

Vidal, René Victor Valqui; Sørensen, Lene; Holmetoft, U.; Gottfredsen, M.

Working Paper

Assessing the creativity & innovation level of IT companies: The case of Denmark

Economic Analysis Working Papers, No. 2007,9

Provided in Cooperation with:

Economists Association of A Coruña

Suggested Citation: Vidal, René Victor Valqui; Sørensen, Lene; Holmetoft, U.; Gottfredsen, M. (2007) : Assessing the creativity & innovation level of IT companies: The case of Denmark, Economic Analysis Working Papers, No. 2007,9, Colegio de Economistas de A Coruña, A Coruña

This Version is available at:

<https://hdl.handle.net/10419/43392>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Assessing the Creativity & Innovation level of IT companies: The case of Denmark

Vidal, R.V.V. *, Sørensen, L. **, Holmetoft, U. and Gottfredsen, M.

*Informatics and Mathematical Modelling, e-mail: vvv@imm.dtu.dk

**Center for Information and Communication Technologies, e-mail: Lene@cict.dtu.dk
Technical University of Denmark, DK-2800 Lyngby, Denmark

Abstract

Increasingly, the creativity and innovation potentials are becoming key factors for IT companies on an ever growing market. The Danish IT companies appear to have a strong base for competing with the rest of the world however it is clear that the companies have difficulties in managing their innovative potentials. This paper presents results of a research study made of 6 Danish IT companies with differing size. The study has focused on providing a first attempt in evaluating the companies' creative and innovative potentials. The paper illustrates how this problem has been approached using a combination of transparent and qualitative techniques. The paper concludes that creative and innovative potentials can be qualitatively evaluated and that this can be the starting point for the development of a strategy concerning the development of creativity and innovation in a company.

Resumen

Cada vez más, los potenciales de la creatividad y la innovación llegan a ser los factores claves para las Compañías de Tecnología de la Información (IT) en un mercado creciente. Las compañías danesas de IT parecen tener una base fuerte para competir con el resto del mundo aunque poseen dificultades para manejar sus potenciales innovadores. Este trabajo presenta los resultados de un estudio de investigación realizado con 6 compañías danesas de IT de diferente tamaño. El estudio se ha centrado en proporcionar una primera tentativa de evaluación de los potenciales creadores e innovadores de la compañías. El *paper* muestra una aproximación al problema utilizando una combinación de técnicas transparentes y cualitativas. El trabajo llega a la conclusión que los potenciales creadores e innovadores pueden ser evaluados cualitativamente y que esto puede ser el punto de partida para el desarrollo de una estrategia con respecto al desarrollo de la creatividad y la innovación en una compañía.

1. Introduction

During recent years, Information Technology (IT) has grown to become an indispensable part of our everyday. Consumers are constantly being bombarded with new and improved digital solutions to make their everyday easier and more entertaining, where as companies have incorporated IT into their way of doing business and keeping track of competition. Apparently, this only seems to be the tip of the iceberg of the immense opportunities. Pervasive computing is set to be the next big issue to hit the market leading the digital revolution even further with information and communication technology everywhere, for everyone, at all times. Needless to say, surviving in the IT-industry demands a high level of *creativity and innovation*¹ as essential parameters, in order to grow and survive in the hyper competitive market for IT; where traditional boundaries such as time and distance are playing less significant roles. The ability to explore the full boundaries for solutions to a given problem using creativity and bring this to new, useful and value adding innovative solution is therefore a valuable asset which can lead to competitive advantages. Where as large American based companies are often dealt with, only limited literature in the area of creativity and innovation is available covering small and medium sized companies. Since the majority of Danish IT-companies are of this small size, and a recent survey (Oxford research A/S, 2003) has indicated a lack of focus on creativity and innovation in the Danish IT-industry, a demand for an approach to assess the creativity and innovation level in the Danish IT-organisations has become more needed. Knowing the creativity and innovation level within essential areas will provide a basis for designing a framework as a starting point for developing innovation strategies suited for Danish IT-companies.

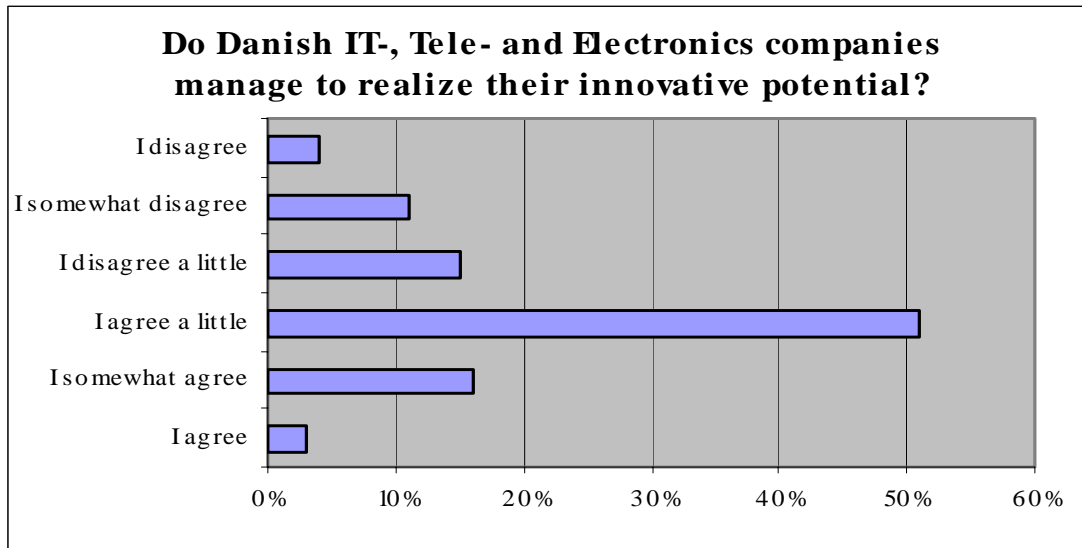
The main purpose of this paper is to present a general approach to assess the creativity and innovation level in IT-firms of the Danish IT-industry. The paper has the following outline. Section 2 presents the background for the study in terms of a factual description of the Danish IT-industry and its current situation. The various tools and methods are described in section 3, covering qualitative approaches such as semi-structured interviews, indicator analysis, spiderwebs, mind maps and a SWOT analysis. In section 4, the results of using the approach will be depicted. A critical evaluation of the results and methods with suggestions for future work are outlined in section 5. Finally the conclusions are presented in section 6. A list describing the key terms in further details, can be found in appendix A.

2. The Danish IT-industry

At a glance the Danish IT-industry seems more than capable of competing in the global market. Creativity and innovation are established terms in Denmark. Moreover, the Danish industry as a whole (primarily made up of small to middle sized companies) can benefit from a highly skilled workforce as a result of what appears to be a well-functioning school system. Focusing exclusively at the Danish IT-industry several points could also indicate that the industry is capable of keeping track of the heavy competition – and even lead the way, being among the best in a number of niches. First and foremost the Danish IT-Industry seems to have recovered from the burst of the dot.com bubble in 2000. Although not at the same rate as in the early nineties, the industry is today constantly growing, money is again being made and the workforce size is steadily increasing. All in all, the Danish IT-industry appears to have a very strong base for competing with the rest of the world. High IT-penetration, high productivity and flexibility and a well functioning public sector as an engine for digitalization, are all strong points that give the Danish IT-industry an advantage compared to the IT-industries of the majority of other countries. The fact that the IT-companies are beginning to cooperate across the IT-sector in order to achieve a strong position in the future market for pervasive computing, could also indicate that creativity and innovation are terms which are taken seriously. However, a more thorough examination of the industry reveals a less positive picture, leaving much to ask in the areas of creativity and innovation as essentials for creating a competitive edge in the fast moving and extremely competitive IT-industry.

¹ Here we define creativity as *a process of developing novel ideas that has a useful potential* and innovation as *the realisation of creativity as a useful, valued added new process, product or service*.

Figure 1: Degree of fulfilment of the innovative potential



The statement “the Danish IT-industry is a poisoned industry without any rules” taken from the magazine *Arbejdsmiljø*, points out that the Danish IT-industry is not as magical and well performing as it seems. In connection to this, Figure 1 illustrates the results of an investigation conducted by Oxford research A/S (2003) within the companies in the Danish IT, Tele- and Electronics association (ITEK). With less than five percent agreeing, and more than fifty percent only agreeing a little to the question of whether Danish IT-, Tele and Electronics companies manage to realize their innovative potential, also stresses that the IT-companies could do much better in order to gain a competitive edge.

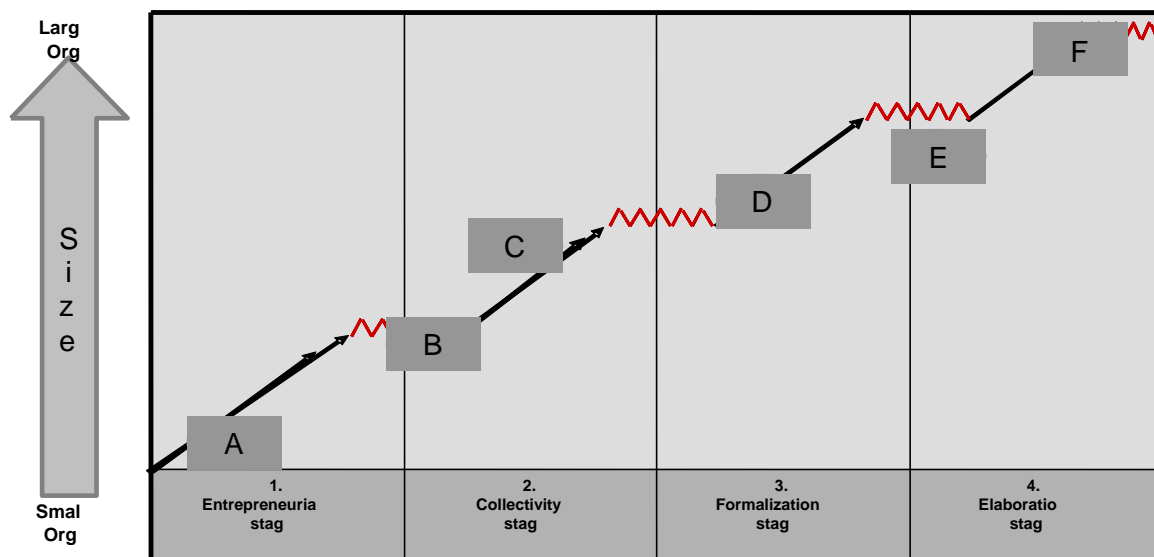
The reason for the poor results is to be found in a number of areas. Especially the area of management and strategy making, which in general lacks the skills; in the areas of staff care and conflict management, fails to support an environment suited for creativity and innovation. However, this is by far the only area where the Danish IT-industry is loosing ground to the global competition. So-called *Innovation Hangovers* (Amabile, 2002) caused by an extremely high time pressure and tight work schedules along with a poor degree of knowledge sharing and cooperation limited to a customer focus, are all points which have negative consequences towards the development of creativity and innovation. The culture and climate in the Danish IT-industry are also suffering from a so-called *Macho Culture*, where problems are often hidden and errors are not tolerated. According to other sources research and development are not at a satisfying level compared to other countries, which is a result of the fact that Danish IT-companies in general are lacking economical and mental reserves. The above mentioned issues more than indicate that the Danish IT-industry has significant problems in a number of areas concerning creativity and innovation which directly influence the competitive abilities in a negative way.

However, the problems listed above are only issues known to the Danish IT-industry as a whole. The importance of these issues varies with the size of the company. This must be taken into consideration when assessing the creativity and innovation level in the Danish IT-industry. When carrying out the assessment, it is therefore necessary to examine a number of companies as a whole from a representative picture of the Danish IT-industry.

Figure 2 illustrates when and what needs to be considered when companies develop from the entrepreneur phase and grow to a company of medium and finally large size. In the early stages of the development the figure indicates a need for creativity. In most cases new companies seem to acknowledge this, bringing forth new creative products or processes. The real issue appears later in their development, as systems and bureaucracy tend to take over jeopardising creativity and innovation. Although a functional strategy at the beginning, this focus can be fatal to the company in question when creativity and innovative forces are needed to enter the next level of development (Elaboration stage). When carrying out the assessment of the creativity and innovation level in the Danish IT-industry, it is important to consider the differences present in

the various sizes of IT-companies. Hence the above-mentioned stage model will be used as a frame in order to get a credible and representative result when selecting the companies which will be examined. By doing so six companies each representing their particular part of the stage model will be selected. Knowing the different creative and innovative issues and levels present in each of these companies, will give a good indication of where action needs to be focused as a starting point for strategic improvements.

Figure 2: Modified stage model



Reference: Quinn, 1983

3. Method and approach

The following section presents the approach designed for assessing the creativity and innovation level of six Danish IT-companies in spring, 2005. At that time the approach and the method used were not planned in advance, except for the use of semi-structured interviews which seemed appropriate to initiate the investigation. It was the context and the research process that more or less determined which methods were applied. In retrospect, the result of this process tuned out to be an appropriate design approach, based on visual interpretation to qualitative as well as quantitative data to explore the conditions for and to assess the level of creativity and innovation within an organisational context. Details on the six Danish companies can be found in Holmetoft and Gottredsen (2005)². The following presentation of the methods must be seen as the structuring of the approach of the analysis. The different analyses were carried out in the steps described below and represent the overall approach for evaluating the creative and innovative level of the IT companies.

3.1 Semi-structured interview

In order to initiate the investigation the use of semi-structured interviews were conducted with a fairly open framework. This allows focused, conversational, and interactive communication, which gives the freedom to explore general views or opinions in more detail. The interviews were conducted with people having a deep insight into how creativity and innovation unfolds in each of the respective organisations e.g. managing or development director. Each interview was conducted in pairs with one person doing the interview and the

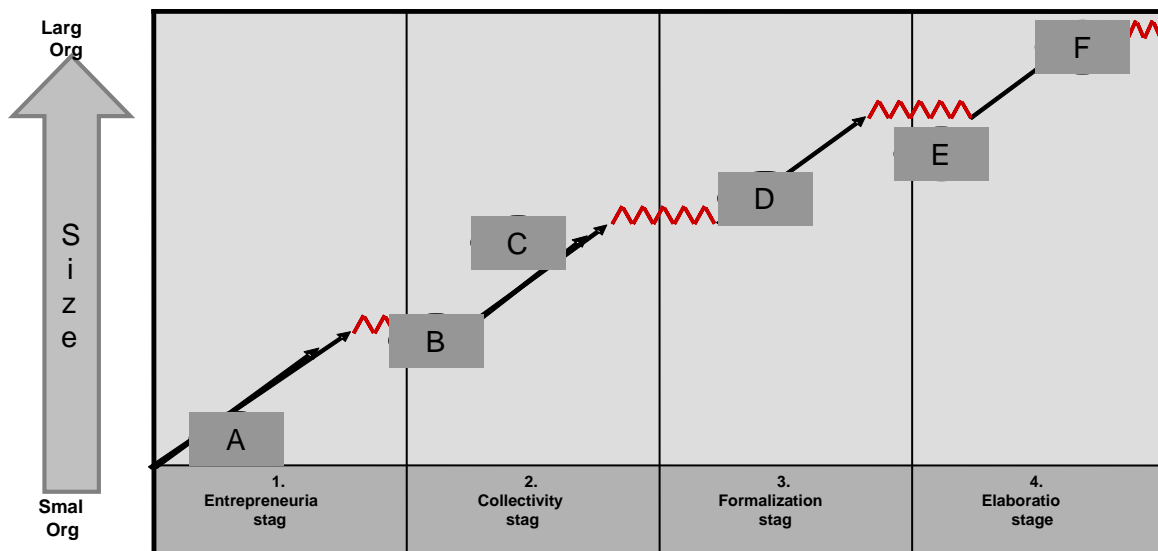
² This is the M. Sc. Thesis in engineering of Holmetoft and Gottredsen, M. under the supervision of Vidal and Sørensen, all authors of this paper.

other taking detailed notes, as accurate note-taking is particularly important to make sound interpretation possible. For the same reason each interview was also digitally recorded.

The interviews were focused around main themes related to organisational creativity and innovation. Possible relationships between these topics were sought out during the interview allowing the interviewer the flexibility to probe for details and the reasons behind the answers. This provided the opportunity for a more thorough understanding of the interviewees' view on their organisation in relation to the main themes. This made comparison possible and helped to identify similarities and differences between the six IT-companies. Nine main themes were identified as the prime areas of importance for creativity and innovation. Shortly after the interviews the data were analysed and the interpretations were presented to the participants, who then had the possibility to comment and make corrections.

The six IT-companies were chosen as they together were representative for the diagonal stretch going from the lower left to the upper right corner in the stage model (see figure 3) according to their size, age and current development stage. They will be treated as anonymous here and are therefore represented by a letter from A to F. See appendix A for further description of the six IT companies.

Figure 3: The six Danish IT companies and their representation in the stage model



The main themes in relation to organisational creativity and innovation, which the semi-structured interviews were based around, were teased out through a literature review and interviews with creativity and innovation experts within different fields. The result was nine main parameters that were considered essential to organisational creativity and innovation:

- innovation strategy,
- management,
- the creative process,
- implementation,
- organisational climate,
- structure & systems,
- resources,
- network, and
- learning.

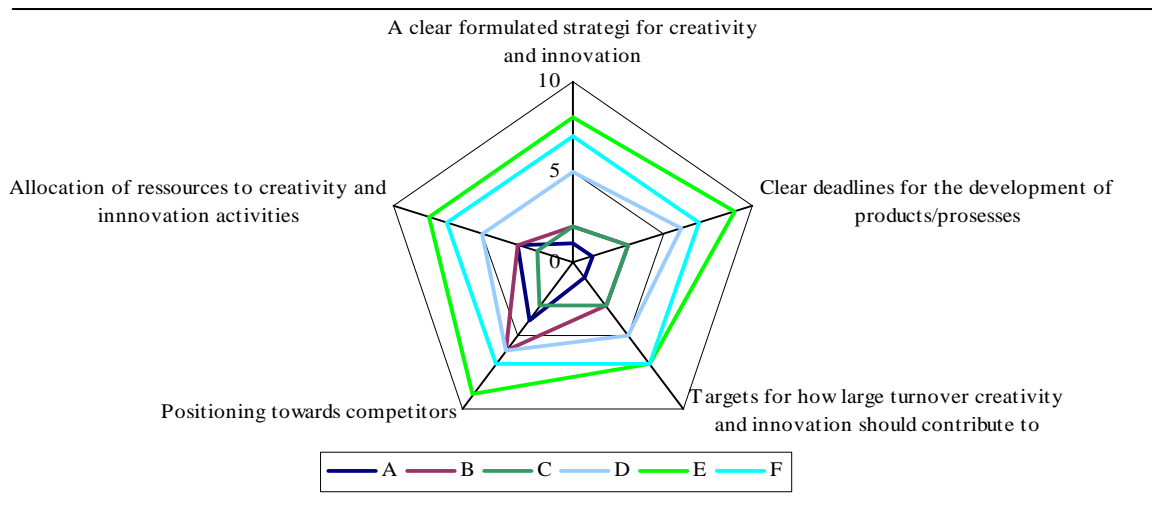
For a description of these parameters and the reason for their selection please see Vidal et al (2006). In order to present the results of the interviews in a compact form it is recommendable to do so in a simple, visual and comprehensible way. This was done through the combination of an indicator based analysis, the mind mapping technique and a SWOT matrix.

3.2 Indicator based analysis

The principle behind the indicator analysis is quit simple. The answers on a series of questions within a subject (e.g. innovation strategy) are grouped in an indicator with an index value between zero and ten. Subsequently another indicator can be created for a different subject with a new index value. In this way it is possible in the end to collect all index values in one single value, as an average. This is a comprehensible and easy way to analyse and communicate the results of the interviews.

The indicator based analyses was constructed for each of the above mentioned 9 parameters. For each of these parameters an indicator have been worked out based on the companies respond to five questions, which was considered important according to the leading literature and practical experience in relation to the specific parameters. The results of the interviews can thereby be outlined in a spiderweb (see figure 4), which displays the level of the firm in question in relation to the other firms, where the index value 10 represents the optimal effort. Spiderwebs are useful when you want to look at several different factors, all related to one item. The advantage of the spiderweb is that it is a visual way to illustrate the level of effort for each firm in relation to each other and at the same time elaborate central aspects of each of the 9 parameters central to creativity and innovation. In this way the spiderweb makes visible concentrations of strengths and weaknesses of each company. Figure 4 illustrates such a spiderweb for the parameter Innovation Strategy. The remaining eight parameters and corresponding spiderwebs can be seen in Gottfredsen et al. (2005).

Figure 4: Strategy score for case-companies



As can be seen in the spiderweb, the performance within the five questions is almost linear growing, with the largest companies achieving the highest scores. However, it has to be noted that company E, only being the second largest company, is superior in all fields compared to the remaining companies. It is also notable that company C is struggling, where as company B in contrary is doing comparably well, although being both the

smaller and younger company. To explain this, a method being able to deepen the nuances between the interviews must be applied to the overall approach.

3.2.1 Mind mapping

Even though the indicator based analyses is a simple and comprehensible way to communicate, it is however not possible to illustrate more profound and different nuances of the ideas in the interviews. To compensate for this it was decided to conduct a more descriptive analysis of the results based on the mind mapping technique (Wycoff, 1991) (see figure 5) with the intention to bring about associations and radial connections to broaden our understanding of the interviews. Mind mapping is a nonlinear way of organising information and is a technique that allows you to capture the natural flow of your ideas and arranging these and their interconnections visually.

A mind map has thus been developed for each of the 9 parameters where the interviewees' thoughts are displayed in order to deepen the nuances between the interviews. This was done immediately after the interviews, and turned out to be an effective way to form a general view of the interview and to identify central aspects and relations between the different parameters.

Figure 5: Reduced mind map for the six companies referring to the innovation strategy



The mind map, although of reduced size in this context, indicates the reason why innovation strategies are largely not dealt with in the smaller companies. The mind map also made it evident that the reason to company E's better performance in the spiderweb analysis was to be found in the lack of well defined strategies and joint efforts within creativity and innovation in the largest company F. The poor results in the spiderweb obtained by company C, was also given the reason that they do not work strategically with innovation what so ever, which to a certain extend contradicts the way company B chooses to operate.

3.2.2 SWOT matrix

The spiderweb and mind map analyses provided a good visual starting point in order to understand and form a general view on organisational creativity and innovation in relation to each of the nine parameters. However, it does not provide a single collective overview of all the dimensions in relations to each other, which is essential in order to take strategic action on how to improve the conditions for organisational creativity and innovation.

In order to get such an overview in relation to all of the 9 parameters a situational analysis in the form of a SWOT matrix (Ansoff, 1987) was carried out. SWOT was chosen because of its simplicity and transparency and because it provides an overview of a situation in which it is easy to identify important problem areas. Furthermore, it is well recognised and broadly used and it creates a good ground for learning about the situation and for reflection on what can be done – stages which are seen as necessary for thinking strategically.

Tables 1 and 2 outlines the issues found. The issues are organised in the so-called SWOT categories: internal strengths and weaknesses, and external opportunities and threats. At the same time, each factor was evaluated in terms of importance and impact. The factors considered most important and having most impact on the situation (creativity and innovation) are in bold.

The factors considered most important were those that have potentially large impacts on the companies if not addressed. In relation to the innovation strategy scores in the spiderweb and the deepened nuances presented in the mind maps, the SWOT matrix also stresses the fact that larger companies are dealing with the innovative process in a strategic and systematic approach. In contrary the smaller companies are characterised by a chaotic approach to the innovative process. Further findings in connection to the SWOT matrix can be found in the following section.

Table 1: Selected internal and external issues characterising small companies

<i>Internal strengths</i>	<i>Internal weaknesses</i>
S1. Large employee involvement/commitment	W1. Time pressure – hasty time-to-market
S2. Quick decision time	W2. Lack of resources
S3. Short, fast and transparent knowledge sharing	W3. Limited network
S4. Flexible and change oriented organisation	W4. Too much chaos – lack of systems
S5. Climate – informal, playful, collaborative	W5. Lack of understanding for the creative process
<i>External opportunities</i>	W6. No strategic considerations in terms of creativity and innovation.
O1. Strengthen understanding of creativity	W7. Somewhat narrow-minded male dominated culture
O2. More strategic and systematic approach to creativity & innovation	<i>External threats</i>
O3. Balance in short vs. long time focus	T1. Losing the ability to recreate and develop new business
O4. Expand network to compensate for lack of resources	T2. Losing customers to more creative competitors

Factors in bold were considered to be most important.

Table 2: Selected internal and external issues characterising large companies

<i>Internal strengths</i>	<i>Internal weaknesses</i>
S1. Extensive resources and in-house knowledge	W1. Too much systems – lack of chaos
S2. Diversity in relation to competences and mentality of employees and management	W2. Lack of understanding for the creative process
S3. Extensive network	W3. Climate – formal, control, bureaucracy
S4. Somewhat strategic and systematic approach to the innovative process	W4. Limited/slow knowledge sharing
	W6. No strategic considerations in terms of creativity.
	W7. Somewhat narrow-minded male dominated culture
<i>External opportunities</i>	
O1. Strengthen understanding of creativity and the creative process	<i>External threats</i>
O2. Unleash some chaos	T1. Losing the ability to recreate and develop new business
O3. Expand network with “radical players/actors”	T2. Losing customers to more creative competitors
	T3. Lower employee involvement/commitment

Factors in bold were considered to be most important

4. Results

The combination of the indicator based analysis with the more descriptive analysis made it possible quantitatively as well as qualitatively to compare the companies against each other in a visual way. This has for instance lead to the finding that for both the small and larger companies it is evident that they do not have a clear and well developed understanding of creativity as a concept and a process. This was clearly stated in the spiderwebs however the reason for this was not absolutely clear. It was of course discussed in the interviews, but it was not until the mind maps were developed that a clear indication as to why creativity apparently is being neglected in the IT-industry presented itself. Thus the mind maps pointed in the direction that creativity to some extent is in conflict with the rather rational and somewhat narrow-minded male dominated culture within the IT-industry, which more or less were expressed by all interviewees.

Another interesting finding present in both smaller and larger IT-companies, which was illustrated in the spiderwebs, were the apparent lack of willingness to take risks. This was a bit surprising as it is often mentioned that the younger and smaller companies often are more willing and flexible when it comes to taking risks. This was also expressed in the mind maps. Here it was evident that ease of communication and fast transparent knowledge sharing in were general characteristics of the smaller IT-companies. This means that ideas in smaller companies quickly, when they in an often spontaneously way appear, can be discussed with the rest of the workforce, and inputs been given, strengthening and developing the idea. Should the idea gain acceptance, the smaller IT-companies are both flexible and change oriented organisations, which quickly can adapt to the new situation. Not surprisingly management also tends to be more attentive and supportive in the smaller IT-companies, where as business plans, mainly required in the bigger IT-companies for the ideas to gain acceptance, unfairly can kill off the idea on the basis of a tight economical perspective. This could indicate that the smaller IT-companies are more willing to take risks as opposed to the larger IT-companies. However, the mind maps also showed that the degree of risk taking in smaller IT-companies is generally overrated. High and constant customer focus, hasty time to market and a need to generate a constant cash flow are factors contradicting this statement, and preventing the smaller IT-companies to fully benefit from some of their obvious advantages.

The combination of the indicator based and the mind map analyses made it possible visually to form a general overview of the interviews and at the same time enhance the understanding of them in relation to each other. From a quantitative point of view the indicator based analysis made assessment of the companies' levels within a specific creativity and innovation parameter possible. However it was only through the mind map analysis that the reasoning behind the values of the indicator based analysis became clear, which from a qualitative point of view improved interpretation. However, both the indicator based and the mind map analysis were conformed to one of the nine parameters at a time, which of course enhanced

understanding of the specific parameter but on the other side made overall comparison difficult. The application of the SWOT matrix helped establish this overall comparison.

The completion of the SWOT matrix provided a systematically and structured situational overview of the organisations internal and external environment in relation to creativity and innovation on which future suitable strategies can be developed to enhance the conditions for creativity and innovation to unfold. The case of the Danish IT-companies showed that for the small to mid-sized companies it is especially the capabilities of management, the flexible organisational climate, ease of communication, quick decisions time, high employee commitment, involvement of network and ability to learn that are important for organisational creativity and innovation. For the larger companies it is more a question of formulating a clear innovation strategy, and establishing organisational structures and systems in order to ensure inter-organisational progress in terms of realising the creativity and innovation potential in the organisations. This should take place within a climate that encourages diversity of thinking and allow for some chaos to unfold in an otherwise orderly organisation, to fully exploit the creative process.

5. Critical evaluation and future work

The approach designed in our study can be criticised from a sociological research point of view. Especially in what concerns the consistency and the validity of the results achieved, as well as the way how qualitative data are quantified in form of indicators. Our approach can also be criticised from a system thinking point of view for the lack of systemic parameters to interlink the different topics of interviews. Our method can be characterised as a pragmatic engineering approach that evolves during the whole inquiring process. It is a participative process seeking to get an insight on a situation to be changed and to start a dialogue with the decision makers. Our approach is more heuristic than scientific, aiming to understand and characterise a situation to be changed. In connection to this a central question to be raised is: What does this approach contribute to in terms of assessing creativity and innovation in an organisational context? In our opinion the approach provides an easy to use starting point for assessing and getting a general overview of the creativity and innovation level of organisations. By following this approach it is possible to obtain a structure on a situation that in relation to creativity and innovation is characterised by fundamentally messy processes and for many are unknown terrain. As such the approach could be used as a self-assessment tool for the management that is interested in understanding the organisation from a creativity and innovation perspective. However, in order to assess not only the creativity and innovation level, but also take further actions based on this assessment, it would be advisable to engage an experienced facilitator with insight in creativity and innovation that could organise and provide guidance on the next steps to be taken. A relevant next step would be to arrange for a workshop in order to involve the entire organisation, or at least a representative number of employees from various departments, and get their opinion on the assessment in order to generate a more complete and accurate assessment before developing a final strategy. Before that a strategy framework for creativity and innovation in IT-firms is needed this is the theme of Vidal et al (2006).

From a research viewpoint it will be interesting to extent the empirical analysis to more firms to refine the number and type of parameters needed to evaluate a firm.

6. Conclusion and recommendation

This paper has presented a designed approach for conducting investigation on and assessing the creativity and innovation level of organisations that is transparent and easy to use. The approach was developed and used with satisfying results when assessing the creativity and innovation level of six Danish IT-companies. The designed approach is a combination of qualitative and quantitative methods with a focus on visual interpretations, which provides an excellent global view of a situation and allows for improved understanding and association to take place. Thus the approach is a good starting point for the structuring of research on organisational creativity and innovation. As such it could be used internally by management to get a grasp on the way in which creativity and innovation unfolds in the organisation. However, one should be aware that companies often do not have the needed knowledge to perform such a task. If management wants to assess the creativity and innovation level of the organisation, it would be obvious that giving the task to someone else, e.g. a creativity or innovation consultants, may be more efficient than conducting the assessment internally. After all, creativity and innovation is fundamentally the results of more or less messy and complex processes for which reason insight and a structured open approach is desirable.

References

- AMABILE, T.M., HADLEY, C.N., and KRAMER S.J. (2002) "Creativity under the Gun". *Harvard Business Review*, 81 (8), 52-61.
- ANSOFF, I., (1987) *Corporate Strategy*, NY: Penguin.
- HOLMETOFT, U., and GOTTFREDSSEN, M. (2005) *Kreativitet, Innovation, Rammeværk – Vejen frem*, IMM, MSc Thesis, Technical University of Denmark (in Danish).
- OXFORD RESEARCH (2003), *ITEK-monitor – Innovation inden for itek-erhvervet*, UK:Oxford research.
- QUINN E. R. and CAMERON, K. (1983), "Organizational Life Cycles and Shifting Criteria of Effectiveness: Some Preliminary Evidence," *Management Science* 29 (6) 50-56.
- VIDAL, R.V.V., SØRENSEN, L., HOLMETOFT, U., GOTTFREDSSEN, M. (2006) "A framework for organisational creativity and innovation", presented at The International Conference on Creativity and Innovation in Decision Making and Decision Support, June 28th-July 1st, 2006, London. To appear in: *Creativity and Innovation in Decision Making and Decision Support*, 2006, vol. 1, pp. 14-29.
- WYCOFF, J. (1991), *Mindmapping: Your Personal Guide to Exploring Creativity and Problem-Solving*, NY: Berkley Books.

Appendix A

Creativity: The creation of new and useful ideas. This is done by exploring and expanding the total number of possibilities based on a diverging approach.

Innovation: Realisation of new and useful creative ideas into process, product or services of value adding character.

Innovation strategy: Strategy dealing with how the company e.g. develops and utilises its resources so that it supports creativity and innovation. This can be supported by a vision or a goal concerning how big an amount of the total turn over which has to come from innovative products. This involves decisions which both in the short- and especially in the long run affects the company's innovative performance.

Pervasive computing: Pervasive computing is the next generation computing environments with information & communication technology everywhere, for everyone, at all times. Information and communication technology will be an integrated part of our environments: from toys, milk cartons and desktops to cars, factories and whole city areas - with integrated processors, sensors, and actuators connected via high-speed networks and combined with new visualisation devices ranging from projections directly into the eye to large panorama displays³.

Innovation Hangovers: State of mind which prevents a person to think creatively and innovatively. This is often caused by a period of high stress levels. The *innovation hangovers* can last several days.

Macho Culture: Male dominated focus. Decisions are often based on a rational way of thinking leaving little space for creativity and innovation. Weaknesses and problems in connection to the daily work are hidden for the surroundings by putting up a façade which reflects control and mental strength, when in reality being under a great deal of stress and mental imbalance. This can result in innovation hangovers.

Company sizes: The classification of the various sizes of companies used in this paper, are primarily based on the number of employees according to the definition stated by the European Union⁴, as follows (on the right side the companies examined in this paper (company A, B, C, D, E, F) are listed according to their respective size):

Size defined by the EU

Small (micro) enterprises: 1-10 employees

Medium sized (small) enterprises: 10-49 employees

Large enterprises (medium sized): 50-250

Company

A, B

C, D

E, F

³ <http://www.pervasive.dk/>

⁴ <http://www.europa.eu.int/scadplus/leg/en/lvb/n26001.htm>