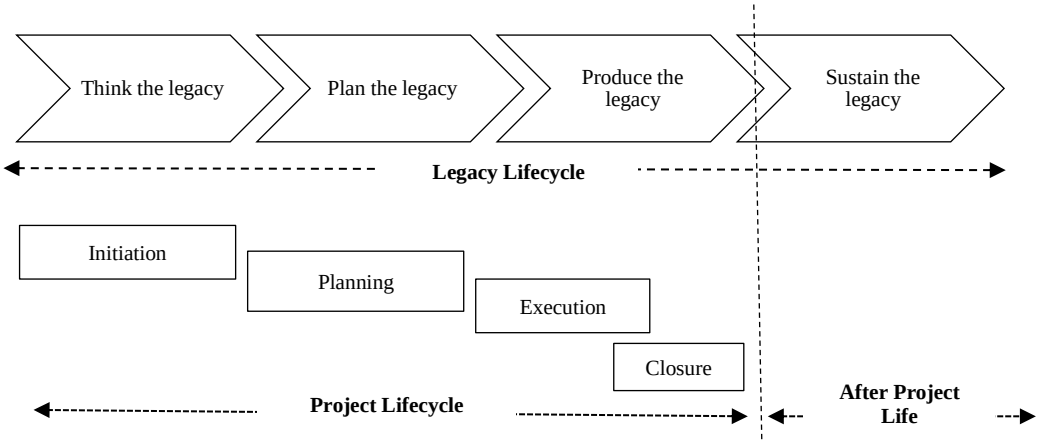
[2] http://www.siemens.com/innovation/en/home/pictures-of-the-future.html [Accessed 10 February 2015].
[3] http://www.airbus.com/innovation/future-by-airbus/ [Accessed 10 February 2015]

By fostering the systematic exploration of future possibilities, scenario planning provides organizations with the opportunity of rehearsing the future and plays an important role in challenging assumptions and mental maps that ultimately leads to better awareness of risks and opportunities and anticipatory resilience as a competitive advantage for the long-term. To actively engage into thinking about the future can enable flexibility in risk responses, prevent missing opportunities and, ultimately, even save a company's future as highlighted by the following examples where key-players in their industry failed to foresee the game-changer disruptions ahead:

- Kodak: once leader in the photography market, Kodak is nowadays a case-study of what can be the impact of neglecting an emerging trend as the company missed the opportunity of digitalization and has gone into bankruptcy in 2012.
- Blockbuster: the well-known movie-rental company filed for bankruptcy in 2010 after failing to adapt its business model to online technology, a trend that was spotted in advance by competitors such as Netflix.
- Nokia: formerly regarded as a leader in mobile phones sector Nokia had lost a large share of the market by underestimating the important shift towards smartphones.

In fact, when a company fails, this is not much related to incorrect forecasting around cost figures or price tables but often due to an inability to think holistically about the driving forces that may change its business landscape in a disruptive way and that can profoundly impact its long-term success.

Following the points mentioned above, the same principle can be applied to a project's legacy, where legacy should be thought about at the very beginning of the project and where scenario planning can be prompted at the project early stages so that the project team and sponsoring organization are engaged and motivated towards a long-term view of the project and that the legacy to be produced and transferred is comprehensive and robust enough to sustain in face of different scenarios that might materialize. This idea is captured below, where the relationship between the legacy lifecycle and the project lifecycle is represented, along with the activities and key questions that compose each of the stages of the legacy process.



Source: authors' construction

Fig. 8. **Relationship between the legacy lifecycle and the project lifecycle**

Table 1

The legacy lifecycle

Stages	Activities	Key Questions
Think the legacy	• Develop the legacy vision for the project.	• Which legacy do we want this project to leave, in regards to people, the planet, and profit? • How better will the world be with this project?
Plan the legacy	• Collect and document requirements for sustainability; • Develop a sustainability plan for the legacy; • Test the legacy vision and sustainability plan through scenario planning implementation.	• Which sustainability requirements do we need to meet to achieve our legacy vision? • Which activities and resources will be required? • Which are the driving forces and critical uncertainties that could affect the project legacy? • How will the world look like after this project is delivered? • Will the legacy still be relevant in 10, 20, 50 years' time?
Produce the legacy	• Deliver the project's product; • Capture, document, and disseminate the project knowledge.	• Does the project meet the requirements and defined acceptance criteria for it to be sustainable? • Is knowledge being effectively captured, documented, and disseminated within the organization? • Is this knowledge available to be re-used?
Sustain the legacy	• Manage the legacy of the project; • Review, monitor and control the application of the sustainability plan;	• Are we continuing to build on the project legacy? • Is the sustainability plan being effectively delivered? • Do current/future projects support (and are being supported by) our legacy?

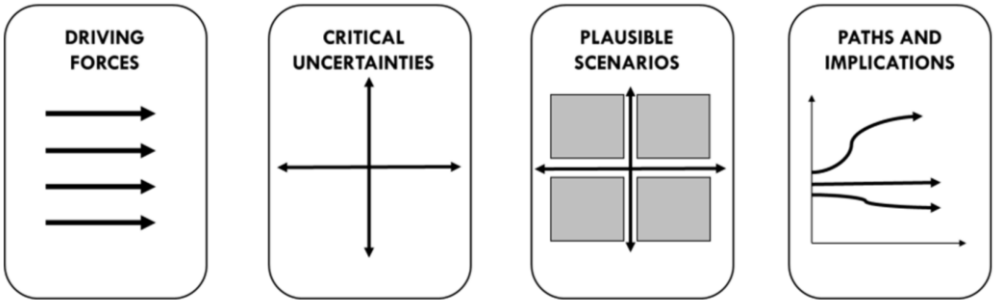
Source: authors' construction

Looking with further detail on how to implement the scenario planning process mentioned as part of planning the legacy, four main steps are recommended in line with most of scenario planning methodologies:

1. ***Scan and Sense*** the environment, with the goal of identifying which are the trends and driving forces shaping society, the region and the industry within which the organization operates, and also the context in which the project exists, putting the concept of legacy and sustainability at the heart of this exercise; PESTLE (Political,

Economic Socio-cultural, Technological, Legal and Environmental) analysis is usually included as part of this first step;

2. ***Explore and Identify*** the critical uncertainties that could re-define dramatically your project legacy vision; these are generally two or three major driving forces from the previous step;
3. ***Shape and Build*** plausible scenarios based on the critical uncertainties previously identified; scenarios should represent contrasting possible futures where the project legacy might take place, each containing a different and distinctive name and narrative;
4. ***Think and Act*** on what might be the paths and implications derived from each of the scenarios for today's project activities in case the project legacy takes place in those scenarios; the purpose is to enhance preparedness for the future, not to be right about it.



Source: authors' construction

Fig. 9. **The Scenario Planning process**

By asking the right questions rather than providing the right answers, the practice of Foresight allows project managers to explore in less obvious places the signs of change, trace them and act upon them, claiming to themselves an active and proactive role and not just the one from a impassive observer towards the world by which theirs projects are surrounded and affected. It is acceptable to be defeated but it is no longer to be surprised.

Conclusion

The paper concluded that there is a strong implicit link between the project legacy, Foresight, and sustainability, which are all oriented towards the future. Further to this point, it advocates that project managers have an important role to play when managing a project, not just focusing on its delivery but also on its legacy and how the legacy can sustain and be sustainable over time. In order to do so, Foresight as a discipline and Scenario Planning as a tool are recommended to support the goal of a lasting legacy.

This paper aimed to start a conversation on incorporating Foresight practices into the field of Project Management, as this area has been scarcely explored and is proving beneficial in other fields such as general management. It should be noted however that it is based on a

conceptual model, hence, one of its main limitations lies in its lack of factual corroboration and thus more empirical research is needed to support the proposal presented through strong evidence.

Recommendations for research include identification and analysis of other areas and processes of Project, Program, and Portfolio Management where the introduction of scenario planning as a tool and technique could be a benefit. Although Risk Management is inherently related to scenario planning due to its nature, others processes might also make advantage of this tool which could be particularly relevant to Portfolio Management, where to set the right mix of projects and resources that are resilient to different scenarios is critical to the effectiveness of the strategy of organisations.

Additional research is also needed regarding the extent to which scenario planning might apply to different industries (e.g. IT and construction) as the criticality of the planning horizon can vary significantly amongst them. Other stream for research would be to investigate to which extent different countries are prone to use scenario planning in their projects by relating this approach with their score in the cultural dimension of "uncertainty avoidance" as defined in Hofstede's model.

Bibliography

Blyth, A., & Worthington, J., 2010. Managing the brief for better design. Routledge.

Carboni, J., 2013. Sustainability starts with Project Management! Expert interview with Joel Carboni. [Online] Available at: http://emete.com/blog/20130610/sustainability-starts-with-project-management-expert-interview-with-joel-carboni/ [Accessed 25 January 2015].

Cooper, L. P., Hecht, M. H., & Majchrzak, A., 2003. Managing a project's legacy: implications for organizations and project management.

Ebbesen, J. B., & Hope, A., 2013. Re-imagining the iron triangle: embedding sustainability into project constraints. PM World Journal, 2(III).

Elkington, J., 1999. Cannibals with forks: the triple bottom line of 21st century business. Capstone, Oxford.

Flyvbjerg, B., Bruzelius, N., & Rothengatter, W., 2003. Megaprojects and risk: An anatomy of ambition. Cambridge University Press.

Gareis, R., Heumann, M. and Martinuzzi, A., 2009. Relating sustainable development and project management, IRNOP IX, Berlin.

Guide, A., 2001. Project Management Body of Knowledge (PMBOK® GUIDE). In Project Management Institute.

Inspired by 2012: The legacy from the London 2012 Olympic and Paralympic Games, A joint UK Government and Mayor of London report, 2013, Cabinet Office, London. [Online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/335774/140723_Inspired_by_2012_-_2nd_annual_legacy_report_-_accessible.pdf [Accessed 25 January 2015].

ISO 26000:2010, 2010. Guidance on social responsibility, International Organization for Standardization.

Jackson, M., 2013. Practical Foresight Guide. [Online] Available at: http://www.shapingtomorrow.com/media-centre/pf-complete.pdf [Accessed 26 January 2015].

Kahn, H., Wiener, A. J., Bell, D., & Bell, D., 1967. The year 2000: a framework for speculation on the next thirty-three years (p. 6). New York: Macmillan.

Pich, M. T., Loch, C. H., & Meyer, A. D., 2002. On uncertainty, ambiguity, and complexity in project management. Management science, 48(8), pp. 1008-1023.

Rigby, D., & Bilodeau, B., 2007. Tools-A growing focus on preparedness, Harvard Business Review, July 2007 issue. [Online] Available at: https://hbr.org/2007/07/a-growing-focus-on-preparedness/ar/1.

Rohrbeck, R., Mahdjour, S., Knab, S., & Frese, T., 2009. Benchmarking report: strategic foresight in multinational companies.

Senge, P., 1990. The fifth discipline: The art and practice of the learning organization. New York: Duubeday Currency.

Shenhar, A.J., Dvir, D., 2007. Reinventing Project Management: The Diamond Approach to Successful Growth and Innovation, 1st ed. Harvard Business School Press.

Silvius, A.G., Schipper, R.O.N., and Van den Brink, J., 2012. Sustainability in project management. Aldershot: Gower.

Silvius, A.G., Schipperb, R., & Nedeskia, S., 2013. Sustainability in Project Management: Reality Bites.

Silvius, A.G., & van den Brink, J., 2014. Taking Responsibility: The integration of Sustainability and Project Management. Advances in Project Management: Narrated Journeys in Unchartered Territory, 137 p.

Taleb, N.N., 2010. The black swan: The impact of the highly improbable fragility. Random House.

Taylor, C.W., 1993. Creating Strategic Visions'. Environmental Statistics, Assessment, and Forecasting, 259 p.

The long term vision for the legacy of the London 2012 Olympic & Paralympic Games, 2014, Cabinet Office, London. [Online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/279554/2901513_OlympicLegacyLTV_acc.pdf [Accessed 25 January 2015].

van Notten, Ph. W.F., 2005. "Writing on the Wall: Scenario Development in Times of Discontinuity", Dissertation.

Voros, J., 2000. Macro-Prospection: Thinking about the future using macro & big history. [Online] Available at: http://www.integralworld.net/pdf/Voros-MacroProspection.pdf [Accessed 18 January 2015].

Wilkinson, A., & Kupers, R., 2013. Living in the Futures. Harvard Business Review, 91(5), pp. 118-127.

United Nations General Assembly, 1987. Report of the World Commission on Environment and Development: Our Common Future. Transmitted to the General Assembly as an Annex to document A/42/427 – Development and International Co-operation: Environment.

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COMPETENCE-BASED SELECTION OF PROJECT TEAM MEMBERS – GENERAL APPROACH

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Abstract

Sometimes selection of the project team members is based on the certain area's specialists' availability. However, big projects, which may include external specialists, can force to open an external competition for the vacant positions in a project team. The aim of the research is to outline importance, benefits and disadvantages of the competence-based selection as an approach selecting project team members besides many other possible approaches.

The tasks of the research are to summarize the sets of competencies for project team members, describe the process of the competence-based selection and develop questionnaire for definition of Latvian public organisations' more popular job competences and ways of the competency model application in the human resource management (HRM) processes if applicable. The survey' population is "employees of a personnel/human resource (HR) departments or employees, who deal with HR affairs, as well as current and past project teams' members (including managers) in Latvian public administrative organizations that are members of the Latvian National Project Management Association".

The project team members' competence-based selection is suitable and rational approach, nevertheless, it is necessary to apply joint scheme of selection for the best results. This time-consuming process requires a lot of preparation work including adaptation of the approach in case of a certain project. The application of the Analytic-Hierarchy Process is proposed to make the competence-based selection more rational.

Key words: *Competence-Based Selection, Project Management Team*

JEL codes: M12, M51, M54

Introduction

Sometimes selection of the project team members is based on the availability of the specialists from the certain area. However, big projects that can include specialists from the outside of an organisation can afford to open an external competition for the vacant positions in a project team. Selection of the appropriate selection method influence further performance of the project team (Stariņeca O, 2013). The authors highlight benefits of the competence-based approach selecting especially external project team members. The research question is "What are advantages and disadvantages of the competence-based selection method comparing to some other team members selection methods?" Authors also are curious about some competences that are the most important selecting project team members in Latvian public administrative organisations as well as "Do these organisations implement external candidates' selection for

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the vacant positions in the project teams?" etc. Answers on these questions would help to define a set of the most important competences and understand the peculiarities of the projects teams' members' selection process in the organisations. The authors will define the guidelines of the general project team members' selection framework. This framework could be a tool for the organisations seeking improvements of the selection procedure and further project teams' performance.

The subject of the study is competence-based selection, and the object of the study is defined as "Latvian public organisations" project team member'. The aim of the research is to outline importance, benefits and disadvantages of the competence-based selection as an approach selecting project team members besides some other possible approaches. The task of the research are:

- Describe the process of the competence-based selection
- Evaluate competence-based selection approach comparing to other selection approaches
- Summarize different general professional competences sets with help of the expert from the Latvian National Project Management Association (LNPMA)
- Develop questionnaire for definition of Latvian public organisations' more popular job competences and ways of the competency model application in the human resource management (HRM) processes if applicable
- Implement a pilot survey and summarize the received responses
- Define hypotheses for the further empirical researches
- Define recommendations and proposes for the Latvian public organisations on the project team members competence-based selection implementation.

The main information sources are scientific literature, official administrative documents, and primary data from the collected survey responses.

Research results and discussion

1. Competence-based selection comparing to some other project team members selection approaches

Competence-based selection presumes that the central candidates' selection criteria are professional competences. Forming the project team, however, the team members' cooperation sometimes is necessary. Team members' collaboration could be more productive and lead to the best performance, if team members have a set of the certain personal and professional characteristics that makes a team create a comfortable emotional/psychological and professional working atmosphere.

There are several approaches that could be taken into account creating a project team and selecting the project team members. Some of them are summarized below split to the suppositive groups of approaches:

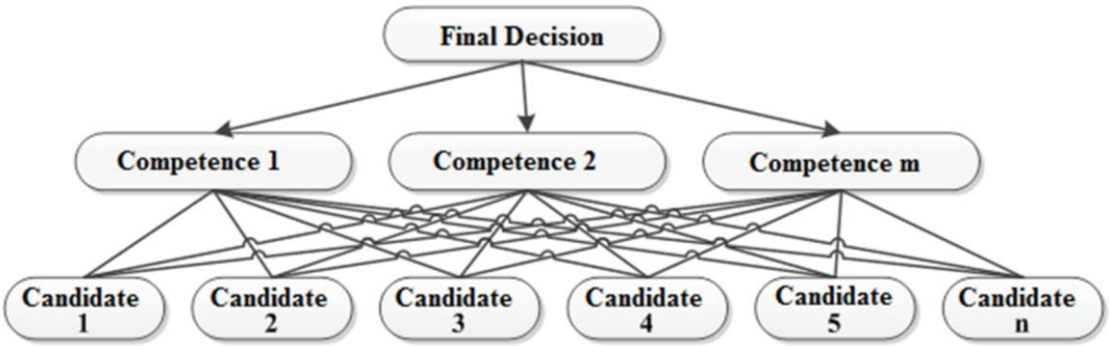
- Psychological approach (temperament types (Childs G., 1995; Williams, 1996; Steiner R., 2008), personality dimensions (Eysenck H. J., 1997; McCrae W. M. & Costa P., 2004), DISC personality types (DISC profile, 2014), people's "world" perception (Fleming N. D., 2001);

- Role approach – Team roles typology (Belbin's team roles (Belbin R. M., 2012), Personality Types (Riso D.R. & Hudson R., 2000);
- Competence approach (Spenser L.M. & Spenser S.M., 1993).

Team can be created based on psychological characteristics of potential team members – relations between temperament types (Childs, 1995). This approach ignores some professional characteristics, i.e. that it is focused on the "soft" skills rather than "hard" skills (Ešenvalde I., 2004) of the candidates. It makes selection process complicated as requires preselection by professional criteria or psychological criteria and final selection by respectively psychological or professional criteria.

Role approach has psychological element. It is mostly based on team members' functional role and type of behaviour, and besides this, it takes into account some people personal characteristics. This approach is more likely to be applied selecting teams. The think that is not constant here is a role. One person can play several roles, or have different roles depending on the team members and type of project, i.e., the same person can be an "Implementer" in one project team, though, working with another project team he/she can take a role of "Co-ordinator". (Belbin R. M., 2012) Hence, it is complicated to use this framework complicating a project team.

Competence approach besides personal characteristics and personal values takes into consideration abilities and knowledge of people (Spenser L.M. & Spenser S.M., 1993). This approach is more complex and suitable for the project team members' selection, because the competence is more complex criteria for selection than a team role or other simple psychological aspect. Selecting the project team members by competence, the person responsible for selection process need to know defined for each role competences and their importance for a certain position in the team implementing a certain project. Competences for each position should be adapted according to the professional and other essential requirements.



Source: author's construction based on B. D. Rouyendegh and T. E. Erkan (2012)

Fig. 1. **Hierarchy for a three-level Multi-Criteria Decision-Making problem for competence-based selection**

Selection is a decision-making process. Therefore, it is necessary to choose a strategy or method to fulfil the selection. To make it rationally and easy for implementation an Analytic Hierarchy Process (AHP) can be used (Saaty T.L., 1980, 2001). AHP is suitable for

competence-based selection as in case of this approach the certain selection criteria are already defined as well as their importance for the position in a team. "AHP method is based on rational decision-making, evaluating the range of the alternatives by the criteria ranged by their importance (Asamoah D. et al., 2012). These preferences between alternatives are reached making pair-wise comparisons. The relative importance is determined using Saaty created nine-point scale, where 1-equal, 3-moderate, 5-strong, 7-very strong, 9-extreme level, 2, 4, 6, and 8 – the intermediate values (Coyle G., 2004)". (Voronchuk I. & Starineca, O., 2014)

In case of AHP application in competence-based selection, each competence is evaluated and have its own weight (importance level for the exact position). All candidates are assessed by each competence and that one, who has the highest weight by each criteria, is selected as the best one from the pool (Fig. 1). AHP presume candidates assessment by each criteria. The method to evaluate it should be primary defined.

J. Varajãoab and M. M. Cruz-Cunhac (2013) already proposed to use a gerund of the International Project Management Association Competence Baseline's (ICB) and AHP approach selecting project managers. We support this idea. However, we would concentrate on the more holistic approach of this tactic application. The same model can be used selecting all project team members. The set of the competences will vary depending on the specifics project team position and project specifications.

2. Project team members' competences

There are various definitions of the competence itself. For example, in the Economic dictionary competence is explained as "a range of questions, where a person has extensive knowledge, experience" (Grēviņa R., 2000). The Oxfords Dictionary gives the following definition of competence: "the ability to do something successfully or efficiently" (Oxford University Press, 2015). Scientific literature authors however are more detailed and concrete defining employee's competence.

Table 1

Five dimensions of the competence framework

No.	Dimension	Description/definition
1.	Cognitive competence	Knowledge (know-that), underpinned by understanding (know-why), is distinguished from competence.
2.	Functional competences	Skills or know-how, things that "a person who works in a given occupational area should be able to do … [and] able to demonstrate".
3.	Personal competency (behavioral competencies)	"Know how to behave", a "relatively enduring characteristic of a person causally related to effective or superior performance in a job".
4.	Ethical competencies	"The possession of appropriate personal and professional values and the ability to make sound judgements based upon these in work-related situations".
5.	Meta-competencies	Concerned with the ability to cope with uncertainty, as well as with learning and reflection.

Source: Cheetham G. & Chivers G., 1996, 1998; Delamare Le Deist F. & Winterton J., 2005

Competence is defined as "a person's basic characteristics, which have a causal relationship with effective and outstanding performance based on the certain criteria" (Spenser L.M. & Spenser S.M., 1993). F. Delamare Le Deist and J. Winterton (2005) publishes a more detailed summary of competences definitons answering on the question "What is competence?" They also mentioned G. Cheetham's and G. Chivers's (1996, 1998) holistic model of professional competence. Their competence framework includes five dimensions listed in Table 1.

Project team members' and manager's competences however have their specifications; they are adapted to the areas peculiarities. One of the most popular framework that also is used by project management practitioners in Latvia (LNPVA, 2012) is an ICB framework that "offers access to the technical, behavioural and contextual competence elements of project management" – "the eye of competence" (International Project Management …, 2006). It includes only three dimensions.

In Latvia, a project manager's competences are defined in the local occupational standard (Labklājības ministrija, 2010). Therefore, the authors selected for the empirical study some competences from both the occupational standard and ICB. The main criteria selecting the competences were applicability to each project team member despite the specifics of the project and the member's position in the team. Therefore, from the ICB the whole list of the behavioural competences was chosen: Leadership, Engagement & motivation, Self-control, Assertiveness, Relaxation, Openness, Creativity, Results orientation, Efficiency, Consultation, Negotiation, Conflict & crisis, Reliability, Values appreciation, Ethics (International Project Management …, 2006). The expert from LNPMA responsible for education and research helped to select the competences from the Latvian occupational standard. They were also filtered by importance in field of projects as a criterion. This list consist of following eight competences (Labklājības ministrija, 2010):

- Ability to analyse problems, set goals and alternative solutions for their achievement;
- Ability to carry out assessment of the project's alternatives solutions by several criteria;
- Ability to formulate valid recommendations and tasks of the project;
- Ability to analyse a structure of the organisation and adapt it to the managerial needs of the project and program;
- Ability to choose and implement planning and controlling methods essential for the project management;
- Ability to ensure a successful run and coordination of the project management process;
- Ability to develop and maintain specific documentation required for the project management for the full period of the project development and implementation;
- Ability to manage project team, delegate tasks, accept and assess operational results.

All these 23 competences were insert in the questionnaire to analyse their importance from Latvian public organisations currents and past project team members' point of view.

3. Survey and questionnaire

The survey's objective is to collect information about the object of the research to answer on the list of questions that will help to create the project team members selection guidelines for the Latvian public administrative organisations. The survey's population is defined as "Latvian public administrative organisations, i.e., 13 ministries, 93 ministries' subordinate organisations and 119 municipalities".

This paper presents only the preliminary survey's results. Sample of the pilot survey: "employees of personnel/human resource (HR) departments or employees, who deal with HR affairs, as well as current and past project teams' members (including managers) in Latvian public administrative organizations that are members of the LNPMA". There were four (Latvijas Nacionālā projektu …, 2015) of them in January 2015. The nonprobability sample method applied is a convenience sample as the research is preliminary and explorative by design. The sample represents only 1.8% of the population, thus it is impossible to admit collected data as representative, and however, it gives an overview of the situation. The pilot survey was active from January 29, 2015 up to February 5, 2015.

The questionnaire was developed in Latvian language, as all respondents are Latvian local inhabitants. There are two groups of the respondents, who answered only on one certain block of questions in the questionnaire. The first block of questions is developed for the current and past *projects teams members* (including managers); the second block of questions is for the employees of personnel/human resource (HR) departments or employees, who deal with HR affairs (*HR specialist*). Each question corresponds to the certain objective of the research (Table 2). The first question should be answered using the rating 10 points scale, where one is "not important at all", and 10 is "enormously important". The special scale for the second closed question's answer is developed. The third question is an open question to clarify a reason of the answer selected on the second question. The questions from no. 3-14 are open questions, here some detailed and precise information needed to be collected, however it can vary too much, therefore it is impossible to propose any exact answers on the questions. All questions except question no. 2.1, 3, 10, and 12 are required for answer. Exceptional questions are optional, because there is a consideration that the observed organisations might not to have systematic information to response.

Table 1

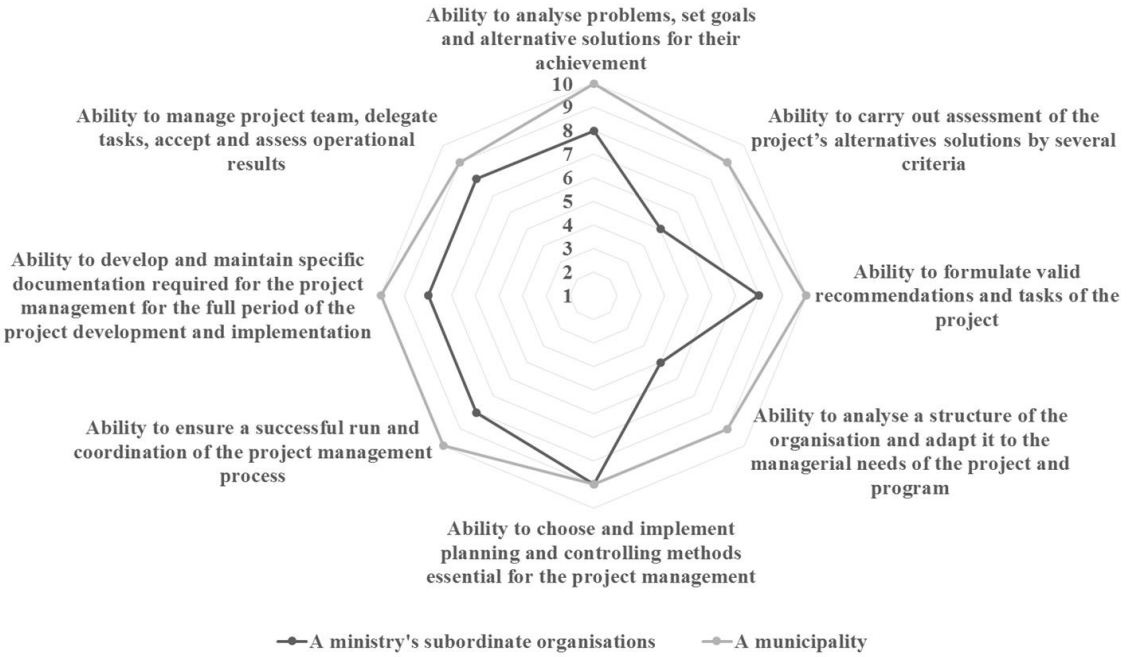
Questionnaire questions and their ground for the research

No.	Question	Group of respondents	Question's planned outcome
1.	Please, evaluate the competences' importance selecting your represented organisation's project team members!	Project team member	Definition of the most important competences for a work in the project team in the observed organisations
2.	Does your represented organisation recruit project team members from the external environment (labour market, other organisations, etc.)?	HR specialist/ Project team member	Identify, if the organization implement external recruitment of the project team members, and check, if the project team members know the source of HR in the team
2.1.	Please, explain the behaviour of the organisation mentioned in the previous answer!	HR specialist/ Project team member	Identify the reason of the certain external HR usage's frequency
3.	Where the competency model is applied in your represented organisation, if there is any?	HR specialist	Identify if the organisation has defined competency model and is it applied selecting HR or somehow else

No.	Question	Group of respondents	Question's planned outcome
4.	Please, list the main HR selection steps that in your represented organisation follows selecting project teams members	HR specialist	Identify common and typical steps and characteristics of project team members' selection in the observed organisations
5.	Please, name your represented organisation	HR specialist/ Project team member	Collection of the organisation's characteristic data
6.	How many employees are in your represented organisation?	HR specialist	Collection of the organisation's characteristic data
7.	What is the average age of your represented organisation's employees?	HR specialist	Collection of the organisation's characteristic data
8.	How many young specialists (up to 35 years) are in your represented organisation?	HR specialist	Collection of the organisation's characteristic data
9.	What is a percentage of the young candidates (up to 35 years) to the open vacancies in your represented organisation comparing to the total number of all applicants?	HR specialist	Collection of the organisation's characteristic data about HR selection
10.	What is a percentage of the young candidates (up to 35 years) to the open vacancies project team in your represented organisation comparing to the total number of all applicants?	HR specialist	Collection of the organisation's characteristic data about project team members selection
11.	What is the yearly average number of vacancies in your represented organisation?	HR specialist	Collection of the organisation's characteristic data about HR selection
12.	What is the yearly average number of vacancies for the project team members in your represented organisation?	HR specialist	Collection of the organisation's characteristic data about project team members selection
13.	Does your represented organisation provide training for the new selected employees (project teams' members)?	HR specialist	Collection of the organisation's characteristic data to evaluate, if the organisation select project team members, if their competency does not fully corresponds to the position requirements
14.	Name your position in the organisation!	HR specialist/ Project team member	Collect data about the respondent to adjust collected data according to the professional status of the respondent

Results of the survey are summarized further on. The popularity of the competences from the Latvian occupational standard selecting project team members in a municipality and a ministry's subordinate organisation in Latvia is summarized in the Fig. 2. All these competences

are more important selecting project team members for a municipality. The less important for the municipality are ability to manage project team, delegate tasks, accept and assess operational results, ability to carry out assessment of the project's alternatives solutions by several criteria. All these competencies are applicable selecting a project team member in spite of his/her position, ability to analyse a structure of the organisation and adapt it to the managerial needs of the project and program, and ability to choose and implement planning and controlling methods essential for the project management. The municipality's projects manager assessed these competences by 9 points. All other competences received a 10 points mark. Ability to choose and implement planning and controlling methods essential for the project management is the same important for a ministry's subordinate organisation (9 points).



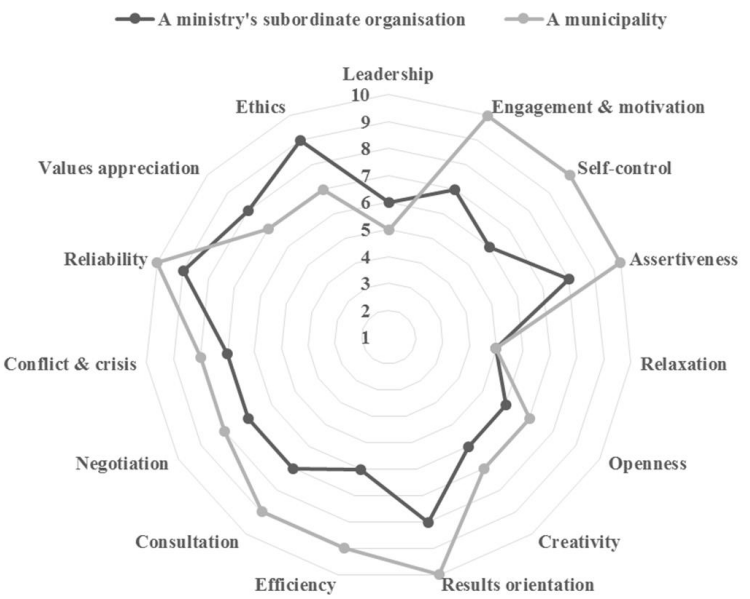
Source: author's created based on data collected towards the survey

Fig. 2. **Importance of competences from the Latvian occupational standard selecting project team members in a municipality and a ministry's subordinate organisation in Latvia**

In general, the projects specialist from the ministry's subordinate organisation assessed all other competences as less important selecting a project team member (average grade is 7.38). Nevertheless, their importance level is higher than average. Less important competences selecting project team members in a ministry's subordinate organisation in Latvia are ability to analyse a structure of the organisation and adapt it to the managerial needs of the project and program and ability to carry out assessment of the project's alternatives solutions by several criteria (they were evaluated by 5 points). Other five competences has 8 points of importance.

The Latvian occupational standard has these competences in a list of competences that requires a project manager, however, it was tested that some (majority) of these competences are

also important for any other project team member. ICB behavioural competences' importance vary a lot in to types of the observed Latvian public administrative organizations (Fig. 3).



Source: author's created based on data collected towards the survey

Fig. 3. **Importance of behavioral competences by ICB selecting project team members in a municipality and a ministry's subordinate organisation in Latvia**

For both types of observed organisations as competences, selecting project team members are important: engagement and motivation, assertiveness, results orientation, consultation, negotiation, conflict and crisis, reliability, values appreciation and ethics. There competences received the grade that is more than six in both cases. Less important is relaxation that can be sign of the calm and comfortable working atmosphere without stress that usually experience observed organisations project teams or organisations unwillingness to care about their team members psychological condition, i.e., it is not a priority selecting project team members.

In addition, it was found out that observed organisations do not recruit external candidates to the positions in the project teams or do it for less than 10%, if they do not have specialists with some certain technical competences.

Unfortunately, no one from the personnel or HR department have participated in the survey, hence it was not possible to collect data that are more detailed on selection process and organisations themselves.

4. Draft of the guidelines, hypotheses and discussion

Planning to create a project team some organisations may use only available internal human resources. However, in spite that project team members can be selected by personnel or HR department specialist, primary selected project manager or other person related to the

project or just holding a head position in the organisation, the selection process should be reasonable and responsible.

The draft guidelines developed reflect systematic activities that need to be implemented using competence-based approach selecting project team members. Especially these guidelines are suitable for public administrative organisations. The draft version of the guidelines include several steps:

1. Define the project team vacant positions;
2. Develop the job descriptions for all project team positions;
3. Define the competences that are needed to fulfil the tasks that are presumed to be fulfilled towards the project (including ICB behavioural competences and eight competences from Latvian occupation standard discussed before);
4. Define the level of each competences importance;
5. Define the selection methods that will check defined competences level (evaluation of the candidates competences should be quantitative, if the organisation apply AHP as a final decision-making method);
6. Research the availability of the resources needed;
7. Develop the job advertisements of each position separately and adjust it to the pool of potential candidates (usually applicable for external recruitment);
8. Receive applications (usually applicable for external recruitment);
9. Screen and pre-select the applications (usually applicable for external recruitment);
10. Apply the defined selection methods to test the candidates;
11. Summarize the results of testing applying the Analytic-Hierarchy Process (Saaty T.L., 1980, 2001) or other decision-making method;
12. Select the most suitable candidates based on the AHP results; if there is no any suitable candidates and only an internal selection was applied, the external recruitment and selection should be started. If there is no any suitable candidates after the external or external and internal recruitment and selection, the process might be started from the points three and four one more time.

The guidelines do not include some steps that are connected to the communication with other employees on the pre-selection period and with applicants and candidates during recruitment and selection activities as well as after them.

The authors defined three hypotheses for the further empirical researches:

- Different types of organisations from the population (ministries, ministries' subordinate organisations and municipalities) have different importance level of the certain project team members' competences;
- Less than 40% of the population have developed and applicable in practice competence model;
- 50% of the population do not recruit external candidates for the position in the project teams at all (have not had such an experience before, in the past).

Organisations might be interested in this research in general, as a result can be practically applicable and will lead to the project teams' more effective and efficient work and better performance. Public organisations particular can use the developed guidelines; however, they are applicable also for the private sector organisations. Organisations might not recruit and select external candidates for the project management positions; however, the competence-

based selection is a rational approach that can be used selecting the candidates from the internal organisational structure, if the organisation is large and have enough resources for the basic daily tasks fulfilment. The larger and specific project, the larger a need to recruit external candidates for the vacant positions in the project team. The competence-based approach to the project team members' selection has many advantages and can be applied as quite a universal tool, however, it is more relevant in some specific circumstances.

Conclusions, proposals, recommendations

Conclusions:

1. The competence-based selection of project team members is suitable and rational approach, however, it is necessary to apply joint scheme of selection to create as good and professional project team as possible.
2. The competence-based selection is a time-consuming process that requires a lot of preparation work. Selecting project team members, necessary to adapt the selection approach in case of particular project.
3. There are some competences from Latvian Project manager occupation's standard that can be applicable for any other project team member and can be used as selection criteria.
4. The developed questionnaire can be used for public and private organisations survey. It is rationally structured and quite easy for filling in. The questionnaire covers two respondents groups at once.
5. Collected responses in some cases were too polar. It can be justified by the fact that the respondents experience in the field has not been taken into account analysing data. Furthermore, it could reflect differences of the various observed organisations' types.

Proposals and recommendations:

1. For convenient organisation of the competence-based selection process, the Analytic-Hierarchy Process can be used. It will also help to make the competence-based selection more rational.
2. The questionnaire developed can be added with a question about the respondent experience in the field and on the position. It will help to correlate answers on other questions, when, e.g., given grades evaluating the competences importance level differs too much.
3. To increase the number of filled in questionnaire, a non-monetary award can be proposed for each or a range of respondents as well as channels of distribution should be more elaborated and influential on the respondents. In addition, the personal contacts with each respondent can influence the responsiveness.
4. The further research can cover testing of some hypothesis: 1) different types of organisations from the population have different importance level of the certain project team members' competences; 2) less than 40% of the population have developed and applicable in practice competence model; 3) 50% of the population do not recruit external candidates for the position in the project teams at all.

Bibliography

Asamoah, D., Annan, J. & Nyarko, S., 2012. AHP Approach for Supplier Evaluation and Selection in a Pharmaceutical Manufacturing Firm in Ghana. *International Journal of Business and Management*, 7(10), pp. 49-62.

Cheetham, G. & Chivers, G., 1996. Towards a Holistic Model of Professional Competence. *Journal of European Industrial Training*, 20(5), pp. 20-30.

Cheetham, G. & Chivers, G., 1998. The Reflective (and Competent) Practitioner: a Model of Professional Competence which Seeks to Harmonise the Reflective Practitioner and Competence-Based Approaches. *Journal of European Industrial Training*, 22(7), pp. 267-276.

Childs, G., 1995. *Understand Your Temperament!* Rudolf Steiner Press.

Coyle, G., 2004. *Practical Strategy: The analytic hierarchy process (AHP)*. Glasgow: Pearson Education Limited.

Delamare Le Deist, F. & Winterton, J., 2005. What Is Competence? *Human Resource Development International*, 8 (1), pp. 27-46.

DISC profile, 2014. *What is DiSC?* [Online] Available at: https://www.discprofile.com/ [Accessed 18 April 2014].

Ešenvalde, I., 2004. *Personāla praktiskā vadība*. Rīga: Merkurijs LAT.

Eysenck, H. J., 1997. *Dimensions of Personality*. New Jersey: Transaction Publishers.

Fleming, N. D., 2001. *Teaching and Learning Styles: VARK Strategies*. Neil D. Flemming.

Grēviņa, R., 2000. *Ekonomikas skaidrojošā vārdnīca*. Riga: Zinātne.

International Project Management Association, 2006. *ICB. IPMA Competence Baseline Version 3.0*. International Project Management Association. [Online] Available at: http://www.lpva.lt/cms/files/lpva/resources/4640_IPMA_ICB_EN.pdf [Accessed 31 January 2015].

Labklājības ministrija, 2010. *Profesiju standarti*. [Online] Available at: http://www.lm.gov.lv/upload/darba_devejiem/profesiju_standarti.pdf [Accessed 31 January 2015].

Latvijas Nacionālā projektu vadīšanas asociācija, 2015. *LNPVA Biedri – Juridiskas personas*. [Online] Available at: http://lnpva.lv/lnpva/biedri/o-biedri [Accessed 29 January 2015].

LNPVA, 2012. *NCB – Projektu vadīšanas nacionālās kompetences vadlīnijas, versija 3.1*. Latvijas nacionālā projektu vadīšanas asociācija. [Online] Available at: http://lnpva.lv/wp-content/uploads/2014/04/NCB_3.1.pdf [Accessed 31 January 2015].

McCrae, R. & Costa, P. 2004. A Contemplated Revision of the NEO Five-Factor Inventory. *Personality and Individual Differences*, 36 (3), pp. 587-596.

Oxford University Press, 2015. *Competence*. [Online] Available at: http://www.oxforddictionaries.com/definition/english/competence [Accessed 31 January 2015].

Rouyendegh, B.D. & Erkan, T.E., 2012. Selection of Academic Staff Using the Fuzzy Analytic Hierarchy Prosecc (FAHP): A Pilot Study. *Tehnicki vjesnik / Technical Gazette*; 19 (4), pp. 923-929.

Saaty, T.L., 2001. *Decision Making with Dependence and Feedback: The Analytic Network Process*. Pittsburgh, PA: RWS Publications.

Saaty, T.L., 1980. *The Analytic Hierarchy Process: Planning priority setting*. New York: McGraw-Hill.

Spenser, L.M. & Spenser, S.M. 1993. *Competence at Work: Models for Superior Performance*. Canada: John Wiley & Sons, Inc.

Stariņeca, O., 2013. Human Resources Selection Approaches and Socially Responsible Strategy. *Economics and Business*, (Submitted for publication).

Steiner, R., 2008. *The Four Temperaments*. London: Rudolf Steiner Press.

Varajãoab, J. & Cruz-Cunhacd, M. M., 2013. Using AHP and the IPMA Competence Baseline in the Project Managers Selection Process. *International Journal of Production Research*, 51(11), pp. 3342-3354.

Voronchuk, I. & Starineca, O., 2014. Human Resource Recruitment and Selection Approaches in Public Sector: Case of Latvia. *Conference Proceedings. International Scientific Conference "New Challenges of Economic and Business Development – 2014"*, pp. 417-430.

Williams, X., 1996. *The Four Temperaments: How to Achieve Love, Health, and Happiness by Understanding Yourself and the People Around You*. St Martins Press (T).

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BOTTOM UP INTRODUCTION OF USER CENTERED DESIGN PRINCIPLES IN A SCRUM DRIVEN SOFTWARE PROJECT

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Abstract

As managing software development projects has shown to be a challenging task, a wide variety of methods have evolved, which address mainly either the technical problems or focus on the end user's needs. The study describes the process of the integration of User Centred Design (UCD) principles in a running software development project, managed according to scrum methodology. While ideally UCD starts even before the project itself with the acknowledgement that it is necessary to involve the end user from the very beginning of the project, practitioners find themselves often in a situation, where a project is already running for some time, when some problems occur, finally triggering the absolute necessity for user involvement. This paper shows a bottom up approach taken in such a case introducing UCD principles in an on-going project. It includes the first part of work regarding introducing user stories and prototypes on the first stage of the development process.

Key words: *UCD, scrum, Agile*

JEL code: L86

Introduction

Agile methodology is widely used in IT projects nowadays. The main idea of it is to build the product for the customer in an iterative manner. Customer satisfaction is one of the key principles of the Agile manifesto (Beck & Beedle 2001). However, the evidences show (Patton 2002), that satisfying the customer is not equal to meeting end-user requirements and developing the usable product. Singh points out, that there are three main problems in scrum regarding usability: Goals of the project rarely include adequate study of user needs, usability generally does not have high priority, product development team mostly does not have a holistic view of the desired product (Singh 2008).

User-Centred-Design (UCD) or User-Experience-Design (UX/UXD) puts the user satisfaction as the main aim of the delivered product. Therefore, that methodology supposes the deep upfront research and analysis of users before the code implementation. There are three key design activities according to Barnum (Barnum & Dragga 2001). First activity is the research on which the users are, which activities they perform, what are the conditions of environment. The second design activity focuses on the product, its usability and understandability. The last activity includes iterative design aimed on fixing the problems, which are found during usability testing.

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Thus, both methodologies should have external team member during the development, which is not a part of the project team – customer in Agile methodology and end-user in UCD. In addition, both methodologies supposed to be iterative. Those similarities allow combining both methodologies, which was shown in several studies. Mainly, they contain interviews with team members of the existing running projects; there some UCD principles have already been integrated. All of those surveys show the importance and benefits of strong communication between the development team, the User Experience (UX) specialists and the end-users. Moreover, lessons learned from existing researches provide tips on building the project with integrated methodology from the beginning. For doing that, teams should already have some basic experience with implementing UCD principles in other projects. While this top down approach is the idea, which is widely accepted to produce the best results, the reality in software development shows that very often topics are addressed only when they start causing problems. Therefore, the aim of this paper is to describe how UCD principles were introduced in the examined company in the middle of the project with a bottom up approach.

The paper includes the description of existed practices in agile-UCD integration and the main concept, which is applied in the current project. Moreover, it contains the results of the integration of the main concepts presented in Silva da Silva researches (Silva da Silva 2012b) in the ongoing project. The final part of the paper includes lessons learned and future researches.

Research results and discussion

1. Background and related work

The interest to involve user experience into the development process allows to introduce ISO 9241-210 standard "Ergonomics of human-system interaction – Part 210: Human-centred design for interactive systems" (British Standards Institution 2010). The main principles of the standard are iterative design and user involvement through the design team. Observed researches show, that there are two main ways for the company to introduce UCD. The first way is moving company with User Experience Team from waterfall lifecycle model to agile. The second way is involving users in the teams, which already work according to Agile methodologies.

Moving User Experience team to Agile

Sy describes Autodesk experience (Sy 2007) for changing work process in User experience team from waterfall to agile methodology. Waterfall assumes that work with end users and collecting the requirements from them for all features happens during the design phase. In Autodesk, usability investigation, including contextual inquiry, should be done before the start of the project when they have waterfall development projects. However, in practice there was a problem that developers also start to code during the onset of the project. As a result, some features were developed without formal and approved design. Doing usability investigation far in advance solve that problem but creates another one – introduction of many unused specifications.

The main idea of Agile development lifecycle is dividing developing process in mini releases (sprints) with including each its own process of analysing requirements, design, implementation, quality assurance. The same idea was implemented in Autodesk project for

usability processes. There are two parallel tracks: during the feature implementation (coding and QA), user experience team focused more on preparing design for next sprint. It solved two problems: developers have approved design before starting coding and usability team was able to take in case results from previously delivered sprints: bugs, technical limitations, etc. For the first sprint "Cycle Zero" was added, which besides of design for sprint 1 includes summarising contextual inquiry and brief description about end users and their workflows.

Implementing those activities in Autodesk project allowed increasing the speed of the development in comparison with working by traditional lifecycle model. In addition, the product becomes more designed because of taking previously delivered work into account and focusing on important designs at first.

Introducing UCD in Agile projects

One of the key principles of Agile manifesto (Kent 2001) is customer collaboration. All stakeholders should be involved in the project for increasing development speed by providing cover for unclear requirements and making important business decisions. In reality, involving customers in adaptive software models is hard. Research (Martin et al. 2004) shows that customer role in the project is one of the most problematic, because he or she "is supposed to provide stories or tests or advice or clarifications to the development team instantly, whenever they are required". Therefore, the person works as a chain between stakeholders and development team.

Manifesto also mentions users in its principles: "The sponsors, developers, and users should be able to maintain a constant pace indefinitely" (Kent 2001). However, the role of the user is not defined well. In the Scrum project, user role is moved to Product owner. Product owner role includes responsibilities for project success, and also specifying requirements and managing backlog. The project owner should work good in both directions: development team and customers. Which is hard to achieve because of lack of the skills in usability, team work, customer education, sales, etc. Singh in her U-SCRUM methodology (Singh 2008) uggested to have two project owners: traditional, who focuses on business, and second one, who focuses on usability of the project and user experience. Together project owners approve the end version of user stories, make prioritization, specify backlog.

Full time UX specialist could replace the second project owner. Fox (Fox 2010), based on Sy research (Sy 2007), Ferreira research (Ferreira et al. 2007) and own experience with three project teams showed the importance of the role of Agile-UCD specialist. That role becomes a connector between UX designers and application developers. However, other researchers ((Lee et al. 2010) point out that Agile-UCD specialist also encounters problems. First problem is no common understandable representation of user tasks and application features. Second one is difficulties in distinguishing application features and user tasks. To solve those issues Lee proposed the usability-pattern-based requirement-analysis method. The idea of the method is to transform user task and relative application features into UML construction.

The main idea of Scrum is sprints; in each one team should deliver completed tasks. This has some negative side effects: teams concentrate more on small tasks with losing overall vision and, as observations show, product owners also try to include tasks in the sprint where they are sure that they will be completed (Singh 2008). As a result, productivity and usability become low. U-SCRUM focuses on main task flows, which are organised in storyboard together with paper prototypes. Another research (Fox 2010) shows that stakeholders and potential end users

are more likely to give feedbacks for low-fidelity prototypes than for high-fidelity or end product. Artefacts like prototypes and task flows provide user experience vision of the product and project plan, which becomes a basis for future discussions of key features between stakeholders.

The results of using U-SCRUM show that the usability of the product becomes higher and it was mentioned by all sides: developers, users, stakeholders (Singh 2008). Moreover, they found improvements in developer productivity because of additional motivation by knowing the overall product. Therefore she suggested to use that methodology for complex and novel products.

Chamberlain (Chamberlain et al. 2006) made a field study in three different companies which followed integration methodology UCD and agile (agile is presented by Scrum and XP). Based on the observation few main principles for successful integration of UCD and Agile methods were defined such as having a proxy user on the team, close collaboration between designers and developers, prototyping, giving enough time for finding user needs, including UCD in project management framework.

Silva da Silva framework

Silva da Silva in his systematic review of the scientific literature regarding integration UCD and Agile methods in 2010 found that interest to the topic increased through the years (Silva da Silva et al. 2011, 79 p.). Based on that review the key characteristics of the integration were selected, which became a basis for the new framework. Also he found out that most of the articles are written in a lessons learned manner (Silva da Silva et al. 2011, 79 p.), but none of them are validated by controlled experiment.

In 2012 Silva da Silva published the paper (Silva da Silva 2012a), which describes proposed framework and two field studies based on experience in two real companies. As a result, initial research was refined and a new framework presented (Silva da Silva 2012a, 93 p.). Framework includes the following key aspects: Little Design Up Front (LDUF), Close Collaboration, Low-Fidelity Prototypes, User Testing, User Stories, Inspection, One Sprint Ahead. Those practices are divided to the project team and UX-Specialist, which the author of the framework strongly recommends to include as a full time member. The refined framework was taken as a basis for this paper.

2. Approach: Bottom-up introduction of UCD methodologies

As the literature research has shown, the ideal starting point is to introduce UCD principles before the project starts in a top-down approach from the project manager. However, this requires the project manager to see the need and benefit of UCD principles upfront, which is unfortunately often not the case. On the other hand usually team members, who are either working on user interface related issues or responsible for quality management, e.g. test manager, recognize this need more often, as this is more closely related to their own area of expertise.

To still allow the usage of UCD principles, they will be introduced in the opposite way: the changes come from the Test manager. Therefore, to increase acceptance, they should be done smoothly and not all at once. First aim is to show the responsible stakeholders, mainly Project Manager and Product Owner, the effectiveness of the changes, only then they could be used in current processes. The main principles of integrating UCD and Scrum methodologies

are taken from Silva da Silva researches (Silva da Silva 2012a). Those principles include the following approaches: little design up front, prototyping, user testing, user stories, usability inspections, one sprint ahead, close collaborations (having UX expert), big picture. Initially, the paper shall describe how those practices were applied in an ongoing IT project, which aimed to build a system for managing students in education institutions, mainly universities. Since the stakeholders decided to make a new version of the system, the focus of the paper moved to preparation phase of the project, sprint 0, where the key requirements are collected, the personas are described and the main prototypes are built.

Application in project

As it was mentioned above, the refined framework from Silva da Silva (Silva da Silva 2012a) was chosen as a basis, while some adaptations for the current project needs were performed.

- Little Design Up Front, including Iteration 0. During the Iteration 0 the main parts of the application are defined, based on the previous version.
- Close Collaboration. There is no Interaction designer in the team. The Designer role is split between Test Manager and Project Manager. The results of the design work are shared with the Team during the common meetings.
- Low-Fidelity Prototypes. The prototypes will not be tested with end-users until the requirement definition processes in the team are settled. Instead of that, the prototypes are tested by Project Team and the Project Owner, who is responsible for the customer satisfaction. Prototypes are taken as the basis for specification.
- User Testing. The user testing will be implemented after the requirement definition processes in the team are settled.
- User Stories. The design work is divided into small parts, which are called "design chunks" (Sy 2007). Such setup supports the idea to use one user story in one task. The acceptance criteria are also included in the user story description.
- Inspection. It was mentioned about, that prototypes are presented to the rest of the team for future discussion. Ideas from the team are collected and will be considered during development of the new user stories.
- One Sprint Ahead (at least). The current study includes only the activities, which are performed during the Iteration 0. Therefore, Iteration 0 includes research and design issues for the Sprint 1.

The steps for UCD integration in Scrum project were divided into two phases:

1. Changes in project organization. Those changes could be done by using a project team instead of real end-users. The idea is to stabilize all processes that project team could influence. The practices that are being implemented in the current project are LDUF, prototyping, user stories, usability inspections by the Project owner and the Project Manager, one sprint ahead, and close collaborations of the UX specialist with marketing.
2. Involving end-user. It refers not only to user testing, but also to the certain stages of the project development, for example, testing prototypes and approving user stories.

At the moment of writing paper, the project is in the Iteration 0. The aim for that sprint is to collect and analyse requirements from the previous version of the project, adapt them for the

new version, define the main principles of the future interface, develop prototypes, prepare technical solutions for the implementation.

Project situation before

The aim of the project is to build a system for managing students in education institutions, mainly universities. The work on the project was built in accordance with Scrum methodology. The duration of one sprint is one week. The team contains of Project Manager (who plays Scrum Master role), Customer Manager (Project Owner role), developers and Test manager. The project turned out to have some "typical scrum problems" (Sy 2007): lack of documentation and replacement of end-user by customer.

Initially, the potential customer and Product Owner took a major role in forming features description. The project didn't have Test manager for the long time, all quality review was done by Project Manager and Product Owner. Most of the changes in task were discussed face-to-face, as it is supposed to be in Scrum. When the Test Manager came to the project the question about feature description becomes critical. The first factor was changes in requirements, which were not documented enough for writing test cases, the second – Test Manager language problems. Moreover, the features were implemented based on the technical opportunities, so usability has last priority for developers.

Project situation "goal"

After discussion about technical problems in the ongoing project, the stakeholders made the decision to build a new version of the product. New version should not only have better technical solution, but also be "user friendly". Therefore, it was suggested by Test Manager to introduce the User Centered Design principles. Due to the lack of resources and absence of the UX designer role, the main UCD activities are performed by the Test Manager. This role was assigned to the Test Manager also because test management processes heavily depend on the end-user needs, which are transformed into the ticket requirements.

Since the changes comes bottom-up, they should be done in smooth manner. Therefore, the first aim for Test Manager is to choose part of one or two integration principles that could be done in current situation. The next step is to demonstrate to the Project Manager the positive effect of the changes. Then support changes until they become the natural process of the development. Thus, step-by-step, the way could be done from the improving task description to involving end-user to the project.

3. Little Design Up Front, Sprint 0

Little Design Up Front (LDUF) is one of the major parts of Agile process. The idea is to do only little preparation before implementation starts. LDUF takes place before each iteration, including the first sprint. The Scrum teams tend to include Sprint 0 for setting up some technical issues like hardware and software settings. It might also include the product backlog, but without many details. Sy introduced Sprint 0 or "Cycle Zero" as "the brief requirements-gathering phase" (Sy 2007).

Sprint 0 includes defining product goals, market validation for completely new product, and analysing prior contextual inquiry data for an ongoing release. Moreover, it could include developing personas and scenarios for a completely new market or capability.

Silva da Silva (Silva da Silva 2012b) proposed the adopted version of Sprint 0 for Scrum. Sprint 0, according to his idea, expects work with the user: Contextual Inquiry, Observation, Task Analysis and Interviews. Following artefacts are used: Paper Prototypes, Design Cards, and User Stories with acceptance criteria, Issues and Feature Cards.

Therefore, Sprint 0 could include the following activities:

- Defining product goals,
- Contextual inquiry,
- User observation and interviews,
- Task analysis,
- Design personas,
- Defining user scenarios or user stories with acceptance criteria,
- Creation of design cards,
- Designing of paper prototypes,
- Developing Issues and Feature Cards.

Development team uses those artefacts in Sprint 1. Same activities are performed for each new sprint. As a result, during the planning game of the current sprint team has validated user stories, clarified requirements and acceptance criteria for the tasks.

Contextual inquiry

According to Holtzblatt (Holtzblatt 2001) the contextual inquiry is "an explicit step for understanding who the customers really are and how they work on a day-to-day basis". Since the people tend to skip some routines during describing their ordinary working day, a contextual interviewer task is to collect all the details and understand why people do certain things.

Contextual inquiry according to Sy (Sy 2007) could include following activities:

1. Interviewing and observing internal users for identification of relevant vocabulary and the structure of future interviews with external users.

2. Interviewing and observing external users who use actual implemented product with their existing work artefacts, in their work environment. The aim is to find how developed product changes their normal behavior.

Based on the interview outcomes cross-functional team can find relevant design problems and develop a solution to satisfy customer needs.

Issue cards and Feature cards

Issue cards are an instrument, that contains an insight, a picture, a drawing or a description of new features (Silva da Silva et al. 2011). For Cycle Zero phase, those cards could include users' workflows or scenarios, unexpected uses of the product, example of users' work with the application (Sy 2007).

The idea of issue cards is to present new requests from the end users to the team. As a result, the team can move them to the Feature cards. The Feature cards are the Issue cards, where design is completed and issue moves to coding phase.

User Personas

Singh (Singh 2008) defines persona as "a psycho-social profile of a prototypical user, reflecting the user's goals, skills, and attitudes". In software development, that profile includes users' feeling during work with the application. The persona includes a description of a user and

his/her everyday life activities. The persona is a result of market research and observation of the episodes from people life. The persona's description includes information about demographic, top tasks, search skills, usability needs. Apart of detail persona description at first Quesenbery and Brooks (Quesenbery & Brooks 2010) highly recommend, to define the situation when that persona acts. The situation description includes characteristic of conditions, in which persona needs to use software, and problems, which persona has in specific situation.

For helping to describe persona, following questions could be used:

- Have you ever [done something]?
- How often do you [do that thing]?
- What makes you decide to [do that thing]?
- Where do you [do that thing]?
- When was the last time you [did that thing]?
- Tell me about [that thing]? (Hennigs n.d.)

User Story

Quesenbery and Brooks in their book "Storytelling for User experience: Crafting Stories for Better Design" (Quesenbery & Brooks 2010) describe different ways of writing the user story. One of the ways is to present user story through Persona description, Context, Persona Emotions, and the reason for telling the story. Context includes time and place of the story along with events happening in the story. Apart from the emotions, story should include imagery, interaction and persona motivation for the actions.

Another way of structuring the story:

1. Specification of the goal and context of the story:
   - Reasons, why persona is using the product,
   - Positive aspects of current interaction.
2. List of activities without detail description of the interface.
3. Result of interactions with key success factors.

The template for writing User Stories is "As is a [user role], I want [a feature]. So that I can [achieve some goal]" (Silva da Silva 2012a). According to proposed framework, Silva da Silva mentions that the user stories should be small enough to develop features in one sprint.

For low fidelity prototypes, the form of prototyping depends of the team. "Low fidelity prototyping consisted of everything from producing hand drawn sticky notes on the whiteboard to putting together some wireframes to help flush out the requirements" (Fox 2010).

Low fidelity prototypes are constructed iteratively with user involving. User involving allows to find problematic usability issues and to correct them before the development process starts.

Plan for Sprint 0 and LDUF in selected company

The sprint 0 is planned for 4 weeks. Apart from usability issues, technical issues, selecting framework and analysing the main features of the old version should be done.

From the list of activities, proposed in the framework (Silva da Silva 2012a), the following issues were chosen:

- Personas. Users divide by their roles. Creation of persona for each role.
- User stories for main project features, using personas.

- Prototyping. Low fidelity prototypes in Balsamic (Anon n.d.).
- Planning Sprint 1.
- Contextual Inquiry and Observation with end users were not planned due to unavailability of end users.

The main functions are taking from the main version, which is already in use in one university, as well as approved by potential customers.

4. Results and Lessons learned

By the middle of Sprint 0 (after 4 weeks), the team achieved following results:

Project manager has chosen the framework, which will be used in the development. The framework contains the main UI elements, which are used in the application.

Based on the previous version of the application, the main fields, buttons, standard procedures like search and filtering were collected by Test manager. That information allowed resuming the most used elements in interface, which later were documented and become the foundation for layout system.

Four main personas were defined. Description of each person was made by Test manager and includes social status, the daily activities, and the main tasks which persona does regarding his or her job. Project manager approved personas. Discussing personas gave new ideas about usability. For example, that each interface should be adapted to be used without a mouse.

Analysis of the previous version allowed selecting four key features of the application. Moreover, Test manager, wrote the user stories for each of it. For each user stories, there is the list of acceptance criteria. Those achievements become the basement for the firsts sprints.

Test manager developed the mock-ups for the main features. The mock-ups development was done in iterative manner with few discussions with Project manager until approving, then with the rest of the team.

Lessons learned

The lack of the resources caused the development of basic features, like main elements for user interface, by Project Manager alone. Therefore, the team had no official Sprint 0, just time that everyone needed to do own preparation. The Test Manager developed prototypes of the key features with understanding that not all of that will be used in next sprints. However, developing such prototypes gave new ideas and solutions about the key UI elements and functions, which should be implemented at first.

In spite of the fact, that literature recommends to go from persona to prototype gradually, it was difficult to follow that process. The prototype starts after definition of personas and user story. During work on prototype, the new details come to the persona characteristic, as a result the user story changes. For example, the fact that users use mostly keyboard without combination with mouse were missed in persona description.

The mockup developed by the Balsamic plugin for JIRA, the issue tracker that is used in the company. The mockups gave a big effect for the development process. At first, the clarifying user workflow during discussing them between Project Manager and Test manager the questions, which appears during formulation of user stories and requirements. At second, the mockups allowed developers to find the way of the future implementation before the actual

work, and, as a result, time is saved. At last, the Product Owner is able to estimate the feature and correct them earlier, so it's not only saves the time, but also gives more freedom in changes, because he has not to think how much reimplementation will cost.

Based on lessons learned, it was decided to implement principle LDUF, user stories and prototypes in the future development process. Therefore, during the Sprint 1, the main features for Sprint 2 will be defined, for each of them the user stories with acceptance criteria are developed, and, the low-fidelity prototypes are drawn.

Conclusion

The idea of integration UCD principles in agile projects was widely discussed since the year 2005 (Silva da Silva et al. 2011). However, most of the studies did not use the framework of integration in advance. As a result they mostly contain lessons learned and described the models, which were found during integration (Silva da Silva et al. 2011). In 2012 Silva da Silva systemized previous studies in studied area and developed the framework for integration UCD and Agile methodologies. Moreover, the principles of that framework were applied in two ongoing IT projects. That practical experience allowed refining the framework.

One of the limitation of the framework consist in its' appliance top-down from project management initiative. Therefore, changes come from the top. In the project, selected for the paper, Test Manager proposed the integration idea after founding the problems in tasks understanding resulting in a bottom-up approach. Since the task description is closely connected with requirements, it was found that the project has minimal cooperation with end-users. Product Owner, based on cooperation with clients, develops most of the features.

After finding the problem, the Test manager decided to try to involve end-users to the development for improving quality of development as well as the product itself. Integration framework, described above, was taken as a primary data source.

That framework is used for integration of UCD principles in currently running IT project, which builds software for managing students in education institutions, mainly universities. During the development a new version of the application was started. Tasks were assigned to any sprints, due to the lack of resources. In addition, a few principles were applied. There are personas, user stories, prototypes and iterative work on the usability development. Most of the usability work was done by the Test Manager and then approved by Project Manager, development team and Product Owner. It was noticed by all team members that those activities make the crucial effect to the implementation process. So it was decided to continue focusing on usability and changing current scrum process.

The integration of UCD and Scrum methodologies is a long process, especially when necessary of changes need firstly to be proof to the higher management level. Therefore, the first aim is to introduce and stabilise the principles, which do not require user involvement or where Product owner or other team members could replace user. The next step is smooth end-user involvement. Therefore, the future work is needed.

Bibliography

Barnum, C.M. & Dragga, S., 2001. *Usability Testing and Research*, New York: Longman. Available at: http://www.amazon.com/Usability-Testing-Research-Technical-Communication/dp/0205315194.

Beck, K. & Beedle, M., 2001. Manifesto for Agile Software Development. [Online] Available at: http://agilemanifesto.org/ [Accessed 12 January 2014].

British Standards Institution & International Organization for Standardization, 2010. *Ergonomics of human-system interaction. Part 210*.

Chamberlain, S., Sharp, H. & Maiden, N., 2006. Towards a framework for integrating agile development and user-centred design. *Extreme programming and agile …*, pp. 143-153. [Online] Available at: http://link.springer.com/chapter/10.1007/11774129_15 [Accessed 30 December 2014].

Ferreira, J., Noble, J. & Biddle, R., 2007. Agile development iterations and UI design. *Proceedings – AGILE 2007*, pp. 50-58.

Fox, B.D., 2010. *Agile Methods and User-Centered Design: How These Two Methodologies are Being Integrated in Industry*. University of Calgary.

Hennigs, L., Using Storytelling with UX | User Centered. [Online] Available at: http://www.user centered.de/user-experience/using-storytelling-with-ux/ [Accessed 29 December 2014].

Holtzblatt, K., 2001. Contextual Design: Experience in Real Life. In *Mensch & Computer 2001: 1. Fachübergreifende Konferenz*. Studtgard, pp. 19-22.

Kent, B., 2001. Principles behind the Agile Manifesto. [Online] Available at: http://agilemanifesto.org/ principles.html [Accessed 19 January 2015].

Lee, S.-H. et al., 2010. A Usability-Pattern-Based Requirements-Analysis Method to Bridge the Gap between User Tasks and Application Features. *2010 IEEE 34th Annual Computer Software and Applications Conference*, pp. 317-326. [Online] Available at: http://ieeexplore.ieee.org/lpdocs/ epic03/wrapper.htm?arnumber=5676277 [Accessed 4 January 2015].

Martin, a., Biddle, R. & Noble, J., 2004. The XP customer role in practice: three studies. *Agile Development Conference*, pp. 1-10.

Patton, J., 2002. Hitting the target: adding interaction design to agile software development. *OOPSLA 2002 Practitioners Reports*, pp. 1-7. [Online] Available at: http://dl.acm.org/citation.cfm?id=604255.

Quesenbery, W. & Brooks, K., 2010. *Storytelling for User experience: Crafting Stories for Better Design* 1se ed., Brooklyn, NY: Rosenfeld Media.

Silva da Silva, T., 2012a. A Framework for Integrating Interaction Design and Agile Methods.

Silva da Silva, T., 2012b. User Experience Design and Agile Development: From Theory to Practice. *Journal of Software Engineering and Applications*, 05(10), pp. 743-751. [Online] Available at: http://www.scirp.org/journal/PaperDownload.aspx?DOI=10.4236/jsea.2012.510087 [Accessed 8 December 2014].

Silva da Silva, T. et al., 2011. User-Centered Design and Agile Methods: A Systematic Review. *2011 AGILE Conference*, pp. 77-86. [Online] Available at: http://ieeexplore.ieee.org/lpdocs/epic03/ wrapper.htm?arnumber=6005488 [Accessed 21 September 2014].

Singh, M., 2008. U-SCRUM: An Agile Methodology for Promoting Usability. In IEEE, pp. 555-560. [Online] Available at: http://ieeexplore.ieee.org/lpdocs/epic03/wrapper.htm?arnumber=4599538 [Accessed 8 December 2014].

Singh, M., 2008. U-SCRUM: An Agile Methodology for Promoting Usability. In IEEE, pp. 555-560. [Online] Available at: http://ieeexplore.ieee.org/lpdocs/epic03/wrapper.htm?arnumber=4599538 [Accessed 8 December 2014].

Sy, D., 2007. Adapting usability investigations for agile user-centered design, 2(3), pp. 112-132.

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REAL OPTIONS IN THE TIMING PROBLEM OF NON-CRITICAL ACTIVITIES

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Abstract

In many projects, there is a problem of choosing the start moment of non-critical activities. Traditionally we can start these activities "as soon as possible" or "as late as possible". In a situation where the result of this decision is dependent on some external factor, such as exchange rates, a real option may emerge. This means that new methods for choosing the start of a non-critical activity can be used.

The aim of the research was to use a real options valuation method to determine the start moment of a project's non-critical activities. This was done using a modified CRR binomial tree method (Cox, Ross and Rubinstein, 1979). The method modification consisted of taking into account a variety of factors on which project results are dependent.

The paper includes an attempt to use the method in a real project. It is supplemented by conclusions of the limitations of the proposed method.

Key words: *Mathematical Methods, Mathematical Models, Numerical Methods, Real Options*

JEL code: C61

Introduction

The critical path method (CPM) as a project modelling technique was developed in the late 1950s by Morgan R. Walker of DuPont and James E. Kelley, Jr. of Remington Rand (Kelley J., Walker M., 1959). It divides activities into critical and non-critical. Critical activities are those which have a specific start and finish time. Non-critical activities have a start time which can be chosen freely. In the literature, there is little space devoted to choosing when to begin non-critical activities. There are two approaches to this choice, as presented in Fig. 1 (activity B is non-critical, all others are critical):

- As Soon As Possible (ASAP);
- As Late As Possible (ALAP).

ASAP is a more appropriate approach when it is important to complete a project within a stipulated time limit. Selecting this approach minimizes the risk of exceeding the date of the deadline. ALAP, the more risky approach, may be chosen because of the availability of resources. There is also a third possibility to start a non-critical activity between these extremes.

In some cases the result of an activity may depend on the point where it ends. An example of this is construction projects, where costs depend on the cost of building materials which vary seasonally. In such a situation the problem of selecting the appropriate moment to start a non-critical activity arises. This is an interesting research problem which raises the

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question of whether it is possible to determine the optimal start moment based on knowledge of the history of changes in the factors that determine the result of the activities.

In financial literature there are known solutions for a similar problem, called the timing problem. They are based on the valuation of financial options. Well-known solutions include the continuous method (Black F., Scholes M., 1973) and the Cox-Ross-Rubinstein (CRR) method (Cox J.C., Ross S.A., Rubinstein M., 1979), which is based on the binomial tree. Some similarities between financial options and projects are described by Myers (1974), and later called real options (Myers S.C., 1977). However, in the case of projects, there are often many factors to be taken into consideration, not only financial issues. Models that include all the factors of a project are called multi-state options (Guthrie G., 2009).

The aim of this paper is to propose a method for determining the start of a non-critical activity based on the multi-state option approach. To achieve this we must firstly define the option situation in the project. Then we have to adjust the CRR method to determine the best moment to start a non-critical activity when there are many state variables. Finally, we must verify the possibility of using this method in real projects.

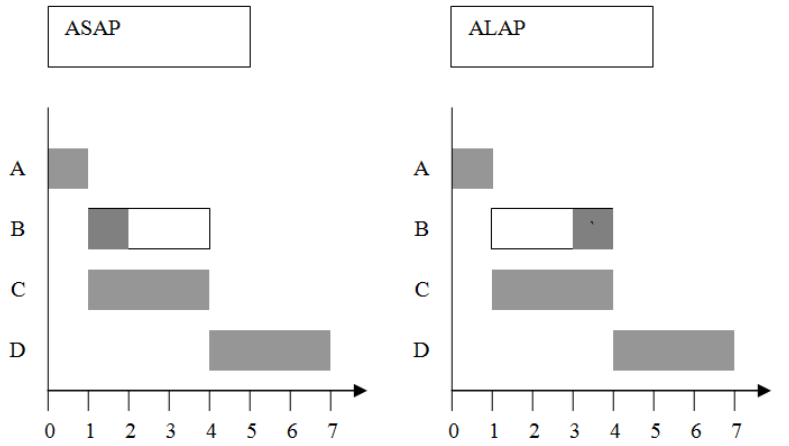


Fig. 1. **Approaches to the choice of when to begin a non-critical activity** (B)

The proposal of an effective method for determining the start of a non-critical activity may be important for project management practitioners who plan and implement investment projects. The use of real options in projects can increase the flexibility of project managers in decision-making within the project.

The paper is divided into several sections. The following section presents a real options approach. The next section describes the proposed method of this paper. The last section presents the application of this method in a real investment project.

A real options approach to decision-making

Project management produces an environment in which many decisions are made. When choosing between the variants **x** and **y** in the classical model of decision-making, we consider

the criteria that characterizes the variants. These are marked as $f(\mathbf{x})$ and $f(\mathbf{y})$. The variant is chosen based on the comparison of criteria. The values of the criteria may change over time. This creates a new situation. The value of criterion $f(\mathbf{x})$ can increase to the value of $f'(\mathbf{x})$. It can also decrease to the value of $f''(\mathbf{x})$. If decisions are irreversible, the timing of the decision is essential. In our case this is the moment of choosing between variants **x** and **y**.

An option situation occurs if there are two conditions:

- the criteria value depends on time;
- decisions are irreversible.

These conditions also occur during the life of the project. The option situation can have straight dependence, called a simple real option. In some cases, the option situation depends on the options of a different situation. This is known as a compound real option.

Simple real options are inherent in each project. The simplest example of them is the timing option – the delay option. The delay option describes a situation in which we can choose the start time of the project. Starting the project is an irreversible decision. Issued cash flows are not recoverable. It is one of the earliest described real options and was considered in Ingersoll J. and Ross, S.A. (1992). A special case of a simple delay option is choosing the start moment of a non-critical activity in the CPM.

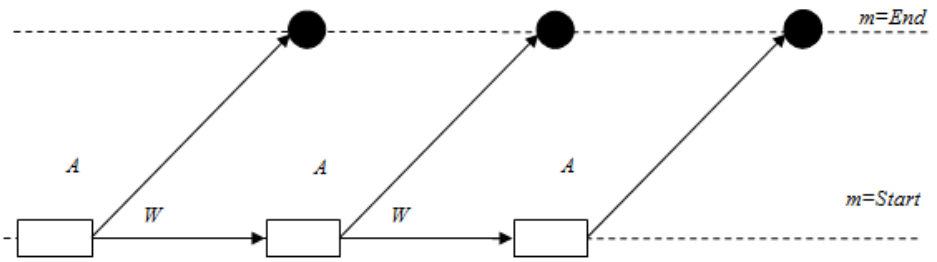


Fig. 2. **Simple delay option - Decision tree (D-Tree)**

For a non-critical activity, we can choose the start time. We can begin it as soon as possible or as late as possible. Fig. 2 shows a situation when we can also start this activity between these two extremes. The decision maker may start the activity (decision *A*), and after one period equal to the duration of an activity, it moves from the current state (*m=Start*) to the last state (*m= End*). The decision maker may also wait (decision *W*), but then the activity will remain in its starting state. After one period, the situation is repeated. The decision maker may then start the activity (decision *A*), then move from the current state to the last state. The decision maker may also wait (decision *W*). After one more period, the situation is repeated one last time. This time the decision maker has only one possibility – to start the activity. If the decision to wait is made, the project will fail.

Proposed method

The method for selecting the start moment of non-critical activities is based on the valuation of the option situations. Because of the simplicity, the method uses the CRR method (Cox J.C., Ross S.A., Rubinstein M., 1979). Since we expect a few different factors to be

relevant, this work will use an extended version of the CRR method, as proposed in Targiel K.S. (2013). The method is enriched with the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method, which is used to select effective decisions. In this case project value depend on two state variables. We assume that each state variable in one period may increase *u*-times and fall *d*-times. This assumption leads to a tree of possible project values (V-Tree), consisting of nodes marked with indices (*i, j, n*), where *i* means the number of falls in the first state variable, *j* means the number of falls in the second state variable and *n* is the number of the period. We denote the first state variable as $X_1(i,n)$ and $X_2(j,n)$ as the second state variable, all in period *n*. To each node the present value of the project $V_s(i, j, n)$, described later, is also connected. We assume that we have *N* periods. The start value of each state variable is denoted by $X_k(0,0)$. The value of *u* can be obtained from historical data using the calibration procedure proposed by Guthrie (2009).

The proposed method consists of several steps which include creating a decision tree (D-Tree), building a tree of state variables (X-Tree), building a project value tree (V-Tree), and at the end, determining efficient decisions.

In a D-Tree, all the possible states of the project are recognized. They may be different phases or specific stages for activities. The possible decisions that could be made when considering a state are also recognized. Making a decision would lead to a transition from one state to another. All possible transitions are identified. The considered D-Tree is shown in Fig. 2.

After creating a D-Tree, the state variables which may depend on the result of the project are identified in order to create an X-Tree. The X-Tree starts from a known present value of state variables. Based on historical data, the values *u* and *d* can be determined in the calibration process. The X-Tree shows the possible changes in state variables and the possible scenarios of each situation, presented symbolically in Fig. 3. Calibration is the appropriate choice for the number of steps and the choice of parameters *d* and *u* to best meet the future values of the state variables.

Calibration begins with choosing the model of the stochastic process. According to the literature (Guthrie G., 2009), the most commonly used stochastic processes are Brownian Motion (BM), Geometric Brownian Motion (GBM) and the Mean Reverting Model (MRM). In this work we use BM defined by the equation:

$$dX_t = \mu\, dt + \sigma\, dW_t \tag{1}$$

and GBM defined by the equation:

$$dX_t = \mu X_t dt + \sigma X_t dW_t \tag{2}$$

where W_t is the Wiener process, X_t is the state variable, μ is the drift parameter, and σ is the volatility parameter.

Each model of the stochastic process provides a particular way of generating lattice nodes. For BM, nodes are defined by the equation (for the *k*-th state variable):

$$X_k(i,n) = X_k(0,0) + (n-2i)\cdot \hat{\sigma}_k \sqrt{t_p} \tag{3}$$

and for GBM, nodes are defined by the equation (for the *k*-th state variable):

$$X_k(i,n) = X_k(0,0)e^{(n-2i)\cdot\hat{\sigma}_k\sqrt{\Delta t_p}} \tag{4}$$

where Δt_p is a part of the year which represents one period in tree and $\hat{\sigma}_k$ is the estimated volatility parameter for BM and GBM. These formulas arise directly from the method of determining the parameters *u* and *d*. This is done during the calibration of the model. For BM we have:

$$u = \hat{\sigma}_k\sqrt{\Delta t_p} \tag{5}$$

$$d = -\hat{\sigma}_k\sqrt{\Delta t_p} \tag{6}$$

and for GBM we have:

$$u = e^{\hat{\sigma}_k\sqrt{\Delta t_p}} \tag{7}$$

$$d = e^{-\hat{\sigma}_k\sqrt{\Delta t_p}} \tag{8}$$

The volatility of the process $\hat{\sigma}_k$ (for the *k*-th state variable), is calculated in each case on the basis of historical data from the variability in this data:

$$\hat{\sigma}_k = \frac{\sigma_k}{\sqrt{\Delta t_d}} \tag{9}$$

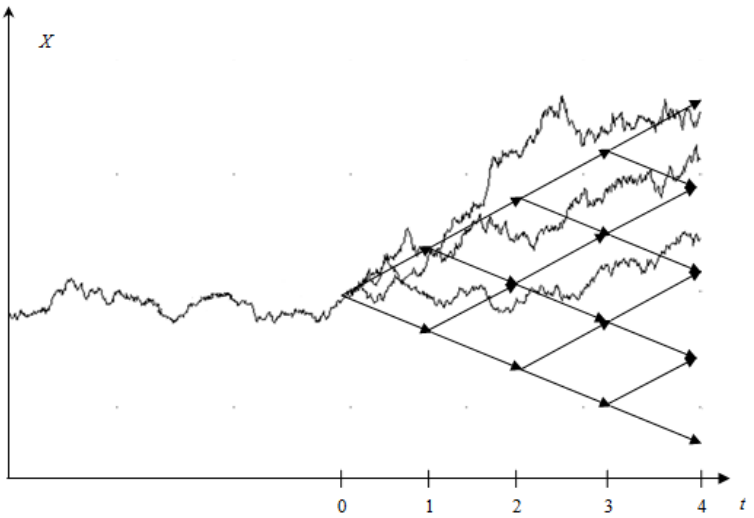
where Δt_d is a part of the year which represents one period in data and σ_k is standard deviation in historical data (for the *k*-th state variable).

A V-Tree is then created. If the project evaluation is based on many state variables, the V-Tree is therefore presented in a vector of values. When considering two state variables, the V-Tree grows in two dimensions:

$$\mathbf{V}^m(i,j,n) = \begin{bmatrix} V_1^m(i,j,n) \\ V_2^m(i,j,n) \end{bmatrix} \tag{10}$$

We denote the present value, which is dependent on two state variables, as $V_k^m(i,j,n)$ – the utility value of the *k*-th state variable, in the *m*-th activity state, in period *n*. There are also *i* – the number of falls of the first state variable and *j* – the number of falls of the second state variable. The calculation of the values of the V-Tree starts from the end (final value). We assume that the final value of the project is a function of state variables:

$$\mathbf{V}^m(i,j,N) = \begin{bmatrix} f_1(X_1(i,N)) \\ f_2(X_2(j,N)) \end{bmatrix} \tag{11}$$



Source: author's construction

Fig. 3. **X-Tree covering the stochastic process**

On this basis, the remaining values of the V-Tree are successively calculated. V-Trees are constructed for each state of the activity. The calculation of values is done by backward induction. Based on the value of the activity after its completion (a value which is usually equal to the state variable, or function of this variable), the values in the preceding nodes are calculated.

In each node, the present value is the discounted expected value of subsequent values:

$$V_1^m(i,j,n) = \left(\pi_u^1 V_1^m(i,j,n+1) + \pi_d^1 V_1^m(i+1,j,n+1)\right) e^{-r\Delta t_p}$$
$$V_2^m(i,j,n) = \left(\pi_u^2 V_2^m(i,j,n+1) + \pi_d^2 V_2^m(i,j+1,n+1)\right) e^{-r\Delta t_p} \quad (12)$$

Subsequent values are weighted by the probability of achieving these values. If we denote by r the risk free interest rate, we can calculate probabilities from the formulas proposed by Seydel (2009):

$$\pi_u^k = \frac{e^{r\Delta t_p} - d}{u - d} \quad (13)$$

for the growth and

$$\pi_d^k = \frac{u - e^{r\Delta t_p}}{u - d} \quad (14)$$

for the k-th state variable.

In this method for selecting the start moment, the most important thing is determining efficient decisions. The application of this method leads to backward induction, in which we consider sets of efficient solutions based on the value of the project. In this case values in the *k*-1 stage are:

$$\{V(X_{n-1})\} = \sup_{d_n \in D_n} \left\{ e^{-r\Delta t_p} E\left[V^{d_n}(\mathbf{X}_n)\right] \right\} \quad n = N,\ldots 1, \tag{15}$$

where: $\mathbf{X}_n$ – vector state variables in period *n,*
D_n – set of feasible decisions in period *n,*
d_n – decision in period *n,*
$V^d(X_n)$ – value of project in period *n,*
r – risk free rate.

Effective decision d_n also gives an effective moment of decision in period *n*. Value *V*, in classical consideration, only depends on the financial factor. However, in sustainable development projects this may be an insufficient approach. In this case, other, non-financial results of the project should be considered. If we consider more than one factor that leads to usability and design considerations in many areas, the problem is converted from a simple valuation to a multi-criteria evaluation problem.

The values determined by the formula in (15) must be calculated for each decision, so we have a superscript denoting the decision on the value achieved for decision *A* and for decision *W*:

$$\mathbf{V}^A(i,j,n) = \begin{bmatrix} V_1^A(i,j,n) \\ V_2^A(i,j,n) \end{bmatrix} \tag{16}$$

$$\mathbf{V}^W(i,j,n) = \begin{bmatrix} V_1^W(i,j,n) \\ V_2^W(i,j,n) \end{bmatrix} \tag{17}$$

The selection of efficient decisions was made using the TOPSIS method, originally developed by Hwang and Yoon (1981), and used here according to Trzaskalik T. (2014).

Application of the method in a real project

We will verify the possibility of using the proposed method using an airport expansion project as an example. Construction of a new runway requires the construction of taxiways. Since the construction of the runway takes more than a year, while the taxiways, which are most frequently constructed from concrete, take a few months, they are non-critical activities that can take place throughout the project. In the considered case, runway construction began in 2013, and was planned to be complete by the end of 2014. In late 2013 the problem of selecting the start moment for taxiway construction arose. Construction should take three months, including the tender procedure. The start of taxiway construction could start at the beginning of each of the first three quarters of 2014, in order to complete the taxiways before the end of 2014. Construction could start in the first quarter of 2014, but in this way the possibility to find a more favorable contract in the next quarters may be lost.

The D-Tree is shown in Fig. 2. We can start the process and the construction of the taxiways at the beginning of the year (decision *A*) or wait for one quarter for the situation to develop (decision *W*). The situation is repeated in the second quarter. In the third quarter, there can only be the decision to start the tender procedure.

Analysis of the problem helps to determine the two factors that can affect the contract. They will be state variables, denoted respectively as:

- X_1 – indicator of the general construction business climate;
- X_2 – exchange rate of PLN/EUR.

Based on the observation of these state variables, in 2013, with the procedure described in a previous paper (Targiel K., 2014), possible moves up and down in those factors in the quarters of 2014 can be rated.

For first state variable, X_1 which describes the general construction business climate (It is published by GUS "Indicator of the general business tendency climate in construction"), we use the BM model. Based on monthly data we compute possible changes in 2014. The obtained X-Tree is presented in Table 1.

Table 1

X-Tree for the general construction business climate

X_1 (%)	*n*			
i	**0**	**1**	**2**	**3**
0	–26.80	–20.63	–14.47	–8.30
1		–32.97	–26.80	–20.63
2			–39.13	–32.97
3				–45.30

Source: author's calculations based on GUS (2014)

The probabilities calculated using Guthrie's procedure (Guthrie, 2009) are $\pi_u^1 = 0.64$; $\pi_d^1 = 0.36$.

For the second state variable, X_2 (exchange rate of PLN/EUR), we use the GBM model. Based on daily data we compute possible changes in the first half of 2014. The obtained X-Tree is presented in Table 2.

Table 2

X-Tree for EUR/PLN exchange rate

X_2 (PLN/EUR)	*n*			
j	**0**	**1**	**2**	**3**
0	4.15	4.28	4.42	4.56
1		4.02	4.15	4.28
2			3.89	4.02
3				3.77

Source: author's calculations

The probabilities calculated using Guthrie's procedure (Guthrie, 2009) are $\pi_u^2 = 0.58$; $\pi_d^2 = 0.42$.

During analysis of the problem it was found that X_1 is moderately more important than X_2. Using Saaty's Fundamental Scale (Saaty T.L., 2008), and the Analytic Hierarchy Process (AHP) method, the weight of each state variable was obtained: $w_1 = 0.75$ for state variable X_1 and $w_2 = 0.25$ for state variable X_2. The consistency index was $CI = 0.00$.

The final value of the first state variable is calculated using a utility function. If its value is greater than –20.00%, the final value is 0.00, otherwise it is 100.00, because in the case of a downturn it will be easier to get favorable provisions of the contract from the contractor.

$$f_1^e(X_1(i,n)) = \begin{cases} 0.00 & X_1(i,n) > -20.00\% \\ 100.00 & X_1(i,n) \le -20.00\% \end{cases} \tag{18}$$

The final value for the third state value is calculated as additional cost:

$$f_2^e(X_2(j,n)) = -K \cdot X_2(j,n) \tag{19}$$

where $K = 0.5$M EUR is the estimated cost of imported materials.

For the nodes in Fig. 2 marked with filled circles, we calculate the final results of the project. The calculated final values are presented in Tables 3-5.

Table 3

Final values in period $n = 3$ (after decision A in period $n = 2$)

(f_1^e, f_2^e)				
i, j	**0**	**1**	**2**	**3**
0	(0.00; –2.28)	(0.00; –2.14)	(0.00; –2.01)	(0.00; –1.89)
1	(100.00; –2.28)	(100.00; –2.14)	(100.00; –2.01)	(100.00; –1.89)
2	(100.00; –2.28)	(100.00; –2.14)	(100.00; –2.01)	(100.00; –1.89)
3	(100.00; –2.28)	(100.00; –2.14)	(100.00; –2.01)	(100.00; –1.89)

Source: author's calculations

Table 4

Final values in period $n = 2$ (after decision A in period $n = 1$)

(f_1^e, f_2^e)			
i, j	**0**	**1**	**2**
0	(0.00; –2.21)	(0.00; –2.07)	(0.00; –1.95)
1	(100.00; –2.21)	(100.00; –2.07)	(100.00; –1.95)
2	(100.00; –2.21)	(100.00; –2.07)	(100.00; –1.95)

Source: author's calculations

Table 5

Final values in period $n = 1$ (after decision A in period $n = 0$)

(f_1^e, f_2^e)		
i, j	**0**	**1**
0	(100.00; –2.14)	(100.00; –2.01)
1	(100.00; –2.14)	(100.00; –2.01)

Source: author's calculations

Using backward induction, from the equations (12), we calculate the vectors of values after decision W in period $n = 1$. In the calculations we use the value $r_1 = 0\%$ as it is not a financial value, and $r_2 = 4\%$. The results are presented in Table 6.

Table 6

Values in period $n = 2$ (after decision W in period $n = 1$)

$(f_1^e, f_2^e)^A$			
i, j	**0**	**1**	**2**
0	(36.29; –2.22)	(36.29; –2.08)	(36.29; –1.96)
1	(100.00; –2.22)	(100.00; –2.08)	(100.00; –1.96)
2	(100.00; –2.22)	(100.00; –2.08)	(100.00; –1.96)

Source: author's calculations

In a similar way, the vectors are calculated for the period n = 1. This time there are two vectors, for decision A and decision W. The results are presented in Table 7.

Table 7

Values in period $n = 1$ (after decision W in period $n = 0$)

$(f_1^e, f_2^e)^A$ $(f_1^e, f_2^e)^W$		
i, j	**0**	**1**
0	(36.29; –2.15) (59.41; –2.16) *	(36.29; –2.02) (59.41; –2.03)*
1	(100.00; –2.15)* (100.00; –2.16)	(100.00; –2.02)* (100.00; –2.03)

Source: author's calculations

Using the TOPSIS method, we can compare these two vectors. An efficient decision is marked with an asterisk. These decisions and their calculated values are taken into account in further calculations.

For period $n = 0$, we receive value vector $(\mathbf{V}^{W}(i, j, 0))^{T} = (74.14; -2.11)$. If we decide to act immediately, we get the vector value equal to $(\mathbf{V}^{A}(i, j, 0))^{T} = (100.00; -2.08)$. Using the TOPSIS method, we can again compare these two vectors. This time the efficient decision is to act immediately.

The current construction business climate is low (-26.80%), so we can get a favorable contract. The cost of imported materials is about 2.07 M PLN. In the presented project, waiting for the situation to develop does not make sense. The current market situation is favorable enough, and volatility too low, to get better results in the future.

Conclusions

This paper presents a systematic approach to the problem of timing in development projects. In this approach, real options were taken into account. Real options are typical situations that occur in project environments. One real option which has been considered in this paper is choosing the start time of a non-critical activity in the classical Critical Path Method.

The multi state real options method was used for a real project in this paper, which showed the usefulness of the obtained results. Based on the knowledge of the volatility of various environmental parameters, we can choose the optimal moment for starting a non-critical activity. In the approach presented in this paper, the future is limited to the cone of possible parameter values. This cone is modeled on the binomial tree. We do not try to predict the future, but to consider everything that may happen in a limited segment of the future.

This paper presents an outline of multi-criteria valuation methods used to make decisions on when to start a non-critical activity. In this perspective, the accuracy of the valuation method is not important. The presented approach is important when considering sustainable development projects, when we are taking into account more than only one (namely the financial) aspect of a project. Although this method is not very accurate, due to its simplicity it can be understood and used by practitioners.

Acknowledgments

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Bibliography

Black F., Scholes M., 1973. The Pricing of Options and Corporate Liabilities. *The Journal of Political Economy,* 81(3), pp. 637-654.

Cox J.C., Ross S.A., Rubinstein M., 1979. Option Pricing: a Simplified Approach. *Journal of Financial Economics,* 7, pp. 229-263.

Guthrie G.,2009. *Real Options in Theory and Practice*. Oxford University Press, Oxford, 2009.

GUS, 2014. *Ceny robót budowlano-montażowych i obiektów budowlanych grudzień 2013*, Warszawa (in Polish).

Hwang C.L., Yoon K., 1981. *Multiple Attribute Decision Making: Methods and Applications*. Springer-Verlag, New York.

Ingersoll J., Ross, S.A., 1992. Waiting to Invest: Investment and Uncertainty. *The Journal of Business*, 65(1), pp. 1-29.

Kelley J., Walker M., 1959. Critical-Path Planning and Scheduling. *Proceedings of the Eastern Joint Computer Conference.*

Myers S.C., 1974. Interactions of Corporate Financing and Investment Decisions – Implications for Capital Budgeting. *The Journal of Finance*, 29(1), pp. 1-25.

Myers S.C., 1977. Determinants of Corporate Borrowing. *Journal of Financial Economics*, 5(2), pp. 147-175.

Saaty T.L., 2008. Priorities Originate from Dominance and Order Topology in AHP/ANP: The Fundamental Scale, Relative Scales and When to Preserve Rank, [in:] Adamus W. (ed.), The Analytic Hierarchy & Network Processes, Wydawnictwo Uniwersytetu Jagiellońskiego, Kraków, 2008.

Seydel R.U., 2009. *Tools for Computational Finance,* 4th ed., Universitext, Springer, Berlin Heidelberg.

Targiel K.S., 2013. Multiple Criteria Decision Making in the Valuation of Real Options. *Multiple Criteria Decision Making*, 8, pp. 129-142.

Targiel K., 2014. Modelowanie zmian zmiennych stanu w modelu dwumianowym do celów wyceny opcji realnych, *Studia Ekonomiczne,* 178, pp. 220-234 (in Polish).

Trzaskalik T. (ed.), 2014. Wielokryterialne wspomaganie decyzji. Metody i zastosowania, PWE, Warszawa (in Polish).

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CORRELATED PERFORMANCE MEASUREMENT FOR PROJECT MANAGEMENT

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Abstract

Every project has an element of uncertainty. Project management (PM) deals with identifying, assessing and controlling the degree of uncertainties. Apart from that, PM helps in successfully completing the designated task in time-bound and cost-bound fashion. Success of any project primarily depends upon the ability to perform fast, efficient and correct analysis of project related data. The most common challenge a project manager encounters is to analyze data set and identify some pattern among these data sets which enable to forecast the health of the project. Project in controlled environment (PRINCE2) is an important and crucial PM methodology. For execution of various types of projects, institutions use PRINCE2. It considers six performance parameters: benefit, cost, quality, risk, scope and timescale. Individual parameter value portrays only incomplete view of performance. To get the more meaningful information and to reduce the uncertainty quotient, we require single parameter to access performance status. In this paper, we propose TRIPATHI Correlation (TRIPCOR) formula which exploits the correlation among performance variables to calculate value of performance factor (PF) for a discrete time interval, called as evaluation interval. This PF value helps to get larger insight in assessment of the project health profile in efficient and fast manner during execution phase.

Key words: *Project, PRINCE2, Correlation, Performance parameter, Project management*

JEL code: H43

1. Introduction

A task is a smallest atomic unit of a work. Task needs different span of time i.e. minutes, hours or days to execute. Atomic task requires knowledge of single discipline for execution. Output of a task does not necessarily produce any visible business impact in basic measurable unit. For example, to book a conference room for meeting is a task. A complex task consists of several simple tasks. Complex tasks are performed in a serial or parallel fashion. To transact such task, it needs knowledge and support of multiple disciplines such as engineering, database, information technology, supply chain. Time span of such tasks varies from few days to couple of years. Complex task becomes a potential candidate to qualify as a project.

A project is envisioned as any work that has a definite beginning, a definite end and some form of 'deliverables'. PRINCE2 defines project as: "A project is a temporary organization that is created for the purpose of delivering one or more business products according to an agreed Business Case" (Great Britain: Office of Government Commerce, 2000). PRINCE2 (Project Management in Controlled Environment) is a project management methodology developed by

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the government of the United Kingdom (UK) and used across the globe, especially in information technology (IT) environments. Successful completion of task produces results which add new thing in some sense or modify an existing system. This change could be a new online service to customer or a new feature in a device. Output of a project has certain amount of measurable impact on business. Impact is measured in terms of increased sales, or wider presence of customer base.

Projects can be classified into two broader categories as per software development life cycle (SDLC): development and maintenance. A project is qualified as development project, if complexity and nature of project is uneven throughout the life cycle of the project. A project is called as maintenance project, if complexity and nature of project is uniform throughout the life cycle of the project. In this paper, we focus on maintenance project.

A project is composed of multiple phases. For analysis point of view, we consider only three phases i.e. Pre-analysis, Execution analysis and Post-analysis in ordered fashion. Figure 1 depicts three phases in ordered fashion. In pre-analysis phase, the key function is to focus on assessing the feasibility of project. During execution-analysis phase, main objective is to investigate the performance variables under control and get the direction from performance variables. During post-analysis phase, prime interest is on the analysis of realizing benefits and exploring, identifying incomplete task, if any such possibility is there.

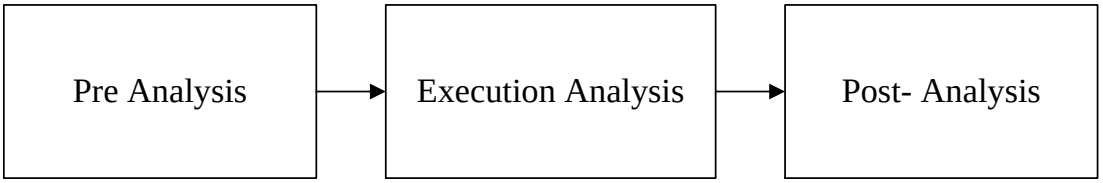


Fig. 1. **Project Phases**

When PM is required?

PM deals with increasing productivity, profitability and maintaining optimum utilization of available resources. Management can be best explained in the words of F.W. Taylor, "Management is an art of knowing what to do, when to do and see that it is done in the best and cheapest way". There are multiple management levels depending upon industry, sector and organization. Effective management aids in realizing the goals and attaining success with minimal effort.

PM is the discipline of planning, organizing, and managing resources to bring about the successful completion of specific project goals and objectives. The main challenge of PM is to realize all of the project goals and objectives, despite of striking a balance among project constraints – scope, quality, time and budget. Past mistakes, feedbacks, best practices and standards help to evolve continuously (Harvard Business Review Guide to Project Management, 2014). Turner suggested that PM could be described as: the art and science of converting vision into reality. Further, it talks about understanding business goal, realizing the technology involved, communicating at various levels. It also deals with motivating and directing people, reducing stress and ensuring everything that needs to be done, gets done. Project management is

required to minimize the probability of failure and successfully complete the project with maximum profitability.

To assess the outcome of the project, performance analysis is very important. In general, performance analysis is done in post analysis phase to find the outcome and to know the reason of success or failure whatever project case is. Performance analysis has many dimensions. Performance analysis can be done from various view point. One of the dimensions is project manager aspect. Scope, cost, quality, time, risk and benefit are considered as six performance parameters but project manager controls only three variables: quality, time and risk. Project manager needs performance analysis while project is in execution. This helps project manager to control the performance variable to lead the project in the successful direction. To do performance analysis in execution phase is one of the important issues in project management domain.

In this paper, we address the issue of assessing and tracking the project health profile in execution phase with respect to project manager view point. To fulfill this task, we propose TRIPCOR formula to calculate the performance factor for a discrete interval which is much less than the project lifetime. A key idea of our approach is to use TRIPCOR to classify the state of project on one hand and to infer the health profile at end of the discrete interval on other. Our goal is to gain the insight of project health in progressive phase in quick fashion and to expedite the decision making process to take the required corrective measures within designated time frame.

The rest of the paper is organized as follows. In Section II, we discuss all the performance variables from project manager's perspective. In Section III, we devise TRIPCOR formula to gain insight of health profile. Finally, conclusion of the paper is described in Section IV.

2. Project Performance

Performance is the progress indicator of the project health. Desired performance and actual performance are not necessarily to be the same. Desired performance reflects the expectations of the stakeholder group and may change over time. If performance of a project is not good, project may not be profitable or successful.

Performance Variables

PRINCE2 provides a way for managing projects within six well defined control variables: Cost, Time, Quality, Scope, Risk and Benefit. Quality is defined as the total amount of features or characteristics of a service or a product, such that it meets expectations and satisfies the stated needs. However, quality is indirectly a function of cost. Risk is another important parameter. Two kinds of problem domains: risk and uncertainty are prevalent in project management. In risk domain, all possible alternatives, consequences and probabilities are known where as in uncertain world, all possible alternatives, consequences and probabilities are not known. Decision making process in risk world is easier than uncertain domain. To calculate the risk associated, we deal in risk world. Benefit signifies the usability of the product and forecasts customer willingness to buy it. Cost is the total input cost for the project. Change in project cost during execution stage has not been considered in this paper. Project time is a time span during which project would be completed within specified parameters: cost, quality and

scope in control. Scope governs the boundary line for the project. Demarcation line for in scope and out of scope must be clearly stated.

Project Performance parameter for Project Manager

To get the better understanding of variables that correlate to performance is of great importance in the world of PM. We observe that performance and quality is associated with each other. Further, we find that performance is also related to risk and time. Our endeavor is to predict project performance behavior with the help of associated performance parameters. This significant knowledge provides useful insight to the project manager to know about in phase or post phase project performance.

Project manager can control only three parameters: quality, time and risk. Therefore, these three parameters are the most significant performance variables for a project manager. Here time parameter is same as defined in pre-analysis phase. Risk is considered as existing as well as new risk. Cost is already finalized before handing over the project to project manager (Harold Kerzner, 2013). Benefit may or may not be realized during execution of the project. Scope is fixed, once project manager takes charge of project. Additional cost for change in scope is handled with different budget.

Need to measure performance from another dimension

Various stakeholders are involved in a project and each stakeholder has its own goal and objective for assessing the project performance as well as outcome. A project manager is one of the key stakeholders who work very closely with project. At most fundamental level, legacy parameters: cost, time and quality are frequently applied and analyzed to assess the success of a project (Roger Atkinson, 1999). However, many suggest that legacy parameters do not cover all the dimensions of a project and some other dimension needs to be included for the assessment of a project. Project manager's view is also one of the dimensions of a project (J. Rodney, 2005).

After looking at the various dimensions of a project, it is required to have different views of project's performance other than the legacy way of measuring the performance of a project using cost, quality and time variables, which is supposed to be aligned for overall success of the project (Jonas B, 2013). It is now quite obvious that legacy performance parameters needs to be added with more parameters, replaced with some other parameters or looked with different aspects. More meaningful indicator of project performance needs to be devised, which would be a true eyes and ears of a project manager during execution phase (Bourne L, 2004).

3. Project Performance Analysis

Analysis performed in execution phase determines the status about the state of the project. This report indicates the direction of the project which helps to take corrective measures to keep project on the right path (Aaron S, 2011). Project time span is divided into equally spaced discrete intervals. This discrete interval is called as evaluation interval (EI). End point of each evaluation interval is known as evaluation point (EP). This time division is depicted in figure 2. As a guideline, the length of discrete interval should be set a value that is

approximately one order magnitude less than that of the whole project life time. At the end of each EI, project health status (PHS) of the project is evaluated. PHS report is taken at equally spanned discrete intervals on time line. At any point of time, a project is in one of the three states: SAFE, UNSAFE and GOOD. GOOD state is the most desirable state while SAFE state is desirable and UNSAFE state is undesirable. Figure 3 depicts these three states.

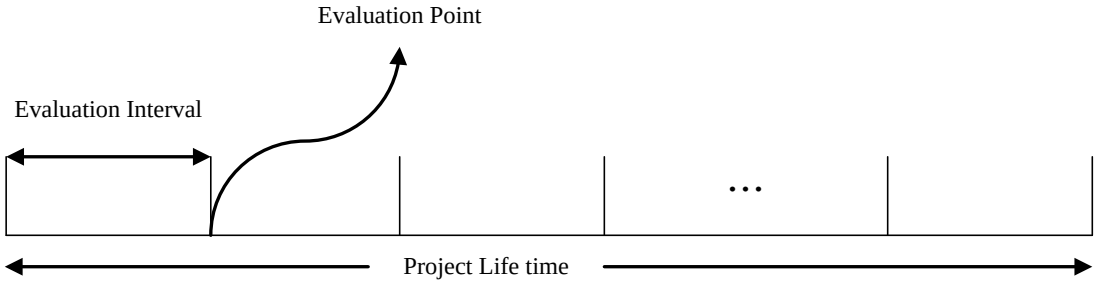


Fig. 2. **Project time line and evaluation interval**

Performance Scale: Performance Factor

A Project manager controls only three performance variables: risk, time, quality. For an EI, we define the relative quality, relative risk and relative time. These relative parameters serve the purpose to decide the project status for EI. The relative parameters are more useful for project manager. Relative quality, relative risk and relative time are measured by quality factor, risk factor and time factor respectively. Quality factor (QF) measures the current absolute quality feature count relative to the maximum quality feature count for that defined scope in a discrete interval. Its value varies in the interval (QF_MIN, 1), where 'QF_MIN' is lower bound of quality factor. Risk factor (RF) is defined as the current absolute risk relative to the maximum for that defined scope in a discrete interval. Its value changes from lower range to upper range as per interval (RF_MIN, 1), where 'RF_MIN' is lower bound of risk factor. Time factor (TF) is defined as the current absolute time taken relative to the maximum for that defined scope in a discrete interval. It stays in the interval (TF_MIN, 1), where 'TF_MIN' is lower bound of time factor. All three parameters: QF, RF and TF are unit less quantities. Values of QF_MIN, RF_MIN and TF_MIN are taken as per project's precision level. Measurement techniques of QF, RF and TF are not the part of the discussion of this paper. Values of QF_MIN, RF_MIN and TF_MIN are non zero and positive.

We propose TRIPCOR formula to calculate performance factor (PF) for an evaluation interval (Dov D, 2004) and TRIPCOR formula which consist of PF is completely devised by author. The function PF depends upon Scaling Multiplier (SM), QF, RF and TF parameters. The value of SM is equal to (RF_MIN + TF_MIN). The function PF calculates the project performance and it is unit less quantity. We define the PF function as follows:

$$PF = \frac{SM*QF}{(RF+TF)} \quad (1)$$

The performance factor is represented as a value in the interval (LB, 1). LB is lower bound of PF which is defined as follows:

$$LB = (TF_MIN + RF_MIN) * QF_MIN/2 \quad (2)$$

Example: Computing the PF value

It is evident that to obtain maximum value of PF, we have to set numerator value to maximum and denominator value to minimum. In the numerator, SM is a constant and QF is a variable while in the denominator, RF and TF are two variables. To calculate the maximum value, we set constant factor QF_MIN =0.1, RF_MIN =0.1 and TF_MIN =0.1. We get the value of scaling multiplier SM=.0.2 using the values of RF_MIN and TF_MIN. After plugging maximum numerator value QF=0.9, and minimum denominator values RF=0.1, TF=0.1 and constant SM =0.2 in the PF formula, we obtain maximum value of PF = 0.9. Similarly, to obtain minimum value of PF, we have to set numerator value to minimum and denominator value to maximum. To calculate the minimum PF value, we set the constant factor values as QF_MIN =0.1, RF_MIN =0.1 and TF_MIN=0.1. After plugging minimum numerator value QF =0.1, and maximum denominator values RF=0.9, TF=0.9 and scaling multiplier SM=0.2 in PF formula. We obtain minimum PF equal to 0.01. This PF value is as per our expectation because lower bound of PF also gives the value 0.01 after substituting QF_MIN =0.1, RF_MIN =0.1 and TF_MIN =0.1 into lower bound of PF. This shows that minimum PF value matches with lower bound LB. In similar fashion, we can also calculate intermediate PF value for various QF, RF and TF values which also lie in the interval (LB, 1).

State Decision at Various Stages

We aim to decide PHS at the evaluation points with the help of PF value. The PF parameter plays the significant role in PHS decision making process. We outline guideline for parameter tuning to evaluate project state. If PF value stays in the range from LB to 0.5, PHS is set as UNSAFE. If value of PF lies in the range 0.5 to 0.75, project qualifies for SAFE and if PF ranges from 0.75 to 1, PHS is GOOD. It is worth mentioning that above mentioned state on the basis of PF value is just a guideline. It can be further fine-tuned as per project requirement.

Progressive Health Status

At each EP, we evaluate PHS for previous EI. If the project is in the desirable state i.e. Safe or Good state, we award 'S'. If project is in the undesirable state i.e. UNSAFE state, we award 'X'. At the completion of each EI, we assign the X or S based on the performance of the project for completed EI. With the help of X and S, we can also decide the status of project from start point of the project up to end of the interval in which project is currently running. To determine the cumulative status of the project, we maintain two running variables: running 'S' count (RSC) and running 'X' count (RXC). At each EP, we take value of RSC and RXC. If there are all 'S' i.e. RXC =0, this signal derives that project is going in the direction to become successful. If RSC value is higher than RXC value, this signifies that project leads to partially successful. If RXC is more than RSC at any EP, this is not desirable scenario. This signals that project is heading to qualify for failed status. This entire analysis is from project manager

perspective to assess the performance of the project. This analysis further facilitate for taking final call regarding the project for the higher layer authority.

Application of TRIPCOR for project manager

One of the key applications is to review progress and health status at various stages of the project completion. After getting the final PHS report in the form of RSC and RXC, we can decide whether project is staying longer duration in desirable state or undesirable state. Success and failure of a project also depends upon how much time it stays in desirable and undesirable state. If project resides for longer fraction of time of whole project duration in desirable state, it signals project is heading in the success direction. This information is very useful to take possible and necessary measures to direct project state into the most desirable state. PF plays a significant role to review health progress of the project and acts as a health indicator (Guillaume M, 2010).

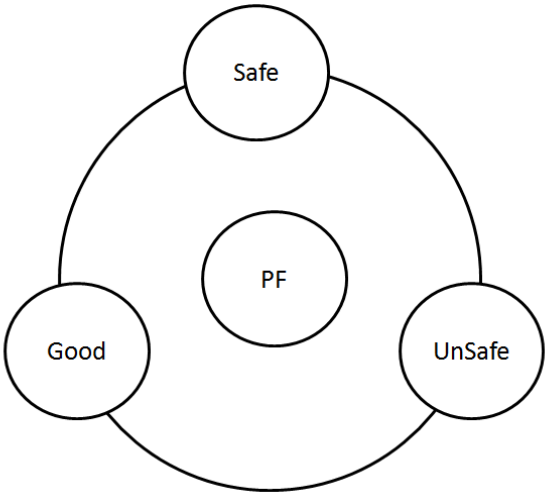


Fig. 3. **State of Project**

4. Conclusion

In this paper, we have investigated the issues of tracking and reviewing health progress during execution phase. We begin with a discussion on the relationship between performance of a project and its six performance variables. Project manager's perspective is also important for calculating the health of the project. From project manager's point of view, quality, risk and time are only significant performance variables. Based on these three performance variables, we devised **TRIPCOR** formula to forecast the performance using performance factor (PF). This formula enables to get health profile of project at different evaluation stages. Therefore, knowledge of health profile facilitates to expedite decision making process and drives to take necessary actions whatever is required.

Several avenues for future research have been identified in this paper. Behavior of performance factor (PF) in **TRIPCOR** formula can be defined in a better way using new

measurement techniques to get better health profile. Measurement techniques to calculate the value of variables of **TRIPCOR** formula could be another research area.

Bibliography

Aaron Shenhar, 2011. Meeting Time, Cost, and Moneymaking Goals with Strategic Project Leadership, PMI Global Congress 2011 – North America. Proceeding, pp. 5-7.

Bourne L., Walker; 2004. Advancing project management in learning organizations, The Learning Organigations, Vol. 11, pp. 226-244.

Dov Dvira, Tzvi Razb, Aaron J. Shenharc, 2004. An empirical analysis of the relationship between project planning and project success , Int. Journal of Project management, Vol. 21, pp. 89-95.

Guillaume Marquesa, Didier Gourca, Matthieu Laurasa, 2010. Multi-criteria performance analysis for decision making in project management, Int. Journal of Project management, Vol. 29, pp. 1057-1069.

Harold Kerzner, 2013. Project Management: A Systems approach to Planning, Scheduling and controlling, John Wiley & Sons Inc., 11th edition, pp. 653-665.

Harvard Business Review Guide to Project Management, 2014. Harvard Business Review.

J. Rodney Turner, Ralf Müller; 2005. The project manager's leadership style as a success factor on projects: a literature review, Project Management Journal, pp. 56-58.

Jonas Balshoej Ebbesen and Alexander J Hope, 2013. Re-imagining the Iron Triangle: Embedding Sustainability into Project Constraints, PM World Journal, Vol II, pp. 3-6.

Managing Successful Projects with PRINCE2, 2000. Great Britain: Office of Government Commerce, pp. 3-6.

Roger Atkinson, 1999. Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria, Int. Journal of Project management, Vol. 17, pp. 338-339.

Sanjoy Bose and Keith Thomas, 2007. Applying the balanced scorecard for better performance of intellectual capital, Journal of intellectual capital, Vol. 8.

Turner, R., Huemann, M., Anbari, F. T., & Bredillet, C. N., 2010. Perspectives on Projects.

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STATISTICAL ANALYSES IN THE CRITICAL FIELD

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Abstract

This is a continuation of our last year's contribution to the conference in Riga (c.f. Tysiak Wolfgang, 2014), where we showed that the creation of a critical field by the use of Monte Carlo simulation offers much more opportunities and better insights into the real structure of the project plan instead of the PERT approach that uses the expected values of the durations of the activities.

But additionally the Monte Carlo simulation creates all the implicitly deduced parameters like earliest/latest starting dates, earliest/latest finishing dates, and buffers etc. as random variables. Therefore we can try to apply well-known statistical methods to these variables and hopefully gain deeper insight into the structure of the project.

Key words: *project management, risk management, PERT, critical field, statistical analyses*

JEL code: G32

Introduction

The ideas presented here resume last year's contribution to the conference in Riga (c.f. Tysiak Wolfgang, 2014). Therefore let us keep this introduction quite short and only repeat the essential parts.

Since a project is said to be "a temporary endeavor undertaken to create a unique product, service, or result" (PMI, 2010), there will always be the need to implement some kind of risk management (PMI, 2010; Schelle/Ottmann/Pfeiffer, 2006). Risks in projects can occur in different dimensions, such as time, costs, quality etc. In this contribution we will only consider uncertainties related to time. A commonly used approach to deal with this is PERT (Kerzner, 2009; Taylor, 2010), which has been developed by the United States Navy together with the OR department of Booz, Allen and Hamilton in the 1950s. Purpose of this development has been to support the deployment of the Polaris-Submarine weapon system (Fazar, 2007). But there are some weaknesses, disadvantages, errors, and inaccuracies in using this method. We will overcome them by using Monte Carlo simulation (Garlick, 2007; Rubinstein, R. Y.; Kroese, D. P., 2007) and create a critical field instead of a unique critical path. The whole approach will be shown by analysing an example of a concrete but fictitious project plan[2].

The PERT approach

Let us look at the following example of a network plan (c.f. fig. 1) and consider uncertainties in time. We assume that these uncertainties are already identified, analysed, characterized, and evaluated during the preceding steps, resulting in a three point estimate of the

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[2] This example is a variation of the example in [1].

optimistic (OD), most likely (MD), and pessimistic (PD) duration. Furthermore let us assume beta distributions for all these durations. The expected value (ED) and the variance (VAR) of the beta distribution can easily be calculated by using the formulas:

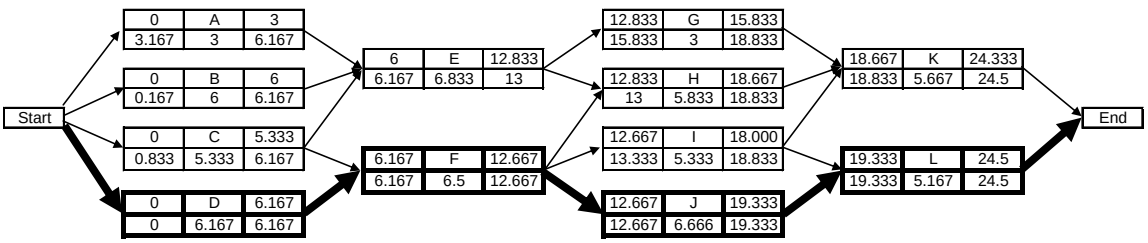
$$\mathrm{ED} = \frac{OD+4\ MD+PD}{6} \qquad VAR = \left(\frac{PO-OD}{6}\right)^2 \tag{1}$$

Activity	Predecessors	OD	MD	PD	ED	VAR
A	-	2	3	4	3.000	0.111
B	-	3	6	9	6.000	1.000
C	-	2	5	10	5.333	1.778
D	-	4	6	9	6.167	0.694
E	A, B, C	3	7	10	6.833	1.361
F	C, D	2	7	9	6.500	1.361
G	E	2	3	4	3.000	0.111
H	E, F	3	6	8	5.833	0.694
I	F	3	5	9	5.333	1.000
J	F	2	7	10	6.667	1.778
K	G, H, I	2	6	8	5.667	1.000
L	I, J	3	5	8	5.167	0.694

Source: author's construction

Fig. 1. **A fictitious project plan**

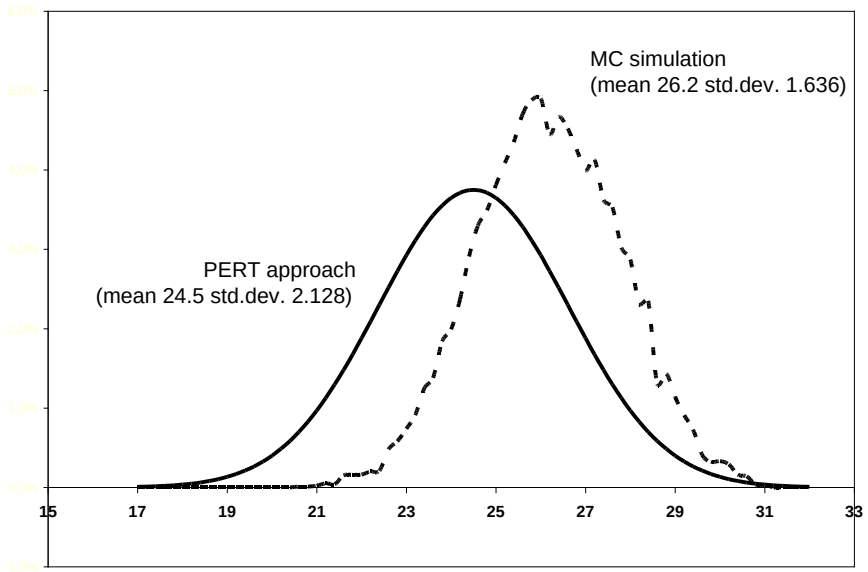
Applying the PERT approach you have to create the critical path (fig. 2) by calculating the earliest start time (upper left cell) and the earliest finish time (upper right cell) of each activity. Then by counting backwards you get the latest finish time (lower right cell) and finally the latest start time (lower left cell). The differences between the earliest and latest values give you the buffers (lower middle cell). The activities with no buffers are critical.



Source: author's construction

Fig. 2. **Critical path (bold arrows) of the project**

Afterwards the cumulated distribution (convolution) along the critical path (D-F-J-L) is observed. Because all the distributions are assumed to be independent, due to the Central Limit Theorem, the result tends to a normal distribution with mean and variance equal to the sum of the individual values on the critical path. In our example we get a mean of 24.5 and a standard deviation of 2.128. The resulting density is shown on the left side in fig. 3.



Source: author's construction

Fig. 3. **Results of MC simulation with beta distributions versus PERT results**

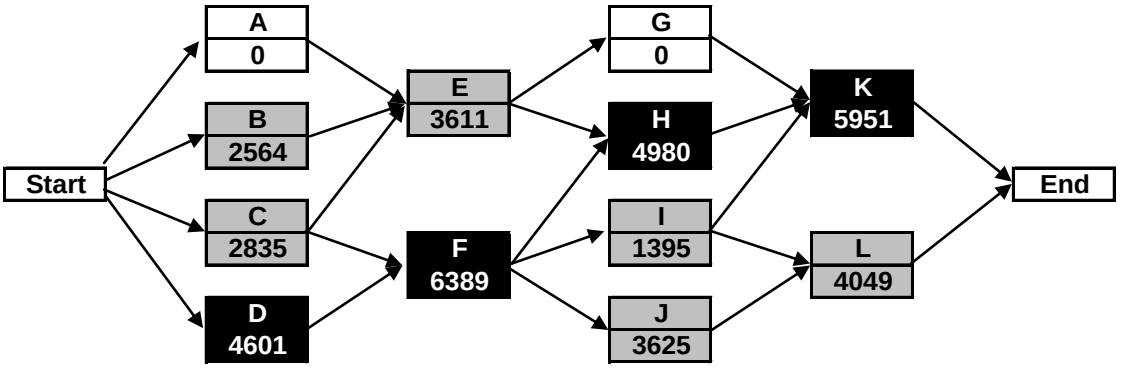
Monte Carlo simulation

As it is commonly known, the Monte Carlo simulation is a method that relies on repeated random sampling from given distributions (Garlick, 2007; Rubinstein, R. Y.; Kroese, D. P, 2007). Because of their reliance on repeated computations and random or pseudo-random numbers, Monte Carlo methods are most suited to calculations by computers. The main idea in applying Monte Carlo methods lies in the fact that one has to model the problem just for one instance and then can create as much instances as you like by creating a loop. In our case we created 10,000 instances and the result is shown in the graph on the right hand side of fig. 3. All the assumed beta distributions for the durations of the individual activities are exactly the same in both approaches (PERT and Monte Carlo simulation) and therefore the two results are fully comparable.

The continuous line is the already mentioned normal distribution that resulted out of the original PERT approach with a mean of 24.5 and a standard deviation of 2.128. The dotted line shows the distribution of the results of the Monte Carlo simulation with a mean of 26.2 and a standard deviation of 1.636. It is obvious that the Monte Carlo simulation leads to an average that is almost 2 units higher than those of the original PERT approach, but with a smaller dispersion. This can be interpreted that the Monte Carlo result is obtained by fixing the right tail of the distribution and then shifting the whole distribution to the right.

The background for this can be found in detail in (Tysiak 2013, 2014), mainly this follows from the fact that in practice there is no unique critical path, but a variety of critical paths that are also reflected within the 10,000 Monte Carlo realisations. We solely get a "critical field" that gives us the probability that a given activity is critical (c.f. fig. 4).

A comparison between fig. 2 and fig. 4 shows us the distinction between the two results: The activities with the highest probability to become critical (black) do not coincide with the assumed critical path of the PERT approach.



Source: author's construction

Fig. 4. **How often is an activity critical within the project?**

Statistical analysis

In contrast to the PERT approach, in the Monte Carlo simulation it becomes obvious that all the considered parameters like starting dates, finishing dates, buffers etc. are uncertain if the durations of the activities are uncertain. Therefore we only have random variables for their representation. In (Tysiak 2013, 2015) we already looked at the distributions of the buffers and tried to get a closer insight into them. Let us now look at the finishing dates of all the activities, taking the end node as a dummy activity with a duration set to zero.

Let us take first the correlation matrix between the finishing dates of all the activities (c.f. fig. 5). For the sake of clarification the cells obtained different shadings for values in the intervals [0.2, 0.5], [0.5, 0.8], and [0.8, 1].

It can be detected that there are significances between activities that we would not have been expected on first sight, e.g. between activities J and K (corr(J, K) = 0.332). These two activities are quite far away within the project plan, but they both are influenced by a common predecessor, in this case activity F. This can also be observed looking at activities G and H that feature a correlation of almost 0.6. Looking at fig. 4 shows us that G is never critical. But – although this might not have consequences to the final end – it can be of interest within a project, for example if the same resource is needed in these two activities. This might especially be important if you extend this approach to a project portfolio (critical chains). It is obvious that there is no significant correlation between the end of activity A and any other variable. This reflects the fact that activity A is never critical and also has no predecessors. This is the reason that this activity is more or less independent from all the other activities.

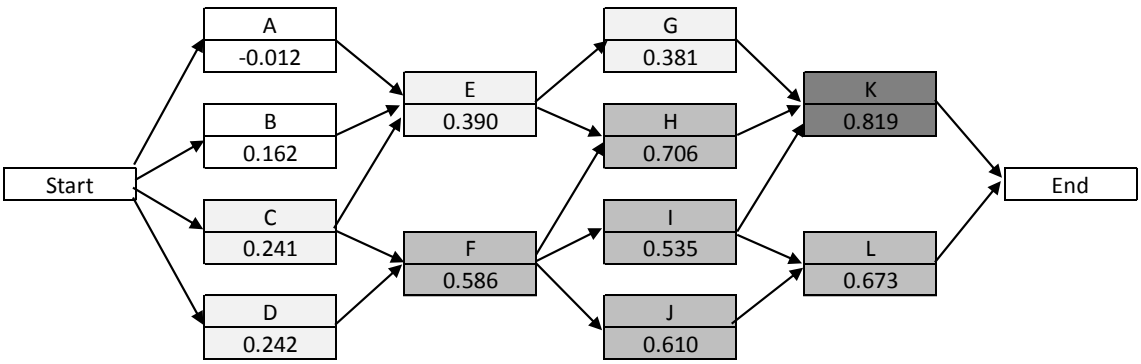
This coherence is also one reason, why the shadings tend to get darker the closer you move to the end of the project plan.

	A end	B end	C end	D end	E end	F end	G end	H end	I end	J end	K end	L end	Final end
A end	1	-0.002	0.003	0.012	-0.007	-0.009	-0.004	-0.011	-0.012	0.000	-0.011	-0.010	-0.012
B end		1	0.011	-0.006	0.438	0.001	0.427	0.253	0.004	-0.002	0.198	0.000	0.162
C end			1	-0.006	0.322	0.303	0.314	0.268	0.238	0.220	0.217	0.208	0.241
D end				1	-0.015	0.409	-0.017	0.193	0.338	0.299	0.188	0.293	0.242
E end					1	0.127	0.976	0.598	0.111	0.101	0.458	0.094	0.390
F end						1	0.124	0.486	0.821	0.736	0.452	0.716	0.587
G end							1	0.584	0.108	0.098	0.446	0.091	0.381
H end								1	0.405	0.361	0.779	0.350	0.706
I end									1	0.609	0.447	0.658	0.535
J end										1	0.332	0.872	0.610
K end											1	0.338	0.819
L end												1	0.673
Final end													1

Source: author construction

Fig. 5. **Correlation matrix between the ends of the activities**

From the last column of the correlation matrix we get the correlation between the end dates of the individual activities and the final end of the project. If we copy these values into the net, we get fig. 6 (with the same shadings that were used in fig. 5). A comparison with fig. 4 reveals a high similarity.



Source: author's construction

Fig. 6. **Correlation between the ends of the activities and the end of the project**

Everybody who is familiar with multivariate statistics knows that one important way to analyse a correlation matrix is the factor analysis. So this is done next! Fig. 7 gives us the eigenvalues of the correlation matrix.

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	5.162	39.709	39.709
2	2.495	19.196	58.905
3	1.016	7.816	66.721
4	1.001	7.703	74.424
5	0.852	6.555	80.979
6	0.796	6.119	87.098
7	0.570	4.387	91.485
8	0.479	3.685	95.171
9	0.259	1.992	97.163
10	0.153	1.181	98.343
11	0.121	0.934	99.278
12	0.071	0.542	99.820
13	0.023	0.180	100.000

Source: author's construction

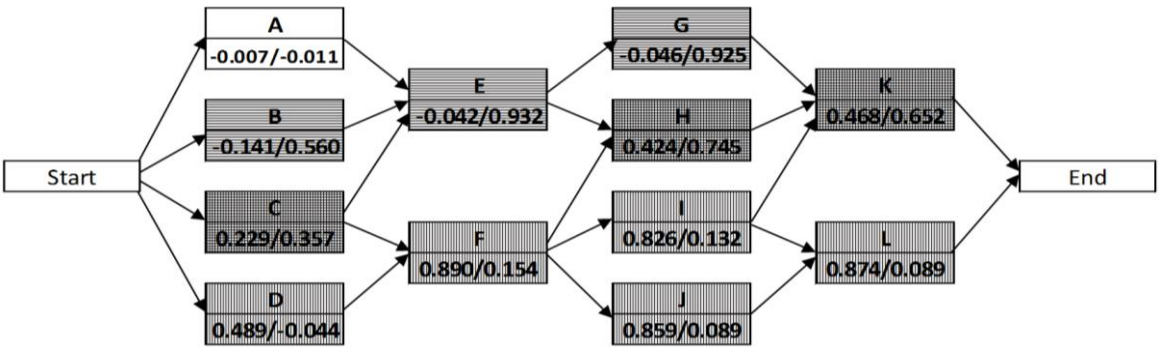
Fig. 7. **Eigenvalues**

The selection of the number of eigenvalues and by this the number of remaining dimensions normally follows Kaiser's criterion (eigenvalue > 1). Because the first two eigenvalues are much larger than 1, whereas the following two are very close to 1, let us look at the factor analysis with only two factors. Fig. 8 gives us the factor loadings after rotation. Loadings larger than 0.2 are shaded. In fig. 9 we try to illustrate these factor loadings in the project net. Again the similarity to fig. 4 and fig. 6 is noticeable.

	Component	
	1	2
Activity A end	**-0.007**	**-0.011**
Activity B end	**-0.141**	**0.560**
Activity C end	**0.229**	**0.357**
Activity D end	**0.489**	**-0.044**
Activity E end	**-0.042**	**0.932**
Activity F end	**0.890**	**0.154**
Activity G end	**-0.046**	**0.925**
Activity H end	**0.424**	**0.745**
Activity I end	**0.826**	**0.132**
Activity J end	**0.859**	**0.089**
Activity K end	**0.468**	**0.652**
Activity L end	**0.874**	**0.089**
Final end	**0.691**	**0.533**

Source: author's construction

Fig. 8. **Rotated factor loadings (2 factors)**



Source: author's construction

Fig. 9. **Illustration of the rotated factor loadings (2 factors)**

Some final remarks about further statistical analyses:

- The factor analysis with 4 factors differs from the 2-factor version in the way that the two additional factors represent the activities that are **not** that important for the time management of the whole project. Activity A for example (which is more or less independent from the other activities) becomes a factor of its own.
- We also tried out some more exploratory data analysis tools (predictive models) like classification trees with Chaid und CART. Unfortunately these endeavours have not been successful. The reason for that may lie in the fact that the Monte Carlo simulation makes very simple initial assumptions (three point estimates) and therefore it seems to make very little sense to apply exorbitant complex methods afterwards. Simple analyses like correlation analysis may be sufficient then.

Conclusions and remarks

In the Monte Carlo approach uncertainties are not only modelled by some parameters (like means, standard deviations etc.), but the whole ranges of the densities are used. Therefore within a Monte Carlo simulation we always work with random variables. In the special case of the time management within a project, the start and finish dates of the individual activities, their different kind of buffers and all the other variables, that depend on the uncertain durations, are random variables. In (Tysiak, 2013; 2015) we already analysed the distributions of the buffers. But also the analysis of the correlation matrix of the end dates of the activities reveals some more insights in the structure of the project. These insights might especially be interesting if we expand this approach to a project portfolio and examine critical chains.

More sophisticated multivariate analyses, like factor analysis, strengthen and support most of the findings that we already could see by just looking at the critical field (fig. 4), but they do not reveal any real new insights.

Bibliography

Tysiak Wolfgang, 2014. *The Dynamics in Monitoring and Control of Risk Management in Projects*, in: Project Management Development – Practice and Perspectives – Proceedings of the Third International Scientific Conference on Project Management in the Baltic Countries, April 10-11, 2014, Riga, University of Latvia.

PMI (ed.), 2010. *A guide to the project management body of knowledge*, (PMBOK®Guide) PMI.

Schelle/Ottmann/Pfeiffer, 2006. *Project Manager*, GPM German Association for Project Management.

Kerzner, 2009. *Project Management*, John Wiley & Sons, Hoboken, New Jersey.

Taylor, 2010. *Introduction to Management Science*, Pearson, Prentice Hall.

Fazar, Program Evaluation and Review Technique, The American Statistician, 1959, Vol. 13, No. 2.

Garlick, 2007. *Estimating Risk*, Aldershot, Gowen.

Rubinstein, R. Y., Kroese, D. P., 2007. *Simulation and the Monte Carlo Method* (2nd ed.), New York: John Wiley & Sons.

Tysiak, 2013. *Recent Developments in Risk Management in Projects Management*, in: Proceedings of the Seventh IEEE Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS'2013), IEEE Service Center Piscataway.

Tysiak, 2012. *From Critical Path to Critical Field*, in: Project Management Development – Practice and Perspectives – Proceedings of the First International Scientific Conference on Project Management in the Baltic Countries, February 8-9, 2012, Riga, University of Latvia.

Tysiak, 2015. *A Deeper Insight in Some Effects in Project Risk Management*, International Journal of Computing, 14 (1).

Project Management Development – Practice and Perspectives
Fourth International Scientific Conference on Project Management in the Baltic Countries
April 16-17, 2015, Riga, University of Latvia

PROJECT RISK REGISTER ANALYSIS AND PRACTICAL CONCLUSIONS

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Abstract

The aim of the current research is to examine real project risk registers to find correlations between the project management theory, especially project risk management, and practical results of real project risk management – the risk registers publicly available in the Internet.

In the research the author has analysed the compliance between the project risk management theory which is described in "*A Guide to the Project Management Body of Knowledge*" by Project Management Institute, *Tasmanian Government Project Management Guidelines* and *Risk Management Guide For DoD Acquisition* and the project risk registers.

In the previous research the author concluded that after analysing just 30 risk registers significant differences could be found between the risk register described in the theory and risk registers of real projects. At the end of the identification phase of the risk management process the coincidence between the described risk register and real project risk registers is high. As a result of the research it cannot be concluded what the minimum amount of information in the risk register is to make it comply with the risk register described in the theory. The challenge is to design recommendations for practical use.

Key words: *risk, project, project risk management, risk register*

JEL code: M00

Introduction

Project management is a new science characterized by dynamic development. The first editions of *A Guide to the Project Body of Knowledge*, *Tasmanian Government Project Management Guidelines* and *DSMC Risk Management Guide for DoD Acquisition* were launched in 1996. The latest version of *A Guide to the Project Body of Knowledge* – the fifth one – was issued in 2013. The latest – 7th version of the *Tasmanian Government Project Management Guidelines* came out in 2011. The most recent, 7th, interim release version of *Risk Management Guide for DoD Acquisition* is of year 2014. Although a new edition was issued in average every three years, the author considers that none of them contains references to research results; it can be assumed that the manuals represent theoretical reflection on the authors' experience. However, the development of a science is impossible without research and research-based conclusions and recommendations.

The article describes the research on 30 risk registers. The aim of the study is to assess the compliance of the publicly (in the Internet) available project risk registers with the description of project risk management in three project risk management manuals. For the purposes of the research the author has used both quantitative and qualitative research methods.

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Research

According to the 2013 issue of *A Guide to the Project Management Body of Knowledge* or *PMBoK* 2013, the risk register is a kind of project documents. (A Guide to the Project …, 2013). The risk register is used in five out of six subprocesses of Project Time Management, Project Cost Management, Project Quality Management and Project Risk Management (A Guide to the Project …, 2013). In PMBoK the risk register is defined as a document in which the results of risk analysis and risk response planning are recorded (A Guide to the Project …, 2013). PMBoK is not an example of a risk register document. The components of the risk register are described in accordance with the subprocesses of Project Risk Management.

In the "Identify", or the second, subprocess the primary output from the "Identify Risks" is the initial entry into the risk register, where the risk register includes the list of identified risks and list of potential responses (A Guide to the Project …, 2013). As the term "list" is used and assuming that the list of identified risks and list of potential responses have been co-ordinated, it can be concluded that at the end of the "Identify" sub process the risk register represents a table with two columns.

In the "Perform qualitative risk analysis" sub process the risk register is supplemented with the assessments of probability and impacts for each risk, risk ranking or scores, risk urgency information or risk categorization and a watch list for low probability risks or risks requiring further analysis (A Guide to the Project …, 2013). In the 2013 issue of PMBoK there is insufficient information for judging how the watch list for low probability risks or risks requiring further analysis is included in the risk register – as an individual column or separate table.

In the "Perform quantitative risk analysis" sub process the risk register updates could include the probabilistic analysis of the project, probability of achieving cost and time objectives, prioritized list of quantified risks, trends in quantitative risk analysis results. Like in the "Perform qualitative risk analysis" sub process, the 2013 issue of PMBoK does not contain sufficient information for concluding how the information on registered analysis is included in the risk register – as individual columns or a separate table, or whether the information is included in the risk register at all because the phrase "could include" is used.

In the "Plan risk responses" sub process the content of the risk register becomes still less certain as before listing the risk register components it is said that "updates to the risk register can include, but are not limited to" (A Guide to the Project …, 2013). Table 1 lists the possible columns or separate tables of the risk register.

In the "Control risks" sub process the risk register is not supplemented.

It can be concluded that the risk register of *A Guide to the Project Management Body of Knowledge* cannot be created as a project management document, disregarding the number of tables or number of columns in a table as the phrases "can include" or "can include, but are not limited" are used and there is insufficient description of the results of the risk management sub processes and the method of integrating them in the risk register or other project documents or their components.

The risk register of *DoD Risk Management Guide for Defence Acquisition Programs*, 7th Edition (Interim Release) is a table with 15 columns – Risk number, Linked WBS/IMS ID#, Owner, Type of risk, Status, Tier, Risk event, Likelihood/Consequence rating, Risk reporting matrix, Risk mitigation strategy, Submitted date, Board review, Planned closure, Expected risk rating, and Plan status (DoD Risk Management Guide …, 2014).

Table 1

Risk register according to PMBoK 2013 project risk management sub processes

Sub process	Information in the risk register by sub process	Notes
Plan Risk Management		No risk register
Identify	• List of identified risks; • List of potential responses.	The risk register can be made as a table with 2 columns.
Perform Qualitative Risk Analysis	• List of identified risks; • List of potential responses; • Assessments of probability; • Assessments of impacts; • Risk ranking or scores; • Risk categorization; • Watch list for low probability risks or risks requiring further analysis.	No unanimous conclusion can be made whether the watch list for low probability risks or risks requiring further analysis is a separate table or just a row in the risk register which was created during the "Identify" sub process.
Perform Quantitative Risk Analysis	• Probabilistic analysis of the project; • Probability of achieving cost and time objectives; • Prioritized list of quantified risks; • Trends in quantitative risk analysis results.	No unanimous conclusion can be made whether the probabilistic analysis of the project, probability of achieving cost and time objectives, prioritized list of quantified risks, trends in quantitative risk analysis results are a separate table or individual columns in the risk register which was created during the "Identify" sub process or they are project documents of some other kind or their components.
Plan Risk Responses	• Risk owners and assigned responsibilities; • Agreed-upon response strategies; • Specific actions to implement the chosen response strategy; • Trigger conditions, symptoms, and warning signs of a risk occurrence; • Budget and schedule activities required to implement the chosen responses; • Contingency plans and triggers that call for their execution; • Fall-back plans for use as a reaction to a risk that has occurred and the primary response proves to be inadequate;	No unanimous conclusion can be made whether the results of the "Plan risk response" are separate tables or individual columns in the risk register was created during the "Identify" sub process or they are project documents of some other kind or their components.

Sub process	Information in the risk register by sub process	Notes
	• Residual risks that are expected to remain after planned responses have been taken, as well as those that have been deliberately accepted; • Secondary risks that arise as a direct outcome of implementing a risk response; • Contingency reserves that are calculated based on the quantitative risk analysis of the project and the organization's risk thresholds.	
Control Risks		The structure of the risk register is not changed; the content of the risk register is supplemented or changed.

Source: author's construction

The risk register of the *Tasmanian Government Project Management Guidelines*, version 7.0 is a table with 13 columns – Unique identifier for each risk, Description of each risk, Impact on project, Assessment of the likelihood, Assessment of the seriousness, Risk grade, Change (about any change in the risk grading), Date of review, Mitigation actions, Responsibility, Cost, Timeline, and Work breakdown structure (Tasmanian Government Project …, 2011).

We can conclude that *DoD Risk Management Guide for Defence Acquisition Programs* un *Tasmanian Government Project Management Guidelines* are more unanimous sources for risk assessment as they describe the form of the risk register table and define the contents, or the number of columns, of the risk register. Table 2 provides the comparison of the risk register columns of *DoD Risk Management Guide for Defence Acquisition Programs* and *Tasmanian Government Project Management Guidelines*.

Table 2

Comparison of the Risk Register Columns of *DoD Risk Management Guide for Defence Acquisition Programs* and *Tasmanian Government Project Management Guidelines*

Heading of the risk register column in *DoD Risk Management Guide for Defence Acquisition Programs*	Heading of the risk register column in the *Tasmanian Government Project Management Guidelines*	Notes
Risk number	Unique identifier for each risk	
Linked WBS/IMS ID#	Work breakdown structure	The location of the columns in the tables does not coincide
Owner		
Type of risk		
Status		

Heading of the risk register column in *DoD Risk Management Guide for Defence Acquisition Programs*	**Heading of the risk register column in the *Tasmanian Government Project Management Guidelines***	**Notes**
Tier		
Risk event	Description of each risk	There are absolutely no coincidences in the column contents as the sources differ in their treatment of the risk management theory
Likelihood/ Consequence rating	Assessment of the likelihood. Assessment of the seriousness.	The number of the columns does not coincide
Risk reporting matrix		
Risk mitigation strategy	Mitigation actions	
Submitted date		
Board review	Date of review	
Planned closure		
Expected risk rating	Risk grade	The location of the columns in the table does not coincide
Plan status		
	Responsibility	
	Impact on project	
	Cost	
	Timeline	

Source: author's construction

Research results and discussion

The research comprised analysis of 30 risk registers. The selection of the registers was made in November, 2013 with the Google search engine by requesting "project risk register" and the first 10 web pages with the search results were examined. Taking into account that the aim of the research was not to find regularities in the risk registers, no assessment was made concerning the general set of risk registers and the kind of the selection. The author believes that 30 risk registers constitute a sufficient number for comparing the selected registers with the risk register described in *A Guide to the Project Management Body of Knowledge* or PMBoK 2013ed., *DoD Risk Management Guide* for *Defense Acquisition Programs*, 7th Edition (Interim Release), and *Tasmanian Government Project Management Guidelines*, version 7.0. (J.Uzulans, 2014).

In the previous research the risk registers were described and it was concluded that by analysing just 30 risk registers significant differences can be found between the risk register described in *A Guide to the Project Management Body of Knowledge* and risk registers of real projects. At the end of the identification phase of the risk management process the coincidence between the described risk register and real project risk registers is high, in all registers the following information indicated in all PMBoK editions, except year 2013 one, is present – the

name of the risk, risk description, consequences and risk owner. However, this information is not present in all risk registers (see table 3). The coincidence can be considered high only by examining the whole set of the risk registers under the study as there are significant individual differences among the risk registers (J.Uzulans, 2014).

In the case of *DoD Risk Management Guide for Defense Acquisition Programs*, 7th Edition (Interim Release), and *Tasmanian Government Project Management Guidelines*, version 7.0 the assessment of the risk register coincidence is easier. Firstly, how many risk registers out of 30 do not comply if the number of columns is smaller than 13. 2 registers have up to 5 columns, 14 registers have between 7 and 12 columns, 10 registers have between 14 and 19 columns and 4 registers have more than 20 columns. No risk register has exactly 13 columns, 1 register has 15 columns. 6 risk registers have 15 or more columns, 14 risk registers have more than 13 columns.

Table 3

Comparison of the Risk Register Columns in *DoD Risk Management Guide for Defense Acquisition Programs* and *Tasmanian Government Project Management Guidelines* and in Risk Registers

Risk Register of *DoD Risk Management Guide for Defense Acquisition Programs*	**Coincidence of the contents of risk register columns**	**Risk Register of Tasmanian Government Project Management Guidelines**	**Coincidence of the contents of risk register columns**
Risk number	6	Unique identifier for each risk	13
Linked WBS/IMS ID#	0	Work breakdown structure	0
Owner	4		
Type of risk	1		
Status	4		
Tier	0		
Risk event	4	Description of each risk	10
Likelihood/ Consequence rating	6	Assessment of the likelihood. Assessment of the seriousness.	14
Risk reporting matrix	0		
Risk mitigation strategy	6	Mitigation actions	13
Submitted date	1		
Board review	1	Date of review	1
Planned closure	0		
Expected risk rating	5	Risk grade	13
Plan status	0		
		Responsibility	3
		Impact on project	0
		Cost	0
		Timeline	2

Source: author's construction

Conclusions, proposals, recommendations

The research has not provided the answer on what an accurate risk register is. From the data in Table 3 we can conclude that several columns can be considered essential in the risk register. They are as follows: Risk number, Risk description, Risk likelihood, Risk consequence, and Risk mitigation. According to the risk register definition no risk register can be made without the Risk descriptions column. Without the columns of Risk likelihood, Risk consequence and Risk rating, however, project risk management cannot be effective as there are no criteria on how to manage risks or what actions and when are necessary.

The risk registers are different and the coincidence or difference of column headings does not guarantee that the column contents will be the same or, respectively, different. The analysis of the risk registers solely by column headings is insufficient – a more profound quantitative analysis of the risk registers must be performed by finding the appropriate project management or project risk management theory description for each of the risk registers used in the research. However, it is not guaranteed that such an analysis will be sufficient. Certainly, a bigger number of risk registers could be analysed than it has been done in the research and then arrive to the conclusion that the more common columns are more accurate than the less common ones. This kind of research results might also be insufficient for drawing conclusions. The effectiveness of project risk management and the risk register as one of the components of effective risk management could be one of the criteria of the risk register accuracy. However, the theory of project management effectiveness has neither been fully designed. The research on risk registers could promote and facilitate the research on the effectiveness of project management.

Bibliography

A Guide to the Project Management Body of Knowledge. (PMBOK® Guide) – Fifth Edition, Project Management Institute, 2013, p. 589.

DoD Risk Management Guide for Defence Acquisition Programs, 7th Edition (Interim Release). December 2014. Office of the Deputy Assistant Secretary of Defence for Systems Engineering, 100 p.

Tasmanian Government Project Management Guidelines. Version 7.0 (July 2011). Office of eGovernment Department of Premier and Cabinet Tasmania, 196 p.

Uzulāns, Juris. Project Risk Management Documentation Evaluation Methods / Juris Uzulāns // Project management development – practice and perspectives: third International Scientific Conference on Project Management in the Baltic Countries, 10-11 April, 2014, Riga, University of Latvia: conference proceedings / University of Latvia. Faculty of Economics and Management, Riga: University of Latvia, 2014. ISBN 9789984494708, pp. 291-299.

Risk registers available and retrieved online at:
http://www.mnsure.org/images/BC9-1-ITAttachmentN.pdf;
http://www.bsee.gov/uploadedFiles/AppendixJ_RiskRegister.pdf;
http://www.north-herts.gov.uk/churchgate_project_risk_register_v9__updated__13_12_2012__web.pdf http://www3. hants.gov.uk/appendix_9_risk_assessments_2.pdf;
http://www.norwich.gov.uk/TransportAndStreets/Transport/Cycling/Documents/Annex18QRA.pdf;
http://www.nerc.ac.uk/research/programmes/appraise/documents/risk-register.pdf;
http://www.drdni.gov.uk/a2_project_risk_register_-stage_2_issue_6__25-09-09_.pdf;
http://files.whatdotheyknow.com/request/edge_lane_contract_and_dft_money/Volume 2/Project Risk Register/Project Risk Register.pdf;

http://www.epsom-sthelier.nhs.uk/EasysiteWeb/getresource.axd?AssetID=17404&type=full&servicetype=Attachment;
http://www.southhams.gov.uk/administration/committee_agendas/executive/26jan12/item13_appA.pdf;
http://www.scottish.parliament.uk/OMG/OMG_Paper_004_-_I_-_Records_Management_project_Risk_Register.pdf;
http://www.plymouth.gov.uk/appendix_5a_-_swdwp_risk_register_v4_update_24_apr_08.pdf;
http://www.derrycity.gov.uk/DerryCitySite/files/4d/4de2ecb9-6a4a-4a5b-8d8b-9c73462c58fb.pdf;
http://www.brighton.ac.uk/aquamanche/images/aquamanche_risk_rRegister.pdf;
http://www.carbontrust.com/media/82096/low_carbon_buildings_risk_register.xls;
http://www.honolulutraffic.com/PMOC_Risk_Register.pdf;
http://jurassiccoast.org/pathfinder-project/public-documents/category/1-final-report/download?=3:final-report-to-defra-appendices;
http://www.gloucestershire.gov.uk/CHttpHandler.ashx?id=53319&p=0;
http://www.norfolk.gov.uk/view/NCC102109;
http://www.skatelescope.org/public/2011-11-08 Monitor_and_Control_CoDR/06-WP2-005-065-020-RE-001rb-Risk-Register.pdf;
http://www.londoncouncils.gov.uk/London Councils/Item4CFCAppendixDCAProjectRisksandIssuesRegisterTe.pdf;
http://www.eastsussex.gov.uk/NR/rdonlyres/4CE9D2F2-9E82-4B71-9597-5A327F1EA438/0/38RiskRegister.pdf;
http://democracy.york.gov.uk/documents/s48888/Annex F2 - Stadium Risk Register.pdf;
http://www.nelincs.gov.uk/GetAsset.aspx?id=fAAyADAAMAB8AHwAVAByAHUAZQB8AHwAMAB8AA2;
http://www.dft.gov.uk/ha/standards/pilots_trials/files/HA2006H.pdf;
http://northbuild.multicard.com.au/Documents/S011 - Strathpine West State School.pdf;
http://cds.u-strasbg.fr/twikiAIDA/pub/EuroVOAIDA/Board3/EuroVO-AIDA_Risk_Register_v0.6.pdf
http://democracy.lbhf.gov.uk/documents/s21751/;
http://www.nws.usace.army.mil/Portals/27/docs/civilworks/projects/ Appendix I Risk Management.pdf;
http://cmis.milton-keynes.gov.uk/CmisWebPublic/Binary.ashx?Document=20886.

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MEASURING ADEQUACY OF FLEXICURITY CONCEPT FOR THE EU COUNTRIES USING FUZZY LOGIC APPROACH

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Abstract

Implementation of the labour market *flexicurity* concept on national level can be seen as governmental project management issue in public administration – to manage a group of critical success factors that are to be achieved by enforcing four *flexicurity* principles: (a) flexible and reliable contractual arrangement through modern labour laws, collective agreements and work organisation; (b) comprehensive lifelong learning strategies; (c) effective active labour market policies; and (d) modern social security system that provides adequate income support, encourages employment and facilitates labour market mobility.

There is no single indicator that measures the total *flexicurity* of the labour market. Furthermore, the value for society from the four *flexicurity* principles is perceived differently across EU countries in response to economic and political history and national traditions that have impact on public administration, as well as labour market regulations. Fuzzy Logic Approach is used when vague criteria must be incorporated into the analysis in order to measure the project effectiveness more precisely. By assuming that the labour market has the highest efficiency when concept of the *flexicurity* is enforced, the target of this research is to create a joint measurement of the labour market efficiency level in EU countries using Fuzzy Logic Approach (Ray S et.al., 2013) that consists of following steps: 1) selecting the critical success factors to be used for project effectiveness measurement; 2) define linguistic variables and their scales for the critical success factors as well as the effectiveness measurement scales; 3) define importance rating and performance rating scales for the critical success factors; 4) define fuzzy measurement index (FMI) for the project effectiveness; and 5) matching FMI with pre-defined linguistic levels of the project effectiveness measurement scale as defined in step 2.

The outcome of this research provides public authorities with comparative analysis and information on measuring adequacy of the *flexicurity* concept in EU countries using the Fuzzy Logic Approach.

Key words: *flexicurity, project measurement system, fuzzy logic, EU*

JEL codes: J08, C63, P52

Introduction

In 2000, the Lisbon strategy for growth and jobs were signed. Revised in 2005 it incorporated Integrated Guidelines for growth and jobs for the period 2005 – 2008, where the flexicurity principle was first encouraged at the European Union level by the following guideline: "Promote flexibility combined with employment security and reduce labour market segmentation, having due regard to the role of the social partners (Integrated Guideline No. 21)". In 2007, the European Expert Group on *Flexicurity* created a report "*Flexicurity*

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Pathways: Turning hurdles into stepping stones", where four precisely defined *flexicurity* policy components were presented:

a) *Flexible and reliable contractual arrangements*, (from the perspective of the employer and the employee, of "insiders" and " outsiders") through modern labour laws, collective agreements and work organisation;
b) *Comprehensive lifelong learning (LLL)* strategies to ensure the continual adaptability and employability of workers, particularly the most vulnerable;
c) *Effective active labour market policies (ALMP)* that help people cope with rapid change, reduce unemployment spells and ease transitions to new jobs;
d) *Modern social security systems* that provide adequate income support; encourage employment and facilitate labour market mobility. This includes broad coverage of social protection provisions (unemployment benefits, pensions and healthcare) that help people combine work with private and family responsibilities such as childcare.

European Foundation for the Improvement of Living and Working Conditions (Eurofound) in 2007 also presented a research "Approaches to flexicurity: EU models". European Union countries were analyzed and grouped by their labour market characteristics and implemented flexicurity models. The factor analysis and cluster analysis were applied. From the factor analysis, it was found that the Nordic countries together with the Netherlands and the UK have higher *flexicurity* and social security indicators than other countries. Meanwhile, the new Member States and Baltic States together with the Mediterranean countries had lower figures for both *flexicurity* and safety.

It can be reasoned that the implementation of the labour market flexicurity concept on national level can be seen as governmental project management issue in public administration – to manage a group of critical success factors (indicators of flexicurity principles) in order to achieve the result of flexicurity labour market. The approach of project management in public administration seems to be beneficial also because of frequent inconsistency between economic and social policy initiatives. When *flexicurity* is defined as the overall goal to be achieved in the labour market, all new policies implemented should complement to the target.

Regardless of previously done studies on analysing the relationship between flexibility and employment or social security (depending on the approach), there is still no measurement that could provide with one common output that characterizes whether the flexicurity is or not implemented in a particular country and at what extent. By assuming that the labour market has the highest efficiency when concept of the flexicurity is enforced, the target of this research is to create a joint measurement of the labour market efficiency level in EU countries using Fuzzy Logic Approach.

The paper is ordered as follows – in the first section the mathematical background of Fuzzy Logic will be given. In the second part will introduce the reader to data used in the research. The third part is the methodology application, where Fuzzy Logic Approach is done, based on the data previously described. As a result, the level of flexicurity of labour market in particular country is defined by following categories: "very poor", "poor", "fair", "good" or "very good". Paper is finished with main conclusions.

Fuzzy logic

Fuzzy sets history began in 1965 with the publication of the American mathematician and engineer Lotfi Zadeh article (Zadeh, 1965). In this article, Zadeh developed fuzzy set theory basics and discussed prospects for the use of a "fuzzy sets" solving mathematical management tasks. While classical mathematics is based on the principle of bivalence: each statement is true or false, the third cannot, Fuzzy set theory are allowed to take a truth function of not only the two values 1 (= yes) and 0 (= no) but also in others, an adequate value to the situation. Representation M: X→[0,1] are called the fuzzy subset of the set X (Lebedinska, 2010, 6 p.). Fuzzy logic is a strong mathematical tool for modelling or controlling uncertain systems, or for approximate reasoning in decision making in the absence of complete and precise information (Ray et. al., 2013).

The, for example, "low-level" subset, when viewed on the merits, has no strict borders, but it has the "vague" or fuzzy boundaries. It can be assumed that "a low-level" is the indicator lower than, for example, 0.095. However, if something greater by one point (0.095 + 0.01), it applies that the indicator is no longer low. Researching the real situation "levels" need to be treated flexibly. In different contexts, low levels may be a pointed to 0, as well as to, say, 0.85. Set of elements that may belong to a greater or lesser degree are called fuzzy sets or L-sets.

The truth values in the Fuzzy logic, called membership values, are indicated by a value in the range 0 to 1, where 0 corresponds to absolute falsity and 1 for absolute truth. This, however, can be also used for evaluating the project management efficiency, where 0 applies for un-efficient project and 1 for the most-efficient project. In the middle the project efficiency is ranged from no or low-efficiency when membership value is closer to zero to medium or high efficiency, when membership value goes to one. Linguistic variables are used for evaluating the project efficiency.

Methodology and Data

The Fuzzy Logic Approach consists of five following steps (Ray et al., 2013):

a) selecting the critical success factors to be used for project effectiveness measurement;
b) define linguistic variables and their scales for the critical success factors, as well as the effectiveness measurement scales;
c) define importance rating and performance rating scales for the critical success factors;
d) define fuzzy measurement index (FMI) for the project effectiveness;
e) match the FMI with pre-defined linguistic levels of the project effectiveness measurement scale as defined in step 2.

First and second step in the Fuzzy Logic Approach to project management efficiency measurement is to select the critical success factors to be used and their linguistic variables. For simplification, in this paper, only the linguistic variables are used and are not grouped in higher categories (success factors). In this case, indicators that characterize the four *flexicurity* principles is the main input and data. The choice of indicators is based on the Annex III "Background indicators relevant for flexicurity" of the European Commission paper "Towards Common Principles of Flexicurity: More and better jobs through flexibility and security" (2007).

Table 1

Input Data Used in Calculations

	1st principle – Flexible and reliable contractual arrangements			2nd principle – Comprehensive lifelong learning (LLL)		3rd principle – Effective active labour market policies (ALMP)	4th principle – Modern social security systems		
	Strictness of employment protection – individual and collective dismissals (regular contracts) OECD	Strictness of employment protection – temporary employment OECD	Involuntary WOMEN part-time employment as a percentage of the total WOMEN part-time employment	Participation rate in education and training (last 4 weeks), age cohort 18-64	Unemployed person participation rate in LLL, age cohort 25-64	Active Labour-Market Policy expenditure, % of GDP (categories 2-7)	Passive Labour-Market Policy expenditure, % of GDP (category 8-9)	Net Replacement: the initial phase of unemployment (67% of AW, 2 children, two-earner married couple)	Average of Net Replacement Rates over 60 months (5 years) of unemployment, %
Belgium	3.08	2.42	8.9	7.8	8.9	0.65	2.26	86	63.97
Czech Republic	2.75	2.00	19.3	14.2	7.5	0.18	0.37	88	56.11
Denmark	2.32	1.79	17.1	38.1	35.1	1.54	1.78	92	72.80
Germany	2.98	1.54	14.5	12.2	5.1	0.45	1.33	90	59.33
Estonia	2.07	2.29	22.2	15.7	8.6	0.15	0.87	79	43.07
Ireland	1.98	0.71	30.6	8.8	6.4	0.71	2.95	81	83.18
Greece	2.44	3.25	55.4	3.0	2.8	0.22	0.73	74	12.04
Spain	2.56	3.17	52.9	12.7	13.4	0.71	3.16	89	47.07
France	2.82	3.75	29.6	8.3	5.2	0.67	1.45	84	58.75
Italy	3.03	2.71	50.6	5.8	5.5	0.31	1.45	87	9.00
Latvia	2.91	1.79	41.2	8.2	4.3	0.33	0.69	94	54.62
Luxembourg	2.74	3.83	8.9	16.1	15.3	0.46	0.79	93	73.44
Hungary	2.26	1.92	36.8	3.1	2.0	0.35	0.72	88	37.62
Netherlands	2.88	1.17	6.5	25.4	17.3	0.73	1.76	78	71.42
Austria	1.99	1.04	9.1	17.5	18.6	0.57	1.41	85	68.51
Poland	2.39	2.33	24.9	8.2	4.7	0.33	0.34	80	46.62
Portugal	3.31	2.46	48.4	12.4	16.9	0.46	1.39	91	58.78
Slovenia	2.67	2.50	8.9	21.9	16.4	0.25	0.68	96	64.54
Slovakia	2.63	2.42	22.3	4.8	1.7	0.22	0.61	86	39.65
Finland	2.17	1.88	30.1	29.4	19.7	0.86	1.79	83	69.29
Sweden	2.52	0.79	27.6	26.5	41.0	0.93	0.80	84	64.65
United Kingdom	1.71	0.42	13.8	20.7	14.8	0.08	0.31	70	62.61
Norway	2.31	3.04	20.3	22.8	18.9	0.45	0.48	86	69.42

Source: authors' calculations based on EUROSTAT and OECD databases

Only the ratio parameters are taken for comparison. Parameters that are measured in absolute values are not included – it could cause large biases, because it is not possible to control for countries specific effects as size of labour market and number of unemployed, state budget, gross domestic product (hereinafter GDP) per capita, etc. For this reason, the linguistic variables that describe the four *flexicurity* principles are following:

1) Strictness of employment protection for permanent employees (OECD);
2) Strictness of employment protection for non-permanent employees (OECD);
3) Involuntary part-time employment for women (EUROSTAT);
4) Percentage of the adult population between 25 and 64 participating in education and training, i.e. lifelong learning (EUROSTAT);
5) Unemployed person participation rate in lifelong learning (EUROSTAT);
6) Expenditure on active labour market policies as a percentage of GDP (EUROSTAT);
7) Expenditure on passive labour market policies, percentage of GDP (EUROSTAT);
8) Net replacement ratio in the first year (OECD);
9) Net replacement ratio after five years (OECD).

For consistency among indicators, ratios from 2011 are used. Except for Latvia the employment protection indexes for regular and temporary contracts were calculated the first time on 2012, and the expenditure on active labour market policy for Greece and United Kingdom are from 2010 because of lack of newer data. At the same time following European countries are omitted: Bulgaria, Croatia, Cyprus, Lithuania, Malta, Romania, Iceland, Switzerland, Macedonia, and Turkey, because either OECD Employment Protection Index or Expenditures on Active and Passive labour market policies in percentage of GDP are not available for these countries.

Application of fuzzy logic to measure *flexicurity* of labour market

After choosing the variables used in further analysis, the performance rating must be defined. It is assumed that each of indicators is normally distributed around the average value for chosen countries. This is a very general simplification to define the performance ratings and has its disadvantages. However, the target of the paper is to analyse whether Fuzzy Logic Approach can be used for governmental policy evaluation. For this reason, this simplification is considered as a good approximation, and it also has implication when it is possible to separate the groups of countries, performing either very good or very bad, relatively to the average level. The assumption is that there should not be many countries with extreme performance, because, first of all, very good performance cannot be reached in the short period since the flexicurity concept is in force, and secondly, each of the countries have some level of both flexible regulation and social security policies so that none of them should have very poor performance overall.

Performance rating intervals are calculated as follows:

1) Very poor performance has interval from the minimum observed or possible value to the value of 1.5 standard deviation lower than average;
2) Poor performance is from value of 1.5 standard deviation lower than average to 0.5 standard deviation lower than average;

3) Fair performance value is from 0.5 standard deviation lower to 0.5 standard deviation higher value than average;
4) Good performance and very good performance has the opposite indication as poor and very poor.

Table 2

Performance Rating for Linguistic Variables

Year 2011	1st principle – Flexible and reliable contractual arrangements			2nd principle – Comprehensive lifelong learning (LLL)		3rd principle – Effective active labour market policies (ALMP)	4th principle – Modern social security systems		
	Strictness of employment protection – individual and collective dismissals (regular contracts) OECD	Strictness of employment protection – temporary employment OECD	Involuntary WOMEN part-time employment as a percentage of the total WOMEN part-time employment	Participation rate in education and training (last 4 weeks), age cohort 18-64	Unemployed person participation rate in LLL, age cohort 25-64	Active Labour-Market Policy expenditure, % of GDP (categories 2-7)	Passive Labour-Market Policy expenditure, % of GDP (category 8-9)	Net Replacement: the initial phase of unemployment (67% of AW, 2 children, two-earner married couple)	Average of Net Replacement Rates over 60 months (5 years) of unemployment, %
Very poor	5.00	5.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
	3.15	3.54	48.93	1.17	2.57	0.02	0.04	75.84	28.35
Poor	3.15	3.54	48.93	1.17	2.57	0.02	0.04	75.84	28.35
	2.75	2.60	33.70	10.35	7.59	0.34	0.83	82.21	46.74
Fair	2.75	2.60	33.70	10.35	7.59	0.34	0.83	82.21	46.74
	2.34	1.67	18.47	19.53	17.64	0.67	1.62	88.57	65.13
Good	2.34	1.67	18.47	19.53	17.64	0.67	1.62	88.57	65.13
	1.93	0.74	3.23	28.70	27.68	0.99	2.41	94.94	83.52
Very good	1.93	0.74	3.23	28.70	27.68	0.99	2.41	94.94	83.52
	0.00	0.00	0.00	100.00	100.00	2.00	4.00	100.00	100.00

Source: authors' construction based on assumption of normal distribution around the countries average

Based on performance rating intervals, the input data table is re-defined by replacing each number in column with the corresponding performance rating level (very poor, poor, fair etc.). As for example, if the numeric value of the indicator "strictness of employment protection (for individual and collective dismissals with regular contracts) index" is 2.91 (case of Latvia), the corresponding performance rating is "poor", while if this value is 1.71 (case of United Kingdom) – the performance rating in the table will take a value "very good".

The Fuzzy numbers are defined with three scales. "I1" shows the lower performance rating values; "I2" shows most likely performance rating values; and "I3" shows upper-performance rating values.

This is the assumption of triangle membership functions. Membership function is a curve that defines how each point in the input space is mapped to a membership value or the degree of membership, here, between 0 and 10, but could also be defined between 0 and 1.

In the table no.3 is showed, that the lowest level of every next performance rating (or the "I1" Fuzzy number) is below the highest level of previous performance rating (of the "I3" Fuzzy number).

Table 3

Triangle Membership Function for Performance Ratings

Performance rating	I1	I2	I3
Very poor	0.0	1.0	3.0
Poor	2.0	3.0	5.0
Fair	4.0	5.0	7.0
Good	6.0	7.0	9.0
Very good	8.0	9.0	10.0

Source: authors' assumptions in conformity with the Triangle Membership Function for Performance Ratings

In the next step the re-defined table, where every numeric value is replaced by performance rating, and three Fuzzy numbers, which define the interval of performance rating, are used. New tables are created, where the performance rating is replaces by corresponding Fuzzy number – in the first case the lowest Fuzzy number of corresponding performance rating, in the second case the middle, and in third case the highest Fuzzy number.

There are FMIs calculated for each country for three scenarios (using lowest values, middle values and highest values of performance ratings separately) and is called FMI(1), FMI(2), and FMI(3). Every of the three FMIs is defined for particular country as an average of Fuzzy numbers of or linguistic variables in particular scenario. Here weighting is used for linguistic variables, to create equal weights of each of four *flexicurity* principles, rather than each linguistic variable. The distance between three FMIs and three Fuzzy numbers of each performance rating is calculated to find closest rating to overall FMI that describes countries performance the best. The overall FMI is not a scalar value, but it is a vector of three dimensions. The performance ratings, for example, "very poor" is a vector (0.0; 1.0; 3.0), "fair" (4.0; 5.0; 7.0) etc., and the FMI is defined as (FMI(1); FMI(2); FMI(3)). For simplicity, Euclidean distances are calculated.

$$E_{distance}(FMI, performance\ rating) = \sqrt{(FMI(1) - I1_i)^2 + (FMI(2) - I2_i)^2 + (FMI(3) - I3_i)^2}\ , \quad (1)$$

where *i* is concrete performance rating (very poor, poor, fair, good, or very good); I1, I2 and I3 are previously defined Fuzzy numbers for each performance rating level; and FMI(1), FMI(2)

and FMI(3) are the Fuzzy measurement indexes. This is done for each country separately. Finally, the overall Fuzzy measurement index (FMI) can be chosen as the smalles Euclidean distance, and the level of implemented *flexicurity* concept in the labour market can be defined as specific performance rating.

Table 4

Calculations of FMI and the Corresponding *Flexicurity* Level in EU and EEZ countries

	Very poor	**Poor**	**Fair**	**Good**	**Very good**	**FMI score (the MIN Euclidean distance)**	**Level of implemented *flexicurity* concept in the labour market**
Belgium	6.784	3.320	*0.144*	3.608	6.546	0.144	Fair
Czech Republic	5.052	*1.588*	1.876	5.340	8.268	1.588	Poor
Denmark	11.554	8.093	4.637	*1.225*	1.780	1.225	Good
Germany	7.073	3.608	*0.144*	3.320	6.260	0.144	Fair
Estonia	5.774	2.309	*1.155*	4.619	7.550	1.155	Fair
Ireland	8.276	4.813	*1.354*	2.121	5.050	1.354	Fair
Greece	2.887	*0.577*	4.041	7.506	10.424	0.577	Poor
Spain	7.746	4.283	*0.821*	2.647	5.583	0.821	Fair
France	6.062	2.598	*0.866*	4.330	7.263	0.866	Fair
Italy	3.753	*0.289*	3.175	6.640	9.561	0.289	Poor
Latvia	4.619	*1.155*	2.309	5.774	8.699	1.155	Poor
Luxembourg	6.928	3.464	*0.000*	3.464	6.403	0.000	Fair
Hungary	5.052	*1.588*	1.876	5.340	8.268	1.588	Poor
Netherlands	8.805	5.340	1.876	*1.588*	4.548	1.588	Good
Austria	8.516	5.052	*1.588*	1.876	4.833	1.588	Fair
Poland	4.330	*0.866*	2.598	6.062	8.986	0.866	Poor
Portugal	6.351	2.887	*0.577*	4.041	6.976	0.577	Fair
Slovenia	7.025	3.561	*0.118*	3.369	6.299	0.118	Fair
Slovakia	4.186	*0.722*	2.742	6.207	9.130	0.722	Poor
Finland	9.888	6.424	2.961	*0.515*	3.466	0.515	Good
Sweden	9.022	5.558	2.095	*1.375*	4.317	1.375	Good
United Kingdom	6.978	3.515	*0.144*	3.419	6.339	0.144	Fair
Norway	7.794	4.330	*0.866*	2.598	5.545	0.866	Fair

Source: authors' calculations based on assumptions about the Triangle Membership Function and constructed Performance Rating for Linguistic Variables

"Good" implementation of the *flexicurity* in the labour markets is in the following countries: Denmark, the Netherlands, Finland and Sweden. In the category of "poor" *flexicurity* level are countries: Czech Republic, Greece, Italy, Latvia, Hungary, Poland and Slovakia. All other countries are in the group of "fair" implementation of the *flexicurity*.

These results are consistent with other studies. In the European Foundation for the Improvement of Living and Working Conditions (hereinafter – Eurofound) paper "Approaches to flexicurity: EU models" (2007), the relationship between flexibility and social security was analysed, and the final findings suggested that countries with the best implementation of flexicurity (both flexibility and social security) were Sweden, Denmark, the Netherlands, Finland and United Kingdom, based on data from year 2006. At the same time, countries with the lowest both flexibility and social security in the Eurofound findings are Slovakia, Poland, Hungary, Czech Republic, also Baltic States, which is consistent with findings of this paper.

Based on results presented, it is possible to argue that the methodology of Fuzzy Logic Approach for *flexicurity* implementation can be used. However, this asks for further research with target to improve the choice of indicators and their weighting, defining critical success factors and understand their necessity, and defining intervals for performance ratings that could lead to the more precise countries division in categories by level of labour market flexicurity.

Conclusions

1. Governmental policy and public administration can be seen as project management issue, when all other actions (policy initiatives) need to complement to the overall goal. Therefore, the project efficiency estimation methods can also be used for analysing the results of implementation of economic and social policies.
2. Fuzzy Logic Approach helps to deal with different perceptions on defining levels of policy implementation, as well as uncertainty. It can be argued that the interval of "very-poor" *flexicurity* performance can partly overlap with "poor" performance, because of different attitude among countries.
3. In the paper, it is showed how that the Fuzzy Logic Approach can be used for measuring the level of *flexicurity* in the labour market for European countries. The first step is to select indicators and define their performance ratings. Then the Fuzzy Measurement Index can be estimated and matched with the performance level of the policy implementation, by calculating the distance measures. The Euclidean distance in this paper is used. In the result, it is indicated whether the level of *flexicurity* in a particular country is "very poor", "poor", "fair", "good" or "very good".
4. The results of the paper shows that countries with "good" flexicurity implementation level are Finland, Sweden, Denmark, and the Netherlands, but countries with "poor" labour market flexicurity are Czech Republic, Latvia, Hungary, Poland, Slovakia, Greece and Italy. These results are consistent with other researches on this topic and, therefore, it is possible to argue that the Fuzzy Logic Approach can be used in governmental policy estimation, particularly for estimating the level of *flexicurity* implementation in the labour market.
5. To develop the methodology created in the paper, several subparts should be deeper analysed: first, the choice of the indicators and their weighting, secondly, if defining critical success factors is beneficial or indicators can be directly inputted into the model, and thirdly, intervals or the Fuzzy numbers for each of the performance ratings should be improved.

Bibliography

Europa.eu., 2015. *Employment policy guidelines (2005-2008)*. [Online] Available at: http://europa.eu/legislation_summaries/employment_and_social_policy/community_employment_policies/c11323_en.htm [Accessed 2 January 2015].

European Commission., 2007. *Towards Common Principles of Flexicurity: More and Better Jobs Through Flexibility and Security*. Directorate-General for Employment, Social Affairs and Equal Opportunities Unit D.2.

European Foundation for the Improvement of Living and Working Conditions., 2007. *Approaches to Flexicurity: EU Models*. Luxembourg: Office for Official Publications of the European Communities.

Ray, S., Das, P., Bhattacharyay, B. and Antony, J., 2012. Measuring Six Sigma Project Effectiveness using Fuzzy Approach. *Qual. Reliab. Engng. Int.*, 29(3), pp. 417-430.

Zadeh, L., 1965. Fuzzy sets. *Information and Control*, 8(3), pp. 338-353.

Lebedinska, J., 2010. *Fuzzy matrices and generalized aggregation operators: theoretical foundations and possible applications*. Dr. Math. University of Latvia, Faculty of Physics and Mathematics.

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AUTOMOTIVE SOFTWARE DEVELOPMENT WITH AMALTHEA

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Abstract

The complexity of automotive software systems is growing rapidly. Today, modern cars contain more than 100 computing devices (Venkatesh Prasad, K.; Broy, M. and Krueger, I., 2010) (called electronic control unit – ECU), e.g. for controlling the heating, ventilation and air condition systems (HVAC) or operating the engine. Developing software for these ECUs and maintaining the different parts and versions of software and hardware has become a major effort for both automotive component suppliers and car makers (OEMs) (Brink, C.; Kamsties, E.; Peters, M. and Sachweh, S., 2014). Therefore, the design flow starting at requirements engineering and ending at the integration of the software into the ECUs has to be supported by adequate tools. In addition, the tools are expected to work as a continuous and consistent tool chain, automating the different steps of the design flow and checking the resulting artefacts for consistency and correctness. Automotive software development projects are tailoring the design flow and the methodology according to their requirements and processes. Therefore, the tooling needs to be tailored, too. To do this, common frameworks and standardized interfaces are required. The two ITEA2 projects AMALTHEA[2] (Brink, C. und Jatzkowski, J., 2014) and AMALTHEA4public are aiming at the development of the respective standards and frameworks. A reference implementation of the open source tool chain framework will be published within the Eclipse project[3]. By making the framework available within one of the largest open source organizations for software development tooling, a broad distribution and application within the industry is supported. Specific tool support for relevant methodology in automotive software development, e.g. product line management, model based and model driven design, AUTOSAR support[4], and multi-core microcontrollers enhances the productivity of the tool chain (Fruhner, D.; Höttger, R.; Köpfer, S. and Krawczyk, L, 2014). Our contribution will present the software development flow behind the AMALTHEA approach and the main concepts of applying and tailoring the tool chain.

Key words: *Automotive Systems, Model Based Software Design, Multicore, AMALTHEA tool chain*

JEL code: O33

Introduction

The growing complexity of automotive software systems leads to a change in development processes and methodology and consequently to the need for different tools. The

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[2] http://www.amalthea-project.org
[3] http://www.eclipse.org
[4] http://www.autosar.org

main driver for the complexity increase of automotive software projects is the division of work. In the past, software was a minor part of the overall product in the embedded systems domain. Today, many products are software-defined, meaning that the major part of the functionality and the unique selling point of the final product are defined by software. In the past, embedded software was developed in rather small projects, e.g. one engineer was doing the definition, development and testing of the complete software with rather simple development tools and methods. Today, larger projects are done by development teams that combine the expertise of specialists for each part of the development work. The project partners may even come from different companies and there may be preferences for certain methodologies and tools according to the specific task, the experience of the partner with certain tools and to some extend also the cost of tools.

AMALTHEA addresses these needs by providing a tool chain environment and tools with the following characteristics:

- It provides a tool framework that allows the exchange of development results (called artefacts) between project partners. The tool chain comes with a model repository for storing development artefacts in common formats (pre-defined by a set of models).
- The project team can select tools according to the needs (e.g. complexity) of a certain task (e.g. verification of the software) and connect it to the tool chain by reading the artefacts (generated by other tools) from the model repository and storing own results in the joint repository – making them available for other tools.
- The tool chain supports exchange of development artefacts between tools by offering a common exchange interface. Furthermore, it supports the cooperation of different project partners since they can exchange their results with the same mechanisms.
- Project partners can tailor the tool chain to the needs of the project by selecting certain tools and plugging them into the tool chain. Tailoring tools and methodology to the project needs is a way of coping with the complexity of software development.
- The tool chain and the repository are freely available as open source software. This allows the adaptation to the project needs on the one hand. On the other hand it forms a kind of de-facto standard for the interfaces and the models supported by the model repository and the tools plugged into the tool chain.
- The tool chain is based on Eclipse[5] and fully compliant to this open source project for software development tools. Eclipse is a de-facto standard for tool chain environments and there are a huge number of open source tools which are available within Eclipse.
- Other major standards for automotive software and automotive software development are supported, too.
- Tool vendors can easily adapt their tools to make them usable in the AMALTHEA tool chain environment, even if they are not provided as open source.

The AMALTHEA project was executed as a joint European undertaking within the ITEA programme[6] from 2012-2014. The project provided the first release of the tool chain, a selection of open source tools (allowing the development of complete multicore applications) and some use cases.

[5] http://www.eclipse.org
[6] https://itea3.org/

Within the AMALTHEA4public[7] project (2014-2017) the consortium aims on adding new functionality and tools. Apart from that, a major goal is to make to AMALTHEA tool chain available to the user. For this purpose, a design handbook, tutorials and how-to-documents are provided. The project will be integrated into the Eclipse maintenance, release and support system. Additional use cases will be elaborated and provided as examples. It is planned to build a teaching pack for training and education. The project is including (within the team or within the advisory group) major automotive companies like Bosch (as project leader), AVL, BHTC, EPC, VW, Volvo and in addition a strong group of tool vendors, consulting companies and embedded system developers. It involves consortia from Germany, Spain, Finland, Sweden and Turkey. Several universities and research institutes are project members and to provide latest research results and technology.

Automotive Software Projects

The AMALTHEA methodology (and tool chain) for automotive software development follows the recent standards and processes in the industry. Suppliers of automotive software have to guarantee compliance to standards like Automotive SPICE[8], TS16949[9], safety standards like ISO-26262/IEC61508 (ISO 26262-1:2011(en), 2011) and others. Furthermore, their software development methodology including the tools is audited and certified by both customers and certification bodies. A standardized tooling with a guaranteed quality and a long time support make auditing and certification much easier. The software development methodology is dependent on the overall development methodology for the automotive system. The dominant patterns are derived from the V model (INOCSE: INCOSE Systems Engineering Handbook, 2011) approach. Nevertheless, software developers prefer more agile processes (Beck, K.; et al., 2001) and therefore, the methodology is adapted to support fast iterations of the development cycle and continuous (or at least frequent) integration of results and artefacts into the complete software system.

Typical large automotive software projects involve 10-100 engineers in several teams and in some cases even in several location or from several companies. They last for 1-2 years and produce hundreds of thousands lines of code, hundreds of requirements and tests and more than 100 man years of engineering work. Each project has a certain degree of innovation and therefore, methodology and tools are adapted from one project to the next. Due to new requirements and standards, new tools are needed and the most advanced best-in-class-tools are applied. This complex and dynamic setup requires a lot of flexibility and adaptability. In addition, methodology and tools for handling the complexity (e.g. for change request management, configuration management, requirements and test management) are urgently required. Setting up the methodology, collecting a first set of requirements, determining the project size and complexity and coming to a first approach for the solution architecture is the core part of the so-called “early phase of the design” (Figure 1). The following phase is mainly refining the methodology, the tooling and the results in an as much as possible flexible and fast iterative process. Therefore, selecting and tailoring the tool chain is usually done in the early

[7] https://itea3.org/project/amalthea4public.html
[8] http://www.automotivespice.com/
[9] http://www.iso.org/iso/catalogue_detail?csnumber=52844

phase together with the project setup. Nevertheless, it needs to be adaptable if decisions turn out to be wrong or requirements are estimated wrongly.

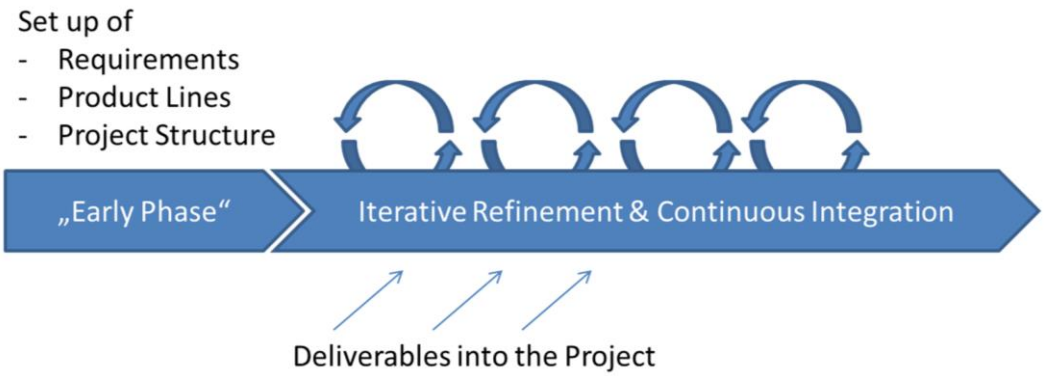


Fig. 1. **Typical automotive software development process**

A major challenge in such projects is to maintain correctness and consistency of the artefacts. If for example a requirement changes, many development artefacts have to be changed accordingly and many tests have to be repeated (and modified). If it turns out that a feature cannot be implemented, consequently a requirement cannot be fulfilled. These cause-and-effect chains have to be traceable throughout the developed artefacts and the various development steps. Traceability needs to be supported by the tools, the respective trace and change processes need to be automated.

The AMALTHEA design flow (Figure 2) supports these requirements by iterating a number of steps until the expected software quality is achieved and a new software version can be released:

- *Requirements* are collected and described in a structured way to make it easy to derive product features, tests and dependencies amongst the requirements.
- Based on the requirements the different *variants of the final product* and there dependencies are defined. This is important since complex automotive systems are delivered in a high number of variants. It is inefficient and error prone to develop each variant separately. The methodology applied to this problem is *product line management* (see below).
- The *architecture of the software system* is defined, e.g. according to the AUTOSAR standard which is currently the dominant approach to standardize the architecture of automotive applications.
- After these steps of structuring the project, the intended functionality of the software is modeled by describing the *behavior of the different software components*. In this step, the functionality according to the requirements is implemented into software components. These components can be verified and simulated to prove there correctness.
- Based on the product line concept the defined functionality is assembled into certain packages according to the software architecture und the variant definition. This is the *variant configuration* step.

- In the following steps, the software components are combined to tasks (or runnables) and these parts are put together to largely independent *partitions*. This step is required to be able to distribute the software to the cores of a multicore electronic control unit (ECU) or even to different ECUs. The software partitions are then *mapped* on the different hardware resources and program *code is generated* from the models by applying automatic code generators. *Timing traces* are used to verify the correct behavior of the software system.

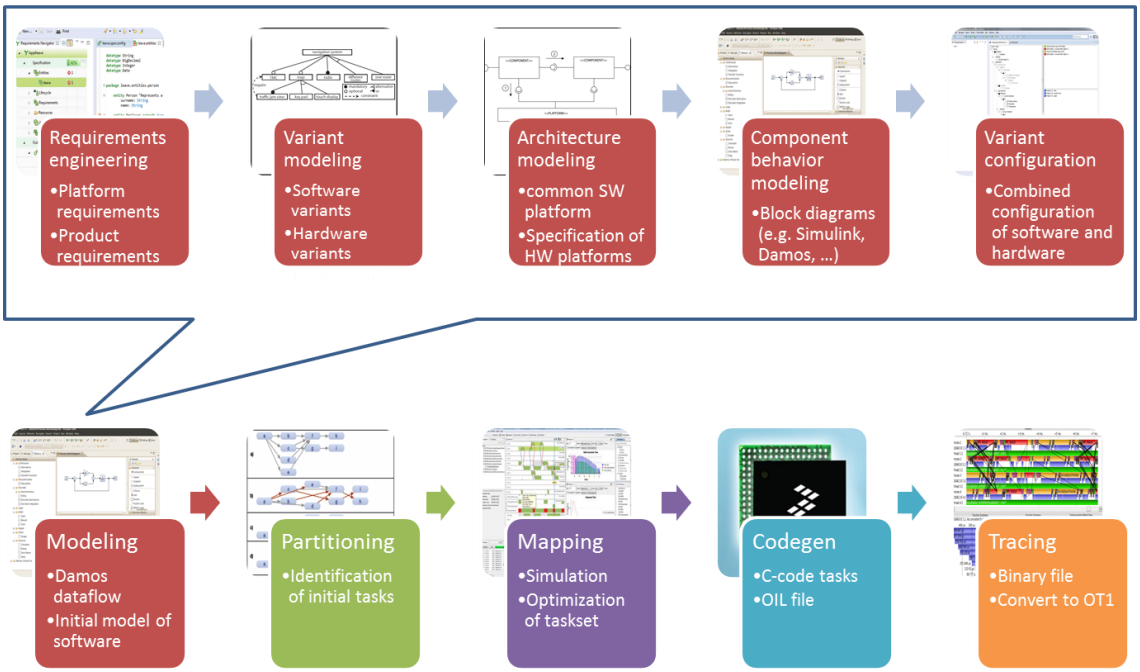


Fig. 2. **AMALTHEA Modeling Process**

Supply chains in the automotive industry (Ro, Y.K.; Liker, J.K. and Fixson, S.K, 200., Veloso, F. and Kumar, R, 2001) are divided into several tiers. Starting with the car makers (OEMs), each tier consists of different suppliers, which produce a product or a module for the tier above (Figure 3). Thereby, the products can consist of different artifacts like software components, hardware, mechanical parts or a combination of them. These artifacts need to be exchanged between suppliers and the OEM, which can be very complicated process, especially if the manufacturers use different tools and there is a need for traceability. After that step, the modules or products are combined to a new product. Each supplier may produce similar products for different OEMs or other suppliers so that it is beneficial to develop a *product line* for such products. Product lines (Clements, P. and Northrop, L., 2001) are a set of products or systems sharing a common set of features. Through the selection of variants, different products can be built out of the product line.

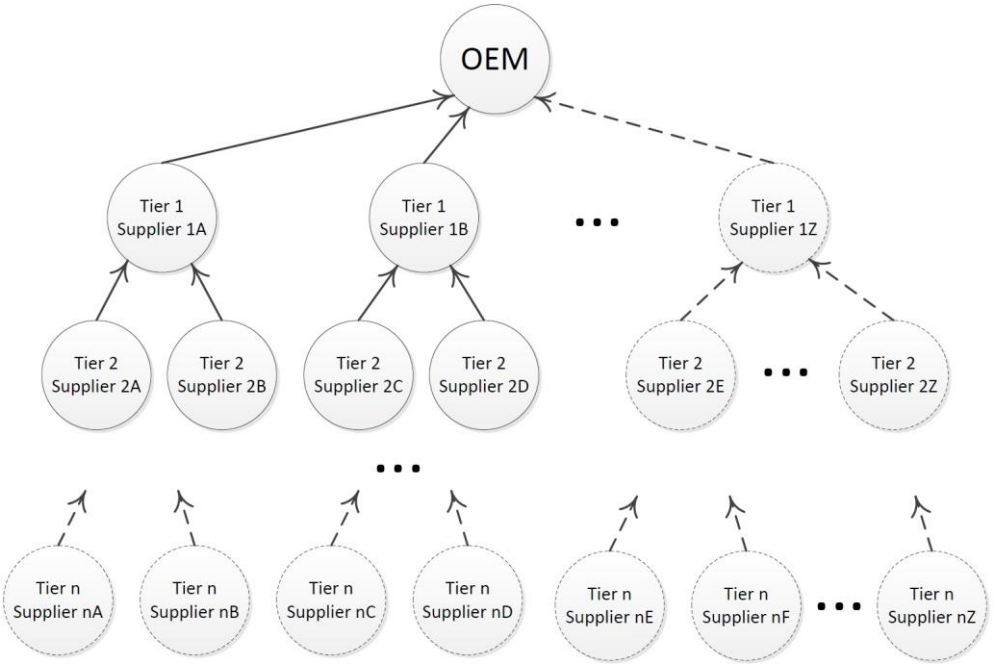


Fig. 3. **Automotive Supply Chain**

Building such product lines (also called product family) in the automotive industry requires three essential activities (Figure 4).



Fig. 4. **Essential Product Line Activities**



Fig. 5. **Core Asset Development**

Source: Clements, P. and Northrop, L., 2001

First, the platform also called core assets has to be developed, which contains all common parts of the product line. Therefore, different inputs need to be considered in order to develop the core assets as well as a production plan (Figure 5). The second activity is the product development, which use the output of the first activity for building individual products.

Furthermore, the requirements for the individual product are an input, which are used to identify necessary adaptations (variants) of the platform. Both activities need to be highly managed through the third.

When setting up a product line three approaches are possible (Krueger, C., 2002):

- *Proactive*
  In the proactive approach, all products and variants are planned and developed in advance, which is like the waterfall approach to conventional software.
- *Reactive*
  The development of the product line starts with a few variants and is extended incrementally (more or less as in a extreme programming approach).
- *Extractive*
  In the extractive approach, one or more existing products are used to form the bases for the new product line.

In AMALTHEA, we integrate the product line development including all three approaches into development process considering aspects of the automotive domain. Furthermore, it is possible to use this process without building a product line, allowing also smaller companies outside the automotive industry to use the AMALTHEA approach. To enable the development of variable systems (product lines), it is necessary to integrate them into the development process (Figure 2). To add the aforementioned support to the existing development processes, we extended the process by introducing further steps regarding variant development. Because of the nature of a product line, the whole process consists of two fundamental steps, the development process and the configuration process. While the development process includes steps to identify requirements and to develop the product line including the required features, the configuration process includes the product generation based on a customer's needs.

If a product lines feature or a configuration changes – same as if a requirement changes – the software components (and in some cases the software architecture) has to be changed to reflect the changed functionality. Accordingly, tests have to be changed and possibly the partitioning and mapping need to be adapted. Some changes even result into a changed target hardware platform. Such changes happen frequently during a software development project. Especially late changes demanded by the customer are a problem. A continuous tool chain is generating the different development artefacts automatically from the basic models and requirements, if configured correctly. This turns implementing changes into triggering automated modification processes. Such an approach is much more reliable than doing all required changes manually and is much faster and efficient. It is the underlying principle of model driven engineering (MDE) which is the principle of the Eclipse Modeling Framework (EMF)[10]. A prerequisite for generating new artefacts from changes in requirements of product lines is the traceability of features and requirements throughout the models and tools. The tools need to know which artefacts are affected by a change and need to be generated again. AMALTHEA provides traceability due to the common and standardized model repository used by all tools.

[10] http://www.eclipse.org/modeling/emf/

Setting up complex project environments based on the AMALTHEA work flow

Based on the AMALTHEA development methodology, the following steps are recommended for the early phase of a software development. This is basically a guideline for a structured setup and preparation of the project based on the assumption that the project will have a certain complexity and wants to solve it by using the AMALTHEA tool chain environment. Of course, this first setup is expected to change while executing the project. AMALTHEA offers the flexibility to do this by iterating the following steps:

- The first step is to describe and *define the development problem*. This definition contains what needs to be developed in which complexity. It is a prerequisite for a proper project assignment. The description of the development problem (or the clarification of the project charter) is not at all a trivial problem. For technical projects, there is certain methodology, e.g. CONSENS (Gausemeier, J.; Frank, U.; Donoth, J.; Kahl, S, 2009). Defining the structure of the product and of the environment in a very generic way is a method for structuring the project assignment. It is required to handle the complexity.
- Following this creative work of clarifying the actual task and scope of the development project, the project assignment or project charter can be derived. Based on that the *development tasks (work break down)* are defined. For this purpose, a basic set of customer requirements has to be available.
- As the next step, the general decision whether one single product or a whole product line will be developed can be taken. This is the basis for *setting up the product line engineering*.
- A further task is to select the partners (internal & external) for the development team. The partners or team members *form a value chain* adding the intended value to the software development project according to the design flow (Figure 2). This can be a company internal value chain or a "real" value chain of companies. This value chain has a joint interest into the project success and wants to cooperate. The methodology and tooling has to make sure, that the value chain is easy to form, that it is easy for partners to join (even in later project phases) and that it offers the flexibility to change and adapt the value chain. The value chain defines the modus of cooperation between the project team members or project partners.
- To support the cooperation within the value chain, IT tools are needed. The tools *form an information supply chain* (Sun, S.; Yen, J, 2005) providing the value chain members with all the required information. For the formation of the information supply chain it needs to be sorted out who has to get what and who has to deliver what at what time and in which quality. As mentioned, AMALTHEA supports forming the information supply chain by providing a joint repository for all information artefacts and by automating the exchange and modification. One aim for the selection and forming of the information supply chain is a fast setup time and fast learning curve for partners who use the tool chain. Therefore, it needs to be somehow standardized and frequently used by all partners, even if it was previously used in a different configuration. Choosing Eclipse as a basis makes sure that most software developers are already familiar with the look & feel and with basic principles.

- After setting up the tool chain environment and defining the basic design flow, the actual tools are selected and plugged into the tool chain. The main target is to keep the flexibility to select preferred/cheap/best-in-class tools according to the needs and wishes of the partners. Using the preferred tool can raise the acceptance of the joint development approach. The step is later on described as the *tool chain tailoring*.
- The aim of all the preparations and setup work in the early project phase is of course to *produce results*. Due to the automation of the design process, iterations are turned into automated generation steps or even push button activities. This leads to fast turn-around times (TAT) for the iterations and to a more reliable outcome with less manual work. The project is able to re-act to late changes or new features and a fast time-to-market is achieved.

Tool chain tailoring

Process tailoring is proposed to be done according to carefully selected criteria and a well-defined methodology (Silva, M.; Jeronimo, C, 2013). The same applies to tool chain tailoring since the tooling follows the development process.

An important benefit of the AMALTHEA4public platform is the high degree of adaptivity and flexibility due to open interfaces and standardized data formats and structures given in the model-driven design approaches. Companies, suppliers and teams are provided with an expandable framework, to which proprietary processes or tools can be added. It is like a tool box, but one which connects the tools and guides and automates their use.

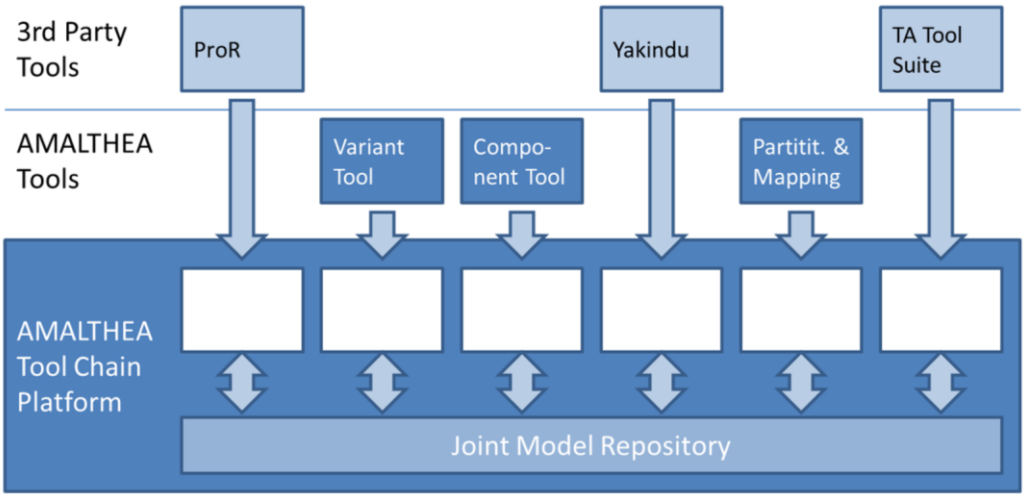


Fig. 6. **Tool chain tailoring with AMALTHEA**

AMALTHEA supports tool chain tailoring with the following technologies:

- It is standardized within Eclipse and therefore based on a popular common framework with a big variety of tools. The usage and philosophy of Eclipse is well known to developers.

- It is open source and the joint model repository and all formats are openly available. Therefore, tool vendors can easily adapt their tools and many tools can be plugged into the tool chain. Furthermore, it is possible to even change the tool chain environment and make it fit to the needs of the project.
- All major interfaces are provided and the most frequently used artefacts are pre-defined within the model framework. Therefore, it is ready-to-use without major adaptations.
- It supports Product Line Engineering, Traceability and Tool Chain Automation which are the dominant prerequisites for efficient model driven engineering.

Conclusions

Complex automotive software developments are not executable in an efficient and effective way with off-the-shelf methodology and tooling. Innovation and product life cycles are too fast to stick to one fixed approach for a long time. Each project is different and methodology and tools need to be tailored to the requirements to achieve excellent results. Furthermore, the partners within a project consortium form a complex cross-company and cross-domain value chain which requires the support of a similarly complex information supply chain. It is the believe of the AMALTHEA consortium that these requirements can only be fulfilled if the industry moves towards open standards and if the basic functionality of the information supply chain is provided by open source software. The Eclipse project is the consequent implementation of this approach and AMALTHEA has the aim to bring this approach into the automotive industry.

With excellent methodology and tool support, cars will be turned into software intensive or even software defined products. This trend is a major challenge for the European industry, but also a major chance to become the dominant player in one of the largest application fields of software and IT in the future.

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Bibliography

Venkatesh Prasad, K., Broy, M. and Krueger, I., 2010. Scanning advances in aerospace & automobile software technology, Proceedings of the IEEE, Vol. 98, No. 4, pp. 510-514.

Brink, C., Kamsties, E., Peters, M. and Sachweh, S., 2014. On Hardware Variability and the Relation to Software Variability, 40th Euromicro Conference on Software Engineering and Advanced Applications, Verona, Italy.

Brink, C. und Jatzkowski, J., 2014. EU-Forschungsprojekt AMALTHEA: Entwicklung einer open-source Entwicklungsplattform, erweiterbar durch die Community. SafeTRANS News, (1): pp. 12-13.

Fruhner, D., Höttger, R., Köpfer, S. and Krawczyk, L., 2014. Partitioning and Mapping for Embedded Multicore System Utilization in Context of the Model Based Open Source Development Environment Platform AMALTHEA, International Research Conference, Dortmund.

Ro, Y.K., Liker, J.K. and Fixson, S.K., 2007. Modularity as a Strategy for Supply Chain Coordination: The Case of U.S. Auto, Engineering Management, IEEE Transactions on, Vol. 54, No. 1, pp. 172; 189, Feb. 2007.doi: 10.1109/TEM.2006.889075.

Veloso, F. and Kumar, R., 2002. The Automotive Supply Chain: Global Trends and Asian Perspectives, Massachusetts Institute of Technology – Working Paper, URL: http://repository.cmu. edu/epp/134/.

Clements, P. and Northrop, L., 2001. Software Product Lines: Practices and Patterns. Addison-Wesley Professional.

Krueger, C., 2002. Eliminating the adoption barrier, Software, IEEE, July-Aug. 2002, Vol. 19, No. 4, pp. 29, 31, doi: 10.1109/MS.2002.1020284.

Kang, K. C., 1990. Feature-Oriented Domain Analysis (FODA) Feasibility Study. CMU/SEI-90-TR-021. [Technical Report]. Pittsburgh, Pennsylvania: Software Engineering Institute, Carnegie Mellon University, November 1990.

Apel, S. and Kästner, C. 2009. An overview of feature-oriented software development. Journal of Object Technology.

Czarnecki, K., Helsen, S. and Eisenecker, U., 2004. Staged Configuration Through Specialization and Multi-Level Configuration of Feature Models. In Third International Software Product Line Conference.

Czarnecki, K., Bednasch, T., Unger, P. and Eisenecker U., 2002. Generative Programming for Embedded Software: An Industrial Experience Report. Technical report.

Czarnecki, K., Hwan, C. and Kim, P. 2005. Cardinality-Based Feature Modeling and Constraints: A Progress Report. Technical report.

Benavides, D. and Segura, S., 2010. Automated analysis of feature models 20 years later: A literature review. Information Systems.

Silva, M., Jeronimo, C., 2013. From Taylor to Tailoring – In Pursuit of the Organizational Fit, Proceedings of the Second International Scientific Conference on Project Management in the Baltic Countries, Riga, University of Latvia.

Sun, S., Yen, J., 2005. Information Supply Chain: A Unified Framework for Information-Sharing, P. Kantor et al. (Eds.): ISI 2005, LNCS 3495, pp. 422-428.

INOCSE, 2011. INCOSE Systems Engineering Handbook v. 3.2.2, INCOSE-TP-2003-002-03.2.2.

Gausemeier, J., Frank, U., Donoth, J.; Kahl, S., 2009. Specification technique for the description of self-optimizing mechatronic systems. Res Eng Design (2009), 20: pp. 201-223, DOI 10.1007/s00163-008-0058-x, Springer, 2009.

Beck, K., et al., 2001. "Manifesto for Agile Software Development". Agile Alliance, 2010.

ISO 26262-1:2011(en) Road vehicles – Functional safety: Guideline on ISO 26262. International Standardization Organization, 2011.

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CAPITAL STRUCTURE AND FINANCIAL CONTROL: THE EFFECT OF LEVERAGE ON PROJECT MANAGEMENT

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Abstract

Amplification characteristics are leveraging financial system which has a small risk of capability. However, the efficiency of this ability is two-ways results and will also pose a lot of risks. Therefore, taking positive measures to strengthen the management of the financial system leverage feature in project management becomes very important. This paper describes the financial system leverage to bring the main problem and to turn the lever amplification (nature) analysis of the characteristics, bi-amplified comparative analysis of profit and loss, bi-amplification characteristics of the risk analysis. Based on the above analysis, we put forward countermeasures about the management of leverage properties of financial system from the application of project management.

Key words: *Financial System; Project Management; Leverage Characteristic; Leverage Category Management*

JEL code: G1

Introduction

Contemporary evolution of the financial system in the outstanding performance, that first developed rapidly, is mixed. This is largely due to its real economic leverage amplification characteristics. It is the leverage performance of the financial system, so it has a small risk of capacity, particularly under the effect of high leverage efforts that people often anticipate. Two financial derivatives, for example, under ordinary circumstances investors only need to pay a small deposit that can carry a huge amount of the transaction. On one hand, it can make the money work more efficiently in project management and avoid risks to achieve hedge of gaining huge profit. On the other hand, the financial derivative transactions or probability also contain a huge risk of losing occurs when the amount loss is correspondingly expanded several times, and its ripple effect will be spread like dominoes away, and it will be difficult to contain it. One of the reasons of the global financial crisis is that five largest investment banks of U.S annihilated in the same time.

Financial system leverage amplification in the application of project management (characteristics) is possible in two ways, because it more often becomes a "double-edged weapon". On the one hand, it promotes the efficient operation of financial markets; on the other

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hand, it brings high leverage effect which is also exacerbating the financial market fluctuations. Thus endeavor is to take positive measures to strengthen the leverage characteristics and quantitative indicators of project management. It became very important nowadays.

1. Financial System Leverage Types and Quantitative Indicators

Financial system of the real economy leverage amplification characteristics of a variety of different forms. In coordination with the role of different areas, it can be classified as the capital in nature and the nature of the transaction leverage. Corresponded quantitative indicators can be divided into capital-leverage and transactional leverage. The main capital gearing types are: risk-sensitive leverage ratio – capital adequacy, and risk-insensitive leverage ratio – (financial) leverage. General capital adequacy ratio is defined as total capital divided by total risk-weighted assets ratio. Also, associated with the capital adequacy ratio and core capital adequacy ratio, namely, the core capital is divided by total risk-weighted assets ratio. According to the China Banking Regulatory Commission requirements (financial), leverage ratio refers to commercial banks to hold, in line with the relevant provisions of a capital with assets ratio's adjusted balance sheets of commercial banks. By comparison with it, we can see that the main difference between these two gearing types lies in the denominator, and the former is based on the risk-weighted assets, while the latter is based on the total assets.

Trading with the main types of leverage margin (ratio) and premiums (rates) plays the main role in a variety of credit guarantee transaction process and is widespread in spot trade, futures trading and options trading. The latter point in a variety of transaction process will be the decision-making right in the future, which will give opportunity to choose the right to determine the point in the delayed time, as well as the beneficial or contingent event, instead of pointing to the subject matter of the transaction itself.

By the U.S. sub-priming mortgage, crisis, triggered by the global financial crisis, has exposed a variety of financial institutions and financial derivatives excessive accumulation of leverage after the negative effects, promoting people to leverage the ability of the financial system (characteristics) of the regulation for reflection. December 2010 by release of Basel Ⅲ, it has raised previous Basel capital adequacy requirements; June 2011 it has introduced a pair of systemically important bank's supplementary capital ratio requirements. And in 2012 the country began to implement "commercial bank's capital management approach". It is more than a series of Basel Ⅲ capital requirements are more stringent (see Table 1) so far.

Table 1

Minimum Capital Requirements Banks Abroad

Domestic and International Regulations	Minimum Capital Adequacy Requirements		
	Core Tier One Capital	First Grade Capital	Total Capital
Basel Ⅲ	4.5%	6%	8%
China Banking 2012	5%	6%	8%

Source: BCBS (2010a), China Banking collate relevant information

At the same time, in order to control the leverage effect (characteristics) to excessive accumulation of the banking sector to avoid future when the deleveraging on the entire financial system and the real economy, resulting in greater impact, Basel Ⅲ also explicitly provides the leverage lower limit requirements (as ≥ 3%), while China is also higher than the corresponding provisions of this rigorous (as ≥ 4%). Basel Ⅲ required the calculation of the leverage ratio, the bank's risk exposure estimates include both sheet items (such as derivatives trading, etc.), but also include off-balance sheet items (such as loan commitments, direct credit substitute, etc.). In the New Basel capital framework agreements established under the capital adequacy ratio and leveraged the synergy of modern banking regulation that became effective control characteristics of the main means of leverage.

2. The Main Problems of Financial Leverage System

2.1. Strengthening the Financial System to the Real Economy Reaction Ability

Leverage which has been made over the years is based on the rapid development of the project management; moreover, more than the speed of the development of the project management itself. It makes the size between the two top-heavy "layers" of "inverted pyramid" one of the consequences. This consequences lead to the frequent grows and falls. The financial system in a bull market has all kinds of asset value, causing liquidity; once the financial system is in a bear market, all kinds of assets impairment, causing liquidity crunch.

2.2. "Bidirectional Amplification" Lever Characteristics of Coexisting Advantages and Disadvantages

In the financial system of the trading, profit and one of the main reasons are that often there is a high leverage, not only derived type is commonly used while trading, recent years foundation type deal is also widely used. Ability to leverage amplification (features) of the financial system is one of its characteristics and is also one of the "\advantages\". The problem is that this kind of amplification ability (features) is a two-way street, which can not only enlarge profit, but also magnify the loss, even if very large financial institutions will continue being because of a department or because of business's local loss, which will be caused by integrity. Such financial leverage as Lehman brothers, which's rate grew up in the first quarter of 2008 in 31.7 times, make sub-prime securities losses small changes later led to a net worth of losses, eventually became "\the last straw breaks the camel's\".

2.3. The Superposition of Multiple Combinations of Making the Nature of Leverage (features)

The financial system of the trading tools combined with derivative will greatly change the lever of original features and make it even harder to identify and measure the risk of future. ARM and contain the subprime MBS, for example, the original form is relatively simple that will help us to safe mortgages and mortgage-backed securities. But the commercial Banks, in order to revitalize the capital investment bank, will expand business scale. The institutional investors, which are seeking for higher returns, will jointly contribute to the CDOs

(collateralized debt obligations (CDO), CDOs and a series of multiple packaging of derivatives, for expanding the influence of subprime mortgages, which are spreading over. It can effectively reduce the risk of products and, as a result, spread into specific risk and magnify systemic risk products.

2.4. The Main Problems of the System (Only Leading to Moving Back and Forth Not Reducing the Risk)

The modern financial system is independent from the real economy running trend, which is becoming more and more obvious. Pursuing of tools leverage efficiency and industry scale makes its trading operation from general enterprises, organizations, and makes retail investors to give priority to institutional investors. In addition to hedge funds, mutual funds and pension funds, the issue of MBS policy is based on financial institutions such as Fannie Mae and Freddie MAC, CDOs, an investment bank, management of the CDS (credit default swaps) insurance company (AIG), even the original mortgage selling assets of commercial Banks has become kind of financial instruments, especially the huge derivative securities holders. It shows more and more independence of entity economy of the project management, more and more large-scale financial business, mainly in the various financial institutions between inside trading and follow later transfer process, rather than risk foreign dispersion process in the true sense.

3. Financial System Ability of Leveraging of the Amplification (Analysis of the Characteristics)

Leveraging "characteristics of the financial system (nature)" is mainly done through the financial tools between the "copy" and the substitute for each other; this is also enhancing the efficiency of the financial system, which is one of the main ways to reduce the transaction costs. Financial instruments and their replication are intermediate tools, alternative tools while you can do it with the same cash flow, but their implicit yields and risk characteristics are not always the same. For example, you can buy a unit stock call option and put option to sell a unit stock copy the stock of cash flow, the call option and put option with the same S, maturity T and the asset price X European option, as is shown in figure 1. We always say call option and put option c and p for short, the price of the tectonic replicate stock cost is c – p. In the options of maturity T, the value of the replica VT is value call option and put option value, the difference between the namely

$$V_T = \max(0, S_T - X) - \max(0, X - S_T).$$

If due date ST stock price is greater than the strike price X, then call option value is ST – X, put option value is zero; If the ST is less than X, the call option value is zero, the put option value is X – ST. Therefore, no matter how the future stock price changes, copy of the stock in this combination in the value of the option maturity date is always | ST – X |. If only considering replicate stock structure cost without considering the time value of money, then the replication tool at the end of profit and loss is:

$$\text{Max}(0, ST - X) - \text{Max}(0, X - ST) - (c - p) = ST - X - c + p.$$

The principal amount of the same circumstances, the financial system in spot trading, futures trading, and options trading yield difference are consisted now of three ways, from the

perspective of the nature of the leveraged financial system to do the corresponding comparison, as shown in the table 2 and table 3. Thus it can be seen that when using different financial instruments traded, because of their leverage performance difference, net profit or loss brought by the difference is huge, also its risk can also be completely different.

Table 2

When prices rise 10%, the financial system of leveraging features

The Type of Transaction	Capital	Leveraged Nature	The Price Rise in Net Profit or Loss	Yield Rate
Spot Transactions	100	1:1	110-100=10	10%
Future Transactions	100	Cash Deposit 10%	(110-100)×10=100	100%
The Option Combinations	100	The Total Cost 1%	(110-100-1)×100=900	900%

Source: authors' construction

Table 3

When prices have felt by 10%, financial system leverage amplification characteristics shows

The Type of Transaction	Capital	Leveraged Nature	The Price Rise in Net Profit or Loss	Yield Rate
Spot Transactions	100	1:1	90-100=-10	-10%
Future Transactions	100	Cash Deposit 10%	(90-100)×10=-100	-100%
The Option Combinations	100	The Total Cost 1%	(90-100-1)×100=-1100	-1100%

Source: authors' construction

4. Financial System and Contrast Analysis of the Bidirectional Amplification

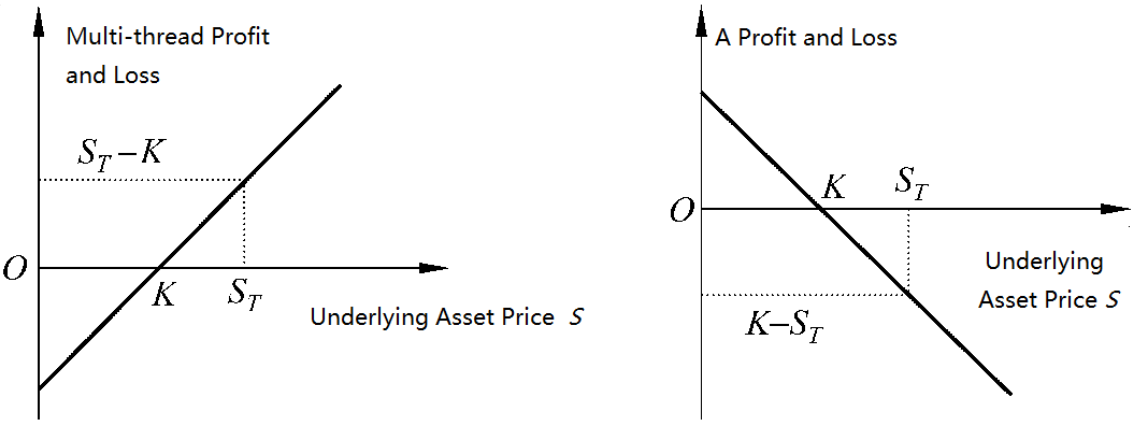
Financial system of contract type can be divided into two major categories of symmetric and asymmetric agreement: contract revenue – risk of distribution is also varied with the type of different one. Basic financial products and forward derivatives (including forwards, futures, swaps) contracts are symmetric. If a T for the session (maturity date), the asset of mark ST (maturity date) to the market price of the trading day, K for the agreed price, delivery, long profit or loss, which the buyer gains and losses, short of symmetric contracts and losses of the seller's profit and loss as shown in figure 2 (a), (b), and lists of their profit upper limit and lower limit losses.

When $S_T > K$, Symmetric long contract value: $V = S_T - K > 0$.
Symmetric contracts bulls and losses of the profit limit: $V_{max} \rightarrow +\infty$.

When $K > S_T$, Symmetric long contract value: $V = K - S_T > 0$.
Symmetrical short contracts and losses of the maximum profit: $V_{max} = K$.

When S<K, Symmetric long contract value: $V=S_T-K<0$.
Symmetric contract bull losses and losses of the lower limit: $V_{min}=-K$.

When K<S_T, Symmetric long contract value: $V=K-S_T<0$.
Symmetrical short contracts and losses of the loss limit: $V_{min}\rightarrow-\infty$.



(a) Symmetric Long Profit and Loss of Contracts **(b) Symmetry Short Profit and Loss of Contracts**

Source: authors' construction

Fig. 1. **Symmetric Contracts of the Long and Short of Comparative Analysis**

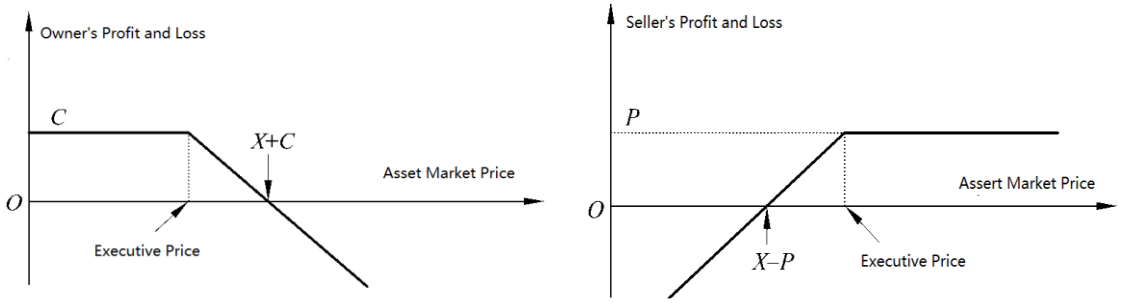
For asymmetric contracts – short of options contracts short call option and put option value, respectively as shown in figure 4 (a), (b), and lists the respective profit upper limit and lower limit losses.

When S_T>X, short call option value: $V=X-S_T+c$.
When X>S_T, short put option value: $V=S_T-X+p$.

Short call options and losses of the loss limit: $V_{min}\rightarrow-\infty$.
Short put option increase and decrease loss limit: $V_{min}=-X+p$.

When S_T<X, short call option value: $V=c$.
When X<S_T, short put option value: $V=p$.

Short call options and losses of the maximum profit: $V_{max}=c$.
Short put option and losses of the maximum profit: $V_{max}=p$.



(a) Short of Profit and Loss of the Call **(b) Short Put Option of the Profits and Losses**

Source: authors' construction

Fig. 2. **Options Contract's Short Comparative Analysis**

5. Financial System of the Bidirectional Amplification Characteristics of Risk Analysis in Projects

Through the above comparison and analysis of profit and loss of the financial system we can see that very different contracts can be found, under the condition of transaction costs to be ignored, the financial system of all kinds of trades is a zero-sum game; If it is included in the transaction costs, many of the financial system can even became a "negative and game". When the direction of the transaction itself change the "empty" replacement, it is not only benefit/risk reversal, and its earnings/risk limit will be completely reversed .The properties of the resulting risk of sudden would be very great. In the previous financial crisis it had such instance.

Table 4

Long and Short Profit Maximum of Limit

Contract Type	Long Profit Upper Limit	Short Profit Upper Limit
Forward Contracts	$V_{max} \rightarrow +\infty$	$V_{max} = K$
Futures Contract	$V_{max} \rightarrow +\infty$	$V_{max} = K$
Swap Contract	$V_{max} \rightarrow +\infty$	$V_{max} = K$
Call Option	$V_{max} \rightarrow +\infty$	$V_{max} = c$
Put Options	$V_{max} = X - p$	$V_{max} = p$

Source: authors' construction

For long-short, both sides of the financial system faced the risk by the nature of the differences that can be controlled by table 4, table's 5 loss limit comparison to contrast (in derivative contracts, for example). Among them, the standardization of futures trading can be the regard as the forward transactions. For swaps, according to the habit of swap market, will be

paid by a fixed interest rate, the party in a floating interest rate as a "buy" interchangeably, for long; will pay a floating interest rate, the party in a fixed rate as a "sell" interchangeably, for short. Agreed delivery price for K fixed interest rate, maturity date to the market price of ST for a floating interest rate.

Table 5

Long and Short Loss Maximum of Limit

Contract Type	Long Loss Maximum	Short Loss Maximum
Forward Contracts	$V_{min}=-K$	$V_{min}\rightarrow-\infty$
Futures Contract	$V_{min}=-K$	$V_{min}\rightarrow-\infty$
Swap Contract	$V_{min}=-K$	$V_{min}\rightarrow-\infty$
Call Option	$V_{min}=-c$	$V_{min}\rightarrow-\infty$
Put Options	$V_{min}=-p$	$V_{min}=-X+p$

Source: authors' construction

In the table we can see the limit of the profit and loss formula for many derivative transactions, the profit is mostly on the "cap" (+ up), losses "is always a bottom" ($-K$, $-c$, $-p$). But for short, is profitable "always limited" (K, c, p), losses are mostly (up) is not guaranteed. Thus the risk of "short" than "long", if it is a cross trade, the risk will be bigger.

Conclusion

To sum up, the financial system that has two-way leverage amplification characteristics and is based on the project has a huge backlash. The levers of different natures and leverage amplification characteristics of high and low will affect the stability of the financial system and the size of the risk. To this it can be modelled on the effective method of five-classification management of credit assets category, the financial system of the lever also features five classification management, including five classification management's internal operations and the department in charge of five classification regulation external category. In anticipation for the function is different, in the field of the nature of the capital property of leverage and trading in leveraged respectively various levels of the lower limit and upper limit (the following quantitative indicators β levels corresponding to the Basel agreement, due to the limit of length, its specific measurements published article). Capital leverage of the quantitative indicators can select sensitive to risk ratio – the ratio of capital adequacy ratio, is not sensitive to the risk type – (financial) leverage two; Trading leveraged quantitative indicators can be selected for the security deposit (rate) or royalties (rate).

The first is in the "normal" state of the financial system institution or trading process. Institutions of capital adequacy ratio have to reach 10% or higher level, the leverage ratio have to reach 4% or higher level; Margin trading process (rate) have to reach 12% or higher level. For the system of financial institutions in the class of "normal" or trading process, regulators through routine statistics and collect information, to master the general situation.

The second is in a state of "attention" of the financial system or process. Institutions of capital adequacy ratio have to reach 8-10% or higher level, the leverage ratio have to reach 3-4% or higher level; Margin trading process (rate) have to reach 8-12% or higher level. For the system of financial institutions in the class of "attention" or trading process, except through the regulatory department's statistics summary related tables outside the area, in which the financial institutions should also require mark-to-market calculating the exposure.

The third class is in a state of "high concern" financial institutions or trading process. Institutions of capital adequacy ratio have to reach 6-8% or higher level, the leverage ratio have to reach 2-3% or higher level; Margin trading process (rate) have to reach 5-8% or higher level. For the system of financial institutions in the class of "attention" or trading process regulatory authorities have to require financial institutions to the related credit risk, market risk, operation risk of comprehensive management, and submit the data classification, the different trades for purpose, to set up a different account between "firewall", and submit the regulatory risk on a regular basis.

The fourth class is in a state of "limit" of the financial system institution or trading process. Institutions of capital adequacy ratio have to reach 4-6% or higher level, the leverage ratio have to reach 1-2% or higher level; Margin trading process (rate) have to reach 2-5% or higher level. For the "restriction" system of financial institutions or transaction, leverage effect significantly, regulators have to take exception to regulatory way and to set up a targeted leverage multiple threshold limit value. As a result, the value net of a delivery will be limited by qualified investors.

The fifth class is in a state of "no" financial institutions or trading process. When Institutions of Capital Adequacy Ratio is < 4%, leverage ratio is < 1%; Margin trading process (rate) is only 2%. For the "prohibition" of the class system of financial institutions or transaction process, due to the high leverage, obviously with a bet. Such risks beyond current regulatory ability, once the market reverse move, not only make the individual institutions in trouble, and will also spill over to other institutions, so besides a few in the middle, which must be banned. Etc. If we will have a better understanding to this problem in the future, we could open appropriate again, but only after we introduce more effective means of regulation in project management.

Bibliography

Alexandridis A.K, Zapranis A.D., 2014. 9. Modeling Financial Wind Derivatives [J]. Wavelet Neural Networks: With Applications in Financial Engineering, Chaos, and Classification.

Beder T, Marshall C M, Bernard L., 2012. Appendix A: It Tools for Financial Asset Management and Engineering [J]. Financial Engineering: The Evolution of a Profession.

Brigham E.F., Tapley T.C., 1985. Financial Leverage and Use of the Net Present Value Investment Criterion: A Reexamination [J]. Financial Management (1972), 14(2), pp. 48-52.

Byoun S., Kim J., Yoo S.S., 2013. Risk Management with Leverage: Evidence from Project Finance [J]. Journal of Financial and Quantitative Analysis, 48(2), pp. 549-577.

Casas C.A., Casas C.A., 2012. Parallelization of artificial neural network training algorithms: A financial forecasting application [J]. 2012 IEEE Conference on Computational Intelligence For Financial Engineering & Economics (CIFER), 430, pp. 337-342.

Chatterjee R., 2014. Practical methods of financial engineering and risk management: tools for modern financial professionals. Quantitative finance series.

Hua-ping Z., Suo-di Z., Ying-dong J., 2014. Analysis on Talent Training Mode for Engineering Management Specialty in Financial and Economic Universities [J]. Journal of Higher Education Finance.

Jianyun G., 2004. On financial management in road maintenance engineering [J]. Shanxi Architecture.

Jugdev K., Mathur G., 2012. Classifying Project Management Resources By Complexity And Leverage [J]. International Journal of Managing Projects in Business, 2012, (1).

Laux C., Loranth G., Morrison A.D., 2014. The Adverse Effect of Internal Control on Governance and Leverage [J]. Social Science Electronic Publishing.

Ling-fang W., 2012. Exploration on Financial Management Mechanism in Engineering Supervision Enterprise [J]. Modern Industrial Economy and Informationization.

Ramaprasad A., Prakash A.N., 2003. Emergent project management: how foreign managers can leverage local knowledge [J]. International Journal of Project Management, Vol. 21, pp. 199-205(7).

Wang C., Liu H., Hsieh C., 2014. Rate-sensitive leverage of QoS and QoP for ubiquitous video streaming via buffer-aware feedback control [J]. Multimedia Tools and Applications, 73(2), pp. 737-761.

Xianzhong S, Lijun T., 2010. The Separation of Control Rights and Cash Flow Rights, Leverage and Corporations' Investment[J]. Research on Economics and Management.

Yi L., 2007. Consideration on the Agent-construction System Practice in Engineering Management and Financial Management [J]. Construction Economy.

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