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Quality improvement through foresight methodology as a direction to increase the effectiveness of an organization

Marcin Olkiewicz[1]

ABSTRACT The aim of this study was to show that quality improvement through foresight can be an instrument for shaping efficiency in an organization. The author of this article presented his own concept of quality improvement in an organization, which can also be a method for the strategic management and development of various aspects of the organization. The universality of the concept as a tool that is supported by the foresight methodology brings tangible results, as shown through "quality foresight" at the micro (unit) level. The case examined indicates that each organization should be analyzed individually while retaining the foresight methodology and process. The study also showed that the application of foresight determines the organizational, management and social changes that influence the innovativeness (including the diversification of technological processes and automation), production dynamics (increase by 260%), sales and quality in the organization. The presented research results indicate that "quality foresight" can potentially become a trend that includes the main strength of quality improvement, the improvement of competitiveness, and the productivity and efficiency in organization development.

KEY WORDS: foresight, quality foresight, improvement, quality, efficiency

JEL Classification: L210, M110, O310

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Introduction

With the increasing pressure on the high utility of products offered by organizations, the notion of efficiency has become a continuous topic of discussions about the creation of strategies concerning quality. This increasing interest in the capabilities of the measurement of expenditures and effects should also be sought in the growing demand and expectations of stakeholders for products that are safe, useful, and durable and are offered by local, national (Atkinson, Cohn, Ducci, Fernándes, & Smyth, 2008) and international organizations.

The constantly raised question in the literature concerning the need to properly shape quality (quality management) and, consequently, to evaluate the economic value of its activities has led to a need for research on the direction of quality improvement (Cauchick & Sobreiro, 2009; Psomas & Fotopoulos, 2009) (Fig 1) as a decision-making process in the strategic management of an organization. To this end, "modern organizations" use the foresight tool (Bober & Olkiewicz, 2015; Hines

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& Bishop, 2006) as an instrument to create a vision for the future of an organization as a part of pro-quality strategic activities.

Complex and uncertain environments (Açikgöz, Günsel, Kuzey, & Zaim, 2016) led to quality becoming one of the main sources of competitive advantages. Quality as an object of research is perceived by stakeholders as, e.g., product quality, environmental relations, and security guarantees, and has become a determinant of the activities that can optimize the resources, skills and experience of an organization. Changes in the perception of quality have forced companies to change their approach to managing a company, particularly in the process of allocating resources, which contributes to increased efficiency. This is manifested through the implementation of standardized management systems or the use of contemporary quality management tools (e.g., Deming, Kaizen, Six Sigma, 5S, TPM) aimed at addressing Total Quality Management (TQM).

The measurement of effectiveness helps organizations improve their quality, shape methods of operations and decision-making (Bober, Olkiewicz, & Wolniak, 2017), and create directions of development both conceptually and practically. Multilevel research conducted in the framework of foresight methodology might provide an opportunity for organizations to achieve market success.

Through the study, the use of foresight methodology as a tool for creating strategic directions for changes in an organization was evaluated. The literature study highlights the use of foresight methodology as a path for organizational development.

Literature Review

The issue of the effectiveness of an organization is an important area of analysis for researchers, theorists and practitioners (Georghiou, Harper, Keenan, Miles, & Popper, 2008; Olkiewicz, 2015) who are interested in the field of management. There are no clear solutions, rules, mechanisms, or logarithms that give the best measurement of efficiency and its determinants. There is an ongoing debate on which tools and techniques to use and what strategies should be adopted to achieve the desired goal of maximizing efficiency.

The literature indicates that one of the most important elements for increasing efficiency is to determine the potential for a flexible strategic action (planning and decision-making process) upon which a change in the mindset and goals is made.

In other words, it can be considered the achievement of goals as a result of the effort that has been made, expectations, liquidity and the way in which the goals were achieved. Efficiency means "something different" for every organization, sector or industry. Organizations that skillfully and consciously maintain high credibility in the value chain through a well-defined strategy will create opportunities for high efficiency in the long term. Foresight is the modern instrument that supervises the correct direction of development, defines the vision of the future and creates an organization's strategies. Previous studies indicated that foresight is considered and used in the *practice of foresight of critical futures studies research* (Hines & Bishop, 2006; Loveridge, 2007), in the *praxis foresight* practice (Barker, Cox, & Sveinsdottir, 2011; Cuhls, 2003; Hideg, 2007; Saritas & Burmaoglu, 2015) and in many aspects of socio-economic and environmental life (Burgelman, Chloupková, & Wobbe, 2014; Georghiou, 2007). The literature also indicates that foresight is most often used in the context of its application, such as international foresight, country foresight, regional foresight, industry foresight, sectoral foresight, corporate foresight, technology foresight and technology assessment (Butter, Brandes, Keenan, & Popper, 2008; Calof & Smith, 2012). Foresight methodologies based on the process action (Farrington, Henson, & Crews, 2012; Makarova & Sokolova, 2014) by activating the world of science can enhance the potential and capabilities of using science-economy cooperation (Georghiou et al., 2008; Öner & Beşer, 2011) to develop entrepreneurship and the state economy. The integration of foresight methodological activities with quality improvement allows quality foresight to be considered a process in which the values measured in various accepted measuring scales are the result of the improvement of entities, objects, and phenomena and the maximization of relations and interactions with stakeholders that are achieved through pro-development and pro-quality objectives and are generated as a part of expert operations (Olkiewicz, 2017).

Quality improvements in organizations within the framework of optimizing process activities (Wolniak, 2013) must be implemented in a strategic, tactical or operational way. It is important to stimulate the development of quality in organizations (Taskov & Mit-

reva; 2015) by focusing on the stakeholders (Andersen, Jørgensen, Lading, & Rasmussen, 2004; O'Sullivan & Dooley, 2009). There are many ways to improve quality. One of the systemic tools used in the improvement process is 5S (seiri - organize, seiton - orderliness, seiso - cleanliness, seiketsu - adherence, shitsuke - self-discipline), which is closely related to the strategic approach of the McKinsey model (7S) (Arvand & Baroto, 2016; Shiri, Anvari, & Soltani, 2014). The 7S model pays particular attention to ensure that the quality strategy and its specific policies, objectives and actions closely correlate with the organization's strategy (vision, mission, and direction). Complete traceability of task correlations, activities and quality objectives with strategic ones (Dess, Peridis, & Lumpkin, 2006; Talib & Rahman, 2010) will allow one to state the measures used to verify efficiency. Other quality improvement processes include QC (Quality Control), TQC (Total Quality Control), TQI (Total Quality Improvement), CQQC (Company Wide Quality Control), ICQQ (Integrated Control of Product Quality) and SQM (Strategic Quality Management). Other methods that support process quality management include KANBAN (combination of two Japanese words, with KAN meaning for *visual* and BAN for *card* – thus, KANBAN means *visual cards*), Deming, Kaizen, Six Sigma, Total Preventive Maintenance, Knowledge Management, and Lean Management. However, the most common way to improve quality in an organization is to implement voluntary international ISO management standards. Polish organizations most often use pro-quality management systems in accordance with the following standards:

- PN-EN ISO 9001: 2015-10 (Quality Management System),
- PN-EN ISO 14001: 2015-9 (Environmental Management System),
- PN-N-18001: 2004 (Occupational Health and Safety Management Systems),
- PN-EN ISO 22000: 2006 (Food Safety Management Systems),
- ISO / IEC 27001: 2007 (Information Security Management System).

The growth of entrepreneurship in the context of improvement requires companies to undertake many organizational, procedural, managerial, social and environmental changes. Hence, the improvement of an organization in terms of efficiency is closely linked to sources that identify quality. Thus, there is a strong correlation between efficiency and quality, where quality is identified by variables such as process management, strategy, continuous improvement, customer orientation, long lead time, and leadership (Bou-Llusar, Escrig-Tena, Roca-Puig, & Beltrán-Martí, 2009; De Waal, 2007). The values of individual quality factors and the strength of their correlation (impact) create (shape), within the framework of continuous improvement (Born, 2012), an integrated management defined by complex quality management (TQM).

Research method

The analysis of quality improvement of an organization based on the parameterization of efficiency requires the objectives conducted through the foresight process to be assessed and increases the chances of achieving them. The author, seeking quality assessment areas, focused on productivity as the main driver and proposed the following research problems:

- Q1: Do organizations consciously use foresight to determine the direction of quality improvement?
- Q2: Do strategic quality improvement directions increase the productivity of an organization and guarantee quality assurance?

The posed research questions were verified by multi-faced studies based on an intracompany research analysis and the inquiry of top management employees and were conducted on a micro scale in a medium-sized enterprise in the electromechanical industry. The organization is situated in the Central-Pomeranian region and employs 80 workers. The conducted research covers a period of 8 years (2008-2016). The research is based on a survey analysis aiming to verify the impact of quality improvement on the effectiveness of an organization. In the future, verified and analyzed quantitative and qualitative data defining the quality and efficiency parameters of the production will be subject to the identification and analysis of the logit model subject to the chi-square test ($\chi 2$), thus allowing the future of quality to be created as part of a comprehensive quality management process in an organization.

Research results

Adopting a main strategic direction for pro-quality activities aimed at increasing efficiency forced the surveyed organization to develop a strategic action

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plan. Achieving the planned parameters required improvements in all areas of the organization's activity. The realization of the improvement process was conducted as part of the implementation activities (i.e., process innovation), with a particular focus on the human factors.

As part of multi-faced operations that affect quality in the framework of organization strategy, model activities were implemented covering the following aspects.

I. Personnel policy

During the research period, the organization changed the perception of the employees from objective to subjective, which required changes in the recruitment process, individual career development planning, and remuneration system, among other areas. Changes in the management of the intellectual capital of the workers resulted in, inter alia,

- changing the age structure of the employees: 18-25 years (9% of the staff); 26-35 years (43% of the staff); 36-45 years (32% of the staff); 45-60 years (10% of the staff) and 60+ (up to 6% of the staff),
- changing the workers' experience in the organization: in months (currently working): up to 12 (12% of the staff); 13-24 (14% of the staff); 25-48 (10% of the staff); 49-120 (36% of the staff) and over 120 (up to 28% of the staff), and
- changing professional development (number of trainings per year to the total number of trainings in 2008-2016): 2008 - 7%; 2009 - 13%; 2010 - 7%; 2011 - 17%; 2012 -14%; 2013 - 10%; 2014 - 4%; 2015 - 9%; 2016 - 17%.

It should be noted that all workers can increase their qualifications on their own, as only 10% of the staff had a higher education, 46% had a high school education, 36% had a vocational education and 4% had a basic education.

The indicated range of education, the age structure of the employees and the opportunities for professional development (work in the organization) indicate the creation of a proper personnel policy that appreciates the workers' knowledge, skills and experience.

II. Policy of production improvement

1) In the area of computerization

In the period analyzed, the organization implemented several IT projects, including the creation of an integrated IT system (Fig. 2) that supported all of the processes. The ERP II (Enterprise Resource Planning) Graffiti system was implemented and allowed the safe planning of enterprise resources, including supply, storage, production, quality control, sales, human resources and accounting. It cooperates with the SAP system and the CAD and CAM software used for design purposes, particularly for 2D and 3D technology. Currently, integrated IT systems are supervised in accordance with the requirements of ISO 27000, which allows organizations and co-operators to increase IT security. Guaranteeing IT security is one of the many elements that form the competitive advantage of an organization.

2) In the area of new technology

Increasing efficiency and improving quality would not be possible without the implementation of technological innovations in the production process. Process innovation in the provision of work increases the need to use the intellectual capital of the employees over physical capital because the organization seeks to obtain the semi-automation and automation of each individual production stage. As part of the innovative activities, during the analyzed period, the following purchases were made:

- AgieCharmilles wire cutting machine (± 0.02 mm accuracy),
- type MAS MVC 1270 CNC milling machine (capability to process up to 1200 kg of metal with ± 0.01 mm accuracy),
- Hexagon Global 7.10.7 coordinate measuring machine (capable of measuring 700 mm x 1000 mm x 700 mm product dimensions),
- presses: PEDH with a pressure of 250 tons, KB 3534 with a pressure of 250 tons, KB 3537 with a pressure of 500 tons, KB 3539 with a pressure of 800 tons, LE 400 with a pressure of 400 tons and Vimercati with a pressure of 100 tons,
- two FANUC welding robots,
- two ASPA and Zpa6 welding guns,
- KiMLA Powercut 3KW laser cutter, and
- six SX200, SX300, SMC50+CR400, SMC50+CR600, SMC50+CR850, SMC50+CR1000 automated lines.

The implementation of highly specialized equipment allowed the firm to increase its productivity (Fig. 3) and production possibilities (product capabilities) (Tabs. 1-2).

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Table 1. Annual growth of production in % - before the implementation of significant changes

	2002	2003	2004	2005	2006	2007	2008
Heating technology		47	44	37	0.92	55	10
Household articles		117	44	83	13	142	26
Automotive		41	89	92	0.64	0.75	0.32
Total		**49**	**60**	**64**	**0.8**	**33**	**0.96**

Table 2. Annual growth of production in % - before the implementation of significant changes

	2009	2010	2011	2012	2013	2014	2015	2016
Heating technology	14	2	26	5	11	5	6	16
Household articles	26	16	23	15	31	4	2	6
Automotive	0.23	121	24	31	7	171	41	50
Total	**11**	**8**	**25**	**9**	**19**	**10**	**7**	**16**

The technical and technological changes implemented in the organization met the requirements and expectations of the client and enabled the organization to achieve the production growth trend (Fig. 4).

3) In the area of infrastructure development

The realization of technical and technological investments leading to the automation of the production processes and the implementation of the electronic production planning system markedly improved the production capacity of the company. However, the ongoing investments required additional financial resources for further production development, i.e., the appropriate infrastructure. Compared to the company in 2017, which had a 2400-square-meter area, the following facilities were added during the analyzed period:

- four production facilities with a total area of 3000 square meters,
- 600-square-meter warehouse, and
- an adjacent property with an area of 1.5 hectares.

The construction of production facilities fully satisfied the current production requirements.

III. Management policy

The concept of organizational development combined with the strategy of social responsibility was largely due to the high expectations and requirements of stakeholders and the poor innovative activity of the company. Therefore, as part of responsible management, the organization, by defining the development path for the implementation of innovative processes and by creating product opportunities, pursued pro-quality policies and activities covering the following:

- creation of a system to support strategic activities in the R & D field,
- implementation of standardized management systems: ISO 9001, ISO 14001, ISO / TS 16949, OHSAS 18001,
- maintenance of a proper financial management (Fig. 5),
- implementation of a systemic activity, which would include
  - a control process - double control during the production process is designed to detect non-compliant products in the shortest possible

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Table 3. Evaluation of the effectiveness of supporting production improvement

2008	2009	2010	2011	2012	2013	2014	2015	2016
82%	80%	58%	80%	70%	88%	52%	60%	66%

Table 4. Annual growth rate of accidents in %

2008	2009	2010	2011	2012	2013	2014	2015	2016
	-0.67%	20%	-0.67%	-0.88%	-0.71%	-0.8%	-0.75%	-0.33%

time from the occurrence of the defect, thereby eliminating the risk of sending flawed components to the customer (final qualitative verification of packaging order production cannot drop below 99% per 100 PPM (PPM - number of parts per million)),

- the process of evaluating the effectiveness of implemented actions supporting the improvement of production (Tab. 3),
- customer satisfaction survey process - at minimum, a stakeholder survey is carried out four times a year, and the results cannot fall below 90% (currently 96.41 per 100 points), and
- the process of ensuring the safety of work - compliance with accepted procedures has resulted in a reduction in the number of accidents (Tab. 4).

Discussion of the results

The situational approach of the organization in a specific situation, environment and time is of primary importance, as far as modern management is concerned. Thus, organizations, specifically the company that is the subject of this study, are focused on increasing their potential by increasing their orientation on knowledge, stakeholders, technical and technological changes, quality, and product. The professional literature and previous studies indicate that the activities of an organization were determined through the lens of purposefulness (increasing the efficiency of production), impact (relationships with the environment), ownership (resources of the organization), and creativity (implementing innovations and creating production and productive capabilities). Accordingly, organizations that focus on shaping values (model chain) by identifying and analyzing the dependencies of individual links in the chain must pay particular attention to the quality parameter that is present in all stages. The analyzed organization pays special attention to the pro-quality activities, which contribute to effective and efficient actions (also in strategic terms), the parameterization of the goals achieved by the organization and the possibility to increase them. Thus, the quality parameter determines the appropriate management of an organization.

The dilemma of an organization is the skillful shaping of its future and directions for development. The literature indicates that foresight can be used to create the future of an organization. In the surveyed organization, the adopted methodology of foresight research allowed efficient strategic planning through the use of technological forecasting (implemented through conducted investments) to achieve, in the area of improvement, specific quality parameters and productivity in production that directly affected the quality of the comprehensive approach in managing an organization. The study proved that the use of foresight as a tool for shaping the future had significant effects on various areas of management. It is worth noting that although the study attempted to show that the organization has a very pro-quality policy, standardized management systems should ensure compliance with

the quality standards (norms) and should not play the role of a forecasting tool to show the genuine differences in anticipating unexpected market trends. This task is accomplished through foresight in anticipating the future market trends towards qualitative dominance. Thus, qualitative foresight is a real challenge for management, as also confirmed by the literature on the subject. The study confirmed the theoretical considerations by stating that because of the quality improvement process, as part of foresight, the organization implemented changes with the following effects:

- creating an area of activity in the organization that is responsible for R & D,
- ongoing activities in shaping relationships with stakeholders and stimulating market relationships,
- changes in the perception and development of intellectual capital,
- skillful acquisition of knowledge through new abilities, behaviors, processes, management systems, and competences,
- implementation of innovation changes, particularly for technological solutions, information systems, and creating intelligent solutions supporting management, and
- the possibility of seeking new competitive advantages.

In the future, an organization that is seeking ways to dominate in quality in the market should conduct a multi-faceted analysis of the costs of quality and the possibility of the wider use of non-standardized quality management systems. In the study, these systems are only theoretically presented because the scale of use remains negligible, but the awareness of workers has increased due to conducted trainings. The planned analysis, which considers the areas of organizational improvement, should identify the qualitative/quantitative variables that will be subjected to the chi-square ($\chi 2$) test. This might allow a firm to shape the future of quality as part of a comprehensive quality management process in the organization while also determining the impact of variables. This will allow a firm to optimize its processes (production) and increase the efficiency and effectiveness of its continuous development activities.

In conclusion, because of the strong influence of stakeholders, the company studied here, in 2007, used the foresight methodology to determine the direction of the organization's development. As a result of extensive research and the specifics of the organization's functions, three main directions for the improvement of particular areas were adopted, i.e., human resources, production, and management methods, and were directly determined the development of quality. The direct effects of the designated directions included the following:

- in the area of human resources – changes in the perception of workers, concern for their well-being (e.g., work, social, economic) and personal development;
- in the production area - implementation of automation and semi-automation by launching six automatic lines (SX200, SX300, SMC50 + CR400, SMC50 + CR600, SMC50 + CR850, SMC50 + CR1000, working with pressures ranging from 160 to 800 tons of ram; the purchase of the most technologically advanced equipment (production machines), and the implementation of an integrated IT system; and
- in the area of management - changes in the management methods (including thinking and strategic planning), the skillful use of innovative possibilities, and proper capital management.

The implemented pro-development changes and requirements and expectations of stakeholders and outlets caused the need to procedurally and systemically systematize activities to guarantee (ensure) the high quality of produced/offered products and services. As part of the implementation of standardized management systems, the realized quality-oriented activities contributed to the increase in efficiency, the removal of barriers (resistance to implemented changes), the monitoring and the continuous improvement of organizational processes. The quality-oriented actions that were created as part of quality foresight made it possible to determine that the improvement of quality had brought the organization closer to achieving the TQM philosophy.

Conclusions and Suggestions

The development of foresight, as a way to help define development scenarios and identify long-term directions for changes, thereby allowing strategy objectives to be achieved, are confirmed, both in the researched company and in the literature analysis. Adopting the

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quality improvement as a direction of organizational development with the use of quality foresight made it possible to achieve market success (i.e., become a market leader in the voivodship) and increase the efficiency and profitability of the organization.

Quality improvement involving the use of international standardized management standards, among other things, positively created and still creates an image of the organization worldwide and guarantees the high and repeatable quality of products and services to stakeholders. Therefore, it can be assumed that the initiative to use quality foresight in this particular case has proven itself and has directly contributed to shaping a sustainable development policy for specific areas of the organization, especially pro-innovation production management, the efficient use and creation of intellectual capital, IT security management and sound financial management.

Quality is an area that determines customer expectations and requirements and broadly understood management, including strategic management. The results of the study indicate that the quality improvement (shaping) activities in the organization determine the correlation between the stakeholders (society), the efficiency (organization capital), and the environment (organization culture and working environment). Skillful management of these areas will create "new" quality, which is currently not determined by the stakeholders.

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Appendix

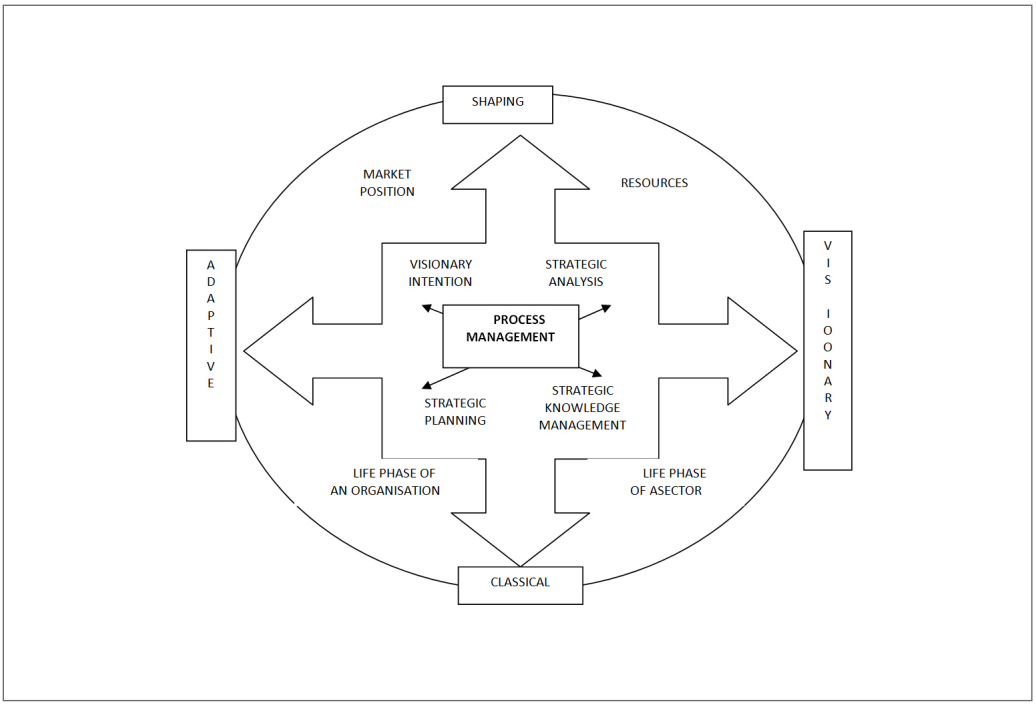

Figure 1. A multi-level approach of generating quality improvement directions in an organization
Adapted from Modelowe kreowanie jakości w organizacjach w ramach foresightu jakości [Model creation of quality in organizations as part of quality foresight] (p.161), by M. Olkiewicz (2017). Koszalin: Koszalin University of Technology.

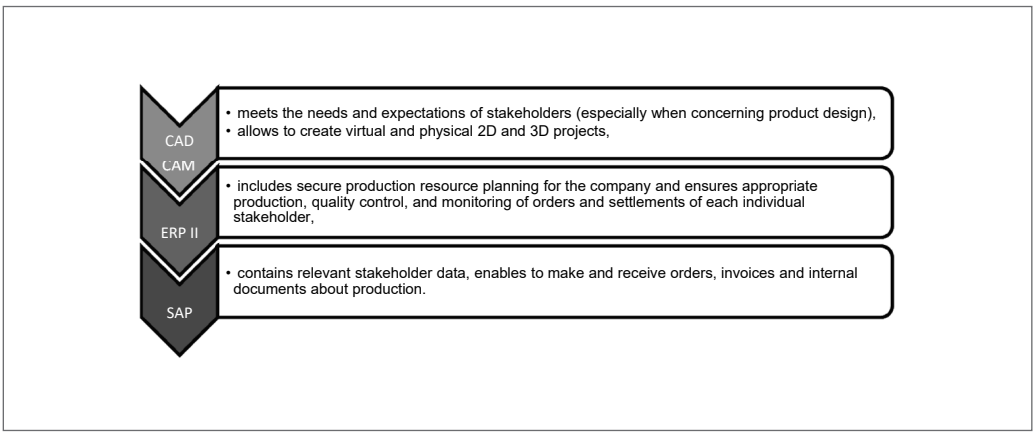

Figure 2. An integrated IT system

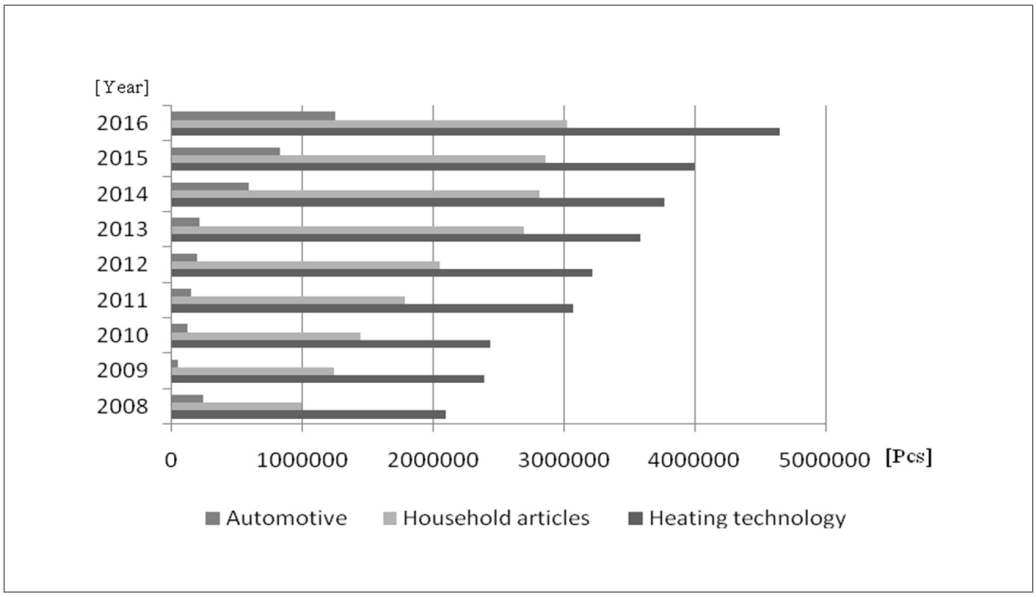

Figure 3. Production volume in specific industries in 2008-2016

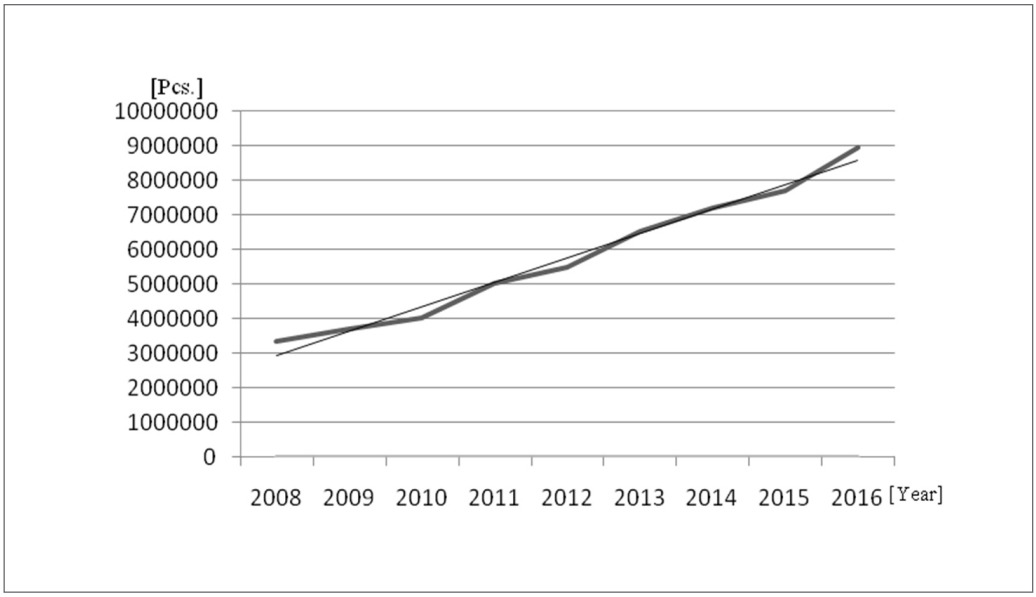

Figure 4. Total production volume in 2008-2016

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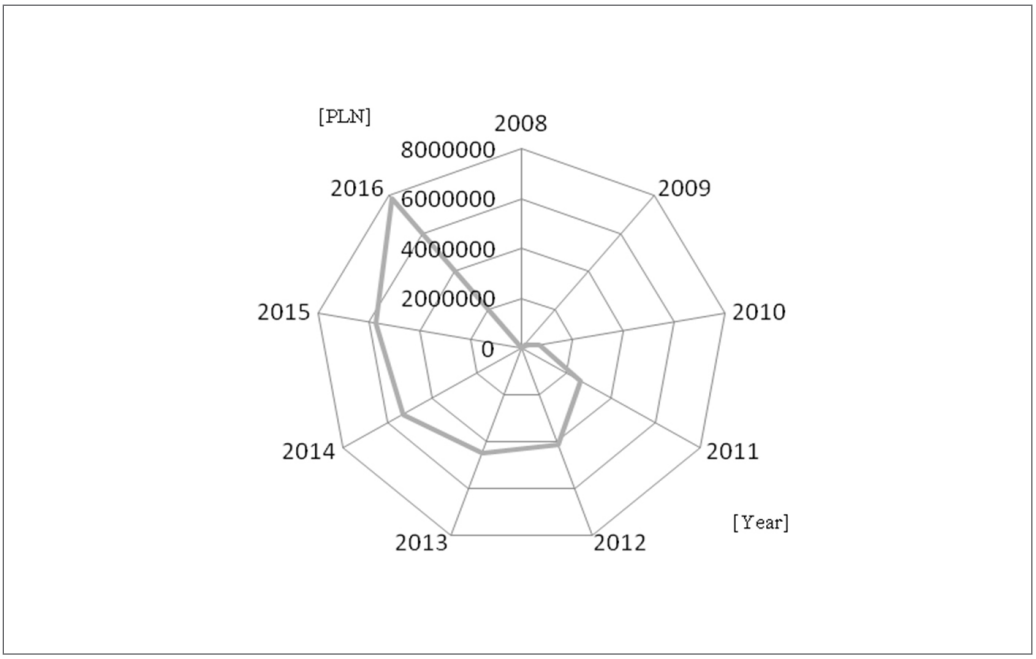

Figure 5. The volume of financing investments in infrastructure and technology in 2008-2016