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The financial effects from continuous improvement adaptations

A study of the Swedish electrical contracting industry

Master's thesis in Production Engineering

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Abstract

The concept of continuous improvement adopts an approach to conduct work in a way that aligns organizations towards their goals. The concept was originally introduced in the Japanese manufacturing industry in the 1950s. It started as a method for solving problems and has since developed to become a philosophy for improvement. The Japanese call it *Kaizen*.

The effects from improvements in a manufacturing setting are often clear and measurable, and can generally be translated to economic gain. However, when improvements are of such nature that they indirectly contribute to value, such as increased employee satisfaction, safety or even to some extent quality, the short term effects can be difficult to measure and long term financial effects become more relevant. This is often the case in the service sector.

The present study has investigated the impact a culture that encourages the work with continuous improvements can have on companies' financial performance. The purpose was hence to identify a connection between continuous improvement work and financial performance.

26 small- to medium sized electrical contracting companies were investigated regarding their efforts towards working with continuous improvement as well as their financial performance. A literature study was performed to create an understanding of the concept of continuous improvement and how it is practiced in small- to medium sized service enterprises (SMSEs). In order to answer the research question, a statistical analysis was performed followed by four case studies. The purpose of the case studies was to support the findings from the statistical analysis.

The statistical analysis showed that a connection between continuous improvement and financial performance was indicated for 81% of the sample companies. The probability that the result was coincidental was less than 1%. The findings from the case studies supported the statistical result.

The study showed that continuous improvement and financial performance were related. Electrical contracting firms that had successfully implemented the concept of continuous improvement had benefited financially from such adaptations.

Keywords: *Continuous improvement, financial performance, quality management, ISO 9001, electrical contracting, SMEs, SMSEs.*

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Contents

- 1. Introduction 1
 - 1.1 Background 1
 - 1.1.1 Kaizen in the west..... 3
 - 1.2 Purpose..... 3
 - 1.3 Research question 4
 - 1.4 Limitations 4
- 2. Method 5
 - 2.1 Quantitative analysis..... 5
 - 2.2 Qualitative analysis 6
- 3. Theory 8
 - 3.1 Quality management..... 8
 - 3.1.1 The fundament of quality management..... 8
 - 3.1.2 Quality management in small- to medium sized enterprises..... 9
 - 3.1.3 Quality management in service companies..... 10
 - 3.1.4 The ISO 9001 series 11
 - 3.2 Creating and sustaining an improvement culture 12
 - 3.2.1 Suggestion systems 12
 - 3.2.2 The low-hanging fruit trap 14
 - 3.2.3 Quality circles..... 14
 - 3.2.4 The emperor’s new clothes 15
 - 3.3 The Electrical Installation Organization (EIO) 15
- 4. Empirical findings 17
 - 4.1 Company A..... 17
 - 4.2 Company B 18
 - 4.3 Company C 19
 - 4.4 Company D 20
 - 4.5 Results from the statistical analysis 21
- 5. Analysis 24
 - 5.1 Company A..... 24
 - 5.2 Company B 25
 - 5.3 Company C 26

5.4 Company D	26
5.5 General analysis	27
6. Discussion	28
6.1 Reflections on trustworthiness	28
7.1 Implications for practice	30
7.2 Future research.....	30
Appendix A.....	35
Appendix B	38
Appendix C	40
Appendix D.....	41

Tables and figures

Table A1: Outcome from categorization of 26 EIO-Q members along with expected outcome.	36
Table A2: Percentage points of the chi-square distribution.	37
Figure 1: The core principles of quality management (adapted from Bergman & Klefsjö, 1995).....	9
Figure 2: A simple set of arrangements to handle improvement errands (adapted from www.c2management.se)	13
Figure 3: Results from the categorization of 26 EIO-Q members regarding their improvement cultures.	22
Figure 4: Results from the categorization of 26 EIO-Q members regarding their financial performance.	22
Figure 5: A combination of figure 3 and figure 4.	23
Figure A1: Plot of the Chi-square distribution.	35
Figure C1: Development of operating margin of the EIO group from the year 2006 to 2013.....	40
Figure C2: Development of operating margin sorted by certification year. ...	40
Figure D1: Continuous improvement efforts for 26 EIO-Q members for years 2013 and 2014.....	41

1. Introduction

The introduction firstly aims at providing an overview of the concept of continuous improvement, its origin, and how it is viewed and adapted by different practitioners. Secondly, the purpose of the thesis along with the research question is presented. The chapter ends with stating the limitations for the thesis.

1.1 Background

The concept of continuous improvements (CI) adopts an approach to conduct work in a way that improves performance through small, continuous arrangements or actions. Small improvements have the benefit of easily being followed by other small improvements, thus they may simplify the ability to create an optimal way of working towards a common goal within organizations. It is therefore usually beneficial for organizations to implement the concept of continuous improvements; (Slack & Lewis, 2011; Weitlaner, et. al., 2012). The concept was first introduced in Japan in the early 1950s by the American quality pioneer W. Edwards Deming. Deming encouraged the Japanese to adopt a systematic approach to problem solving, which later became known as the Deming Cycle, or Plan-Do-Check-Act (PDCA) cycle. The method was adopted by Toyota Motor Corporation and later became a cornerstone in their work with continuous improvements. They called it “*Kaizen*”, which directly translates to “*ongoing changes to the better*”. Today, the concept has expanded to include improvement of processes, data collection and analyses, documentation, group dynamics, self-managing and much more, (Liker, 2004).

Imai (1986) explains that the ideal type Kaizen is built on three principles:

- Principle 1 – Process orientation

Improvement work should start at the processes. The idea is that sound processes where non value-adding work is minimized create satisfactory results. Also, a process orientation where focus lies on the activities and methods rather than outcomes, facilitates the use of employee experience and common sense. However, for improvement work to be effective, a process needs to be thoroughly understood. Interaction between people, machines, material and information is complex and managing the variability and interdependency of such activities requires commitment, knowledge and high participation from the employees. Management should emphasize process improvements by stimulating and supporting the members of the organization to engage in such work by providing the adequate skills and training.

In the spirit of the Deming-cycle, process orientated improvement work calls for evaluation and follow up. This can act as an important catalyst for further process improvement as well as increase the willingness and motivation amongst employees to keep improving. The number of submitted suggestions and the rate of implementation and participation indicate the

efforts made by employees, but also the support given by management. This indicates that Kaizen can be applied to monitor employee motivation, a property that, according to Berger (1997), is partly overlooked in western adoptions of CI.

- Principle 2 – Improving and maintaining standards

CI is a concept that emphasizes challenging the existing standards, and for small improvements to accumulate to an overall performance contribution for the whole organization, this process must be ongoing. Standards therefore need to be up to date and maintained. “There can be no improvement where there are no standards”, (Imai, 1986).

Standardization is also inherent in the PDCA-cycle. The problem solving wheel adopts a simple approach to work with CI and to maintain standards. The “A” stands for “act”, which denotes an organizational implementation of an improvement. This is generally the responsibility of the middle management. Middle management is informed of the improvement, usually via a suggestion system, and, provided the result is considered satisfactory, formalizes the improvement by altering the existing standards, thereby closing the PDCA-loop.

Lastly, standards contribute to employee competence and character through providing;

1. Individual authorization and responsibility.
2. Learning opportunities through interpersonal and interdepartmental knowledge transfer.
3. Discipline, because standards are binding and all-encompassing.

- Principle 3 – People orientation

Fundamental for Kaizen is the belief in peoples’ inherent desire for quality and value creation. This intrinsic attribute combined with a managerial support and a reward system focused on acknowledgement and praise is considered enough to create a high motivation to work with continuous improvement.

High levels of participation from both managers and workers at the shop floor are recommended in order for CI to be efficient. To succeed in engaging all employees, the concept requires some contextualization. Improvement work should be conducted in all areas of an organization, but different people, depending on e.g. hierarchy or skill, should engage in different improvement activities.

Briefly mentioned above is management’s role in maintaining standards, but management also has the responsibility, besides improving day to day operations such as machinery and equipment, to gradually improve system processes such as planning and control, organization,

decision making and IT-systems. Kaizen on an individual level is associated with improving one's own work, on-the-spot method improvements and waste minimization. Improvement work in groups takes another form, where quality control circles (QCCs) and smaller group activities aimed at improving work methods, routines and procedures are dominating, see section 3.2, "Creating and sustaining an improvement culture".

1.1.1 Kaizen in the west

Improvement work in western companies has traditionally been seen as a managerial activity. The employees have merely had the job of adopting or maintaining the improvements, never to challenge them. An improvement culture can never take form with such an approach. *Kaizen* should be considered a philosophy for improvement, not a tool for improvement, and not a one-man-job. It should be integrated in the organizational culture as a natural way to think and act, (Imai, 1986). Another common mistake in western companies is to view Kaizen as an improvement system only. The concept is first and foremost a way to motivate and incentivize the employees, in which recognition and merit for promotion is far more important than monetary rewards. It is also a system for education. The most efficient way to learn about one's work is to analyze it and improve it. This creates motivation whereby the improvement suggestions will keep coming as a natural continuation, (Berger, 1995).

Corresponding to Imai's first principle, one way to facilitate this learning is to allocate responsibility of processes. Weitlaner et. al. (2012) identified process ownership as an important complement to continuous improvement when 840 Austrian service- and manufacturing companies were investigated regarding their process ownership, continuous process improvement, financial performance, and customer satisfaction. It was found that the companies with high process ownership and a thoroughgoing improvement work had more satisfied customers and performed better financially, and that continuous improvement work had a direct correlation to profitability whereas process ownership to a larger extent positively affected customer satisfaction.

1.2 Purpose

Research regarding the financial effects from CI is otherwise limited in academia. It is not difficult to argue that increased productivity or reduced lead time, can contribute to financial performance, but the relationship between continuous improvement work and financial performance is nevertheless complex, especially in environments where immediate effects from improvements are difficult to measure. The "C" in the PDCA-cycle stands for "check". The arrangement aims at following up and evaluating an improvement. It includes monitoring and measuring. When improvements are of such nature that they indirectly contribute to value, such as employee satisfaction, safety or even to some extent quality, the short term

effects can be difficult to measure and long term financial performance becomes more relevant. This is often the case in the service sector.

The present study will investigate the impact a culture that encourages the work with continuous improvements can have on companies' financial performance. The purpose is hence to identify a connection between continuous improvement work and financial performance.

1.3 Research question

Can a relationship be found between continuous improvement work and increased financial performance amongst organizations practicing such work?

1.4 Limitations

The study was carried out investigating one type of industry, the electrical contracting industry. This provided uniformity to the study, since all study objects possess similar characteristics. The study comprised investigation of members of the Electrical Installation Organization (EIO), specifically those partaking in EIO's quality scheme, EIO-Q. Only ISO 9001 certified small- to medium sized enterprises (SMEs) were included.

The overall result from improvement work was identified and correlated with the change in company financial performance between consecutive years. Larger improvements and other factors that could influence financial figures were not included in the analysis unless they could be related to, or as a result of, a continuous improvement culture.

Differentiation of improvement efforts between companies were determined by selecting the mean number of submitted suggestions per year and the mean rate of participation of employees amongst the sample companies as reference point. Companies displaying results above the mean in both aspects were considered likely to support the work with continuous improvements.

2. Method

This chapter describes the research methodology used in the thesis. A deductive process was adopted to answer the research question. Deductive research has its strength in testing theories and hypothesis through subjecting these to empirical scrutiny, (Bryman & Bell, 2003). Particularly for this thesis, the deductive research strategy is suited to attain knowledge of the prerequisites and circumstances regarding continuous improvement in SMEs within the EIO.

Both quantitative and qualitative research was conducted to test the hypothesis and thereby answer the research question. This integration of research methods is called multi-strategy research, (Layder, D., 1993).

2.1 Quantitative analysis

The quantitative analysis was based on data from improvement work and financial figures from 26 EIO-Q members, all of which met the criteria stated in the limitations section. Two hypotheses were derived from the research question; a null hypothesis and an alternative hypothesis. The null hypothesis stated that improvement culture and financial performance are independent. The alternative hypothesis stated the opposite, i.e. that there is a dependency. Pearson's chi-square test of independence was used to statistically test the null hypothesis. The method aims at determining the independence of two variables associated with one sample, (The Concise Encyclopedia of Statistics, 2008). The sample consisted of 26 investigated companies within the EIO. The companies were categorized regarding their improvement culture and their financial performance, and the categorical variables were the presence or absence of an improvement culture and whether the companies were highly financially successful or not. This created a two-times-two table.

It is often appropriate to use relative measurements when comparing companies' financial performance, and one common measurement is operating margin, i.e. operating profit over turnover, (Skärvad & Olsson, 2009). The mean operating margin for the certified companies was selected as a reference point in the evaluation, but other aspects were also taken into consideration. Expanding companies that showed a continual operating margin above the sample mean were considered highly financially successful. Expanding companies were mapped by analyzing turnover development and increase in headcount. Companies that decreased in headcount were considered less financially successful. There are two arguments for taking a decreased headcount into consideration. Firstly, it was found that the general demand for electrical installation work in Sweden may be high. Decreasing the workforce under such circumstances was therefore considered alarming. Secondly, in 2014, the average number of employees at the sample companies was 36. Therefore, continual layoffs may, given the company size, correspond to a large percental decrease of the work force.

A change in fiscal year can render deviating results the year the change took place. Data of division of fiscal year for each investigated company was therefore analyzed. The effects

from an improvement culture are only visible over time; (Martichenko, 2004; Jha et al., 1996). Therefore, it was necessary to also examine financial performance over time. The companies' finances were analyzed over an economic cycle of five years. Conjectural effects were therefore taken into consideration.

Two variables were selected to define a CI culture; rate of participation per year and number of suggestions submitted per employee and year. Participation rate was defined as the percentage of the employees that had, at any stage during an improvement errand, handled that errand. The two variables captured both the frequency of suggestions and the employee commitment, and therefore best indicated the presence of an improvement culture. The mean participation and mean number of submitted suggestions from the 26 sample companies was selected as a reference point for comparing improvement efforts.

When all companies had been categorized, the outcome was compared to a mathematically expected outcome. The expected outcome was calculated by multiplying the total values for each row with the total of each column, creating another two-times-two table. The probability that the observed differences between the outcome and the expected outcome arose by chance was then calculated using a particular probability distribution called the chi-square distribution. The result validated or rejected the hypothesis.

2.2 Qualitative analysis

The Chi-square test can only determine a relationship between two variables, not the nature of the relationship. It cannot prove that one variable is contingent on the other and is therefore arguably insufficient to answer the research question. A complementary qualitative study was therefore deemed necessary. The main purpose of the qualitative study was to support the results from the statistical analysis through interviewing four selected companies. To allow for an interesting comparison of the interview results, it was important that the chosen companies displayed indices of an improvement culture but that their financial performance differed. The research could have been conducted the other way around, examining companies with high profitability and varying CI efforts, but the premise of the present study was to evaluate the effects an improvement culture has on financial performance. Whether the opposite relationship is forthcoming requires further research. The qualitative analysis therefore took its starting point in investigating which companies displayed indices of an improvement culture.

6 companies performed above the industry average with regards to participation rate and submitted suggestions for year 2014, whereas 3 performed around the average; see the results section for statistics regarding improvement work. The financial performance of all 9 companies was investigated whereupon 4 displayed clear financial trends, either related to turnover or to operating margin. These companies were selected for the qualitative study.

In preparation for the interviews, a literature study was performed to accumulate knowledge of how SMEs perform continuous improvement work and what the prerequisites of

succeeding with such work are. The study also comprised investigation of how the service industry works with continuous improvements and how that differs from manufacturing companies. Furthermore, the relevance of an ISO certification with regards to improvement work was studied. This was relevant since all examined companies were ISO 9001 certified. The concept of an improvement culture was also studied along with the impact suggestion systems can have on such a culture. Understanding the above mentioned circumstances allowed for relevant questions during the interviews. Hence, the research was conducted deductively. The literature study also investigated previous research on the topic of quality management, continuous improvements, and their connection to company success. Scientific literature from books, journals and articles was used throughout the literature study.

Interviews were conducted in a semi-structured manner. The format allows the interviewer to ask more leading and general questions – compared to a structured interview which in many cases acts as an oral survey – thereby establishing a climate for discussion and opportunities for complementing questions in response to significant replies, (Bryman and Bell, 2007). The purpose of the interviews was to support the findings from the statistical analysis in order to answer the research question, i.e. to investigate the integration of continuous improvement work in company culture and to what extent this had affected the profitability. The research question is complex because the work with continuous improvements needs to be isolated from several other factors that can affect financial performance. Information regarding company culture as well as financials was therefore best obtained through probing and discussion. A semi-structured interview was therefore considered appropriate. The interview guide is presented in appendix B.

3. Theory

This chapter presents a summary of the reviewed literature. It is divided into three parts. The first part presents the concept of quality management and how it can be applied to small- and medium sized companies. This is followed by an explanation of the ISO 9001 standards. The second part presents the concept of an improvement culture and how such a culture can be created and sustained. Lastly, a presentation of the electrical installation organization (EIO) is presented. Brief information on EIOs quality management initiative, EIO-Q, is included.

3.1 Quality management

The Japanese definition of continuous improvements (CI), or *Kaizen*, implies “improvement that involves everyone—both managers and workers—and entails relatively little expense”, (Imai, 2012). A similar description is provided by Bessant et al. (1994), who argues that the employee involvement and low costs can yield great benefits for any company adopting the concept. This suggests that the work with continuous improvements does not depend on resources nor type of organization, that is, the philosophy is context free. However, continuous improvement work is recognized as a key ingredient in quality management; (Bessant et al. 1994; Bergman & Klefsjö 2002; Temponi , 2005; Wood, 1997), and research shows that the prerequisites to adopt quality management and establish a continuous improvement culture may differ between size and type of organization. The following part of the literature study will introduce quality management and cover continuous improvements in the context of quality management work within small to medium sized service enterprises (SMSEs).

3.1.1 The fundament of quality management

Quality management, henceforth denoted QM, is a concept for regulating and improving the quality of organizations’ processes and products. Figure 1 displays the core values of QM, developed by Bergman & Klefsjö (1995). There are naturally more models on QM, but they all, almost exclusively in one way or another, contain the five elements displayed in figure 1. The selected model is the simplest found and therefore henceforth referred to in the literature review.

A quality management system (QMS) represents the methods, tools, routines and allocation of responsibilities to support these core values, (Bergman & Klefsjö, 1995). A well implemented QMS should contribute to achieving company goals and targets as well as to increased customer satisfaction and profitability. It also provides additional benefits by giving external parties, e.g. prospective suppliers and customers the possibility to learn more about the organization’s work with quality, (Bergman & Klefsjö, 2002).

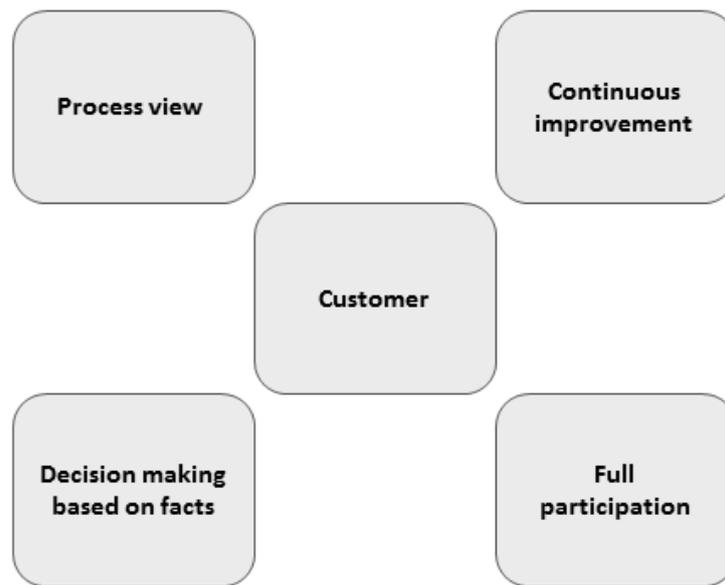


Figure 1: The core principles of quality management

3.1.2 Quality management in small- to medium sized enterprises

Small- to medium sized enterprises (SMEs) are defined as a range between 10 to 50 employees for small enterprises and between 50 to 250 employees for medium enterprises, (European commission, 2005), and they make up for more than 95% of the worlds' businesses, (ISO 9001 for small businesses, 2008). It is often stated that SMEs suffer from resource limitations, but opinions differ regarding whether such limitations have any significant effect on continuous improvement efforts, (Assarlind, M., 2014). For example, Ghobadian and Gallear (1996) suggest that it is rather the engagement from top management that determines the success of a CI initiative whereas Beheshti and Lollar (2003) and Bicheno (2008) argue that the resource limitations themselves can act as an incentive to focus on improvement work.

Assarlind (2014), on the other hand, points out two reasons why QM is more difficult to establish in SMEs than in larger organizations. The first is that SMEs might not realize the benefits that could come from QM, nor have the awareness of its methods and principles. The second is the aforementioned resource scarcity amongst SMEs. External support is identified as a critical factor for adoption of QM in SMEs. This implies costs for funding and for access to competence through e.g. consultancy services, (Assarlind, 2014). Other associated costs are production downtime for manufacturing companies and training of personnel. These costs might deter SMEs from adopting QM and consequently implementing a thoroughgoing work

with continuous improvements, (Achanga et al., 2006). Deleryd et. al. (1999) also argue that resource limitations can restrict SMEs from adopting QM. Contributing factors are lack of knowledge, people and time.

3.1.3 Quality management in service companies

Researchers within service management, e.g. Zeithaml et. al. (1985) and Edvardsson & Thomasson (1989), explain service through four characteristics:

- Intangibility. Services are abstract and difficult to evaluate before they have been acquired
- Co-production. Services are often produced, delivered and consumed at the same time. The customer specifies the service to a high degree.
- Heterogeneity. The customer participates in the production of the service which creates variation in process and result.
- Perishability. Services cannot usually be stored or saved.

There is no right way to define quality in services. What is important is that the definition chosen is known by the entire service company and that it can be communicated both internally between employees and externally to the customer, (Edvardsson, 1996). This is further emphasized by Bicheno (2008), who recommends that service companies should try to keep a holistic view of the value flow and recognize that there is a common purpose that applies to everyone, that is, to improve the customer experience.

Customer expectations differ between service and manufacturing companies. Manufacturing companies work according to specifications that allow them to set clear targets that can be quantified and measured. In service companies, such specifications as well as customer expectations are generally more unclear since they change more frequently. This means that the quality management system must be designed to adapt to these changes, and that is a great incentive to continuously improve, (Bicheno, 2008).

It also means that service companies generally work closely with their customers, as is evident by the four characteristics. This facilitates certain room for experimentation with new ideas. Service consumers can help evaluate improvement efforts and consequently influence the value provided by the service. Due to the “co-production” characteristic, such evaluation will be quicker for service than for manufacturing, (Bicheno, 2008). Similar conclusions have been drawn earlier by Bitner (1991) who suggests that a crucial part of quality work in the service business is the feedback from the customer. It is particularly important when the

nature of the service is repetitive and reoccurring since it is during such circumstances when continuous improvement work yields the best results, (Bitner, 1991). However, improving ad hoc is not sustainable. Improvements also need to be incorporated into the organization and become standards, (Bicheno, 2008).

3.1.4 The ISO 9001 series

The ISO 9000 series, developed by the International Organization for Standardization (ISO), is a set of standards for implementing and sustaining a QMS. A standard is, according to ISO, “a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose.” The ISO standards therefore provide support for ensuring the safety, reliability and quality of products and services. They act as a strategic tool for waste- and error minimization, cutting costs and increasing productivity. Furthermore, a certificate can act as a competitive advantage, both locally and globally. The ISO 9000 series took form in 1987 and originates from US military standards, (Bergman & Klefsjö, 1995). ISO 9001 sets out the requirements of a QMS, and over one million companies and organizations in over 170 countries have implemented ISO 9001 as of 2015 (www.iso.org).

Poksinska et. al. (2005) conducted a survey investigation of how ISO 9001 certified companies in Sweden related to their quality management systems and their certificates. The investigation showed that the main reasons that companies pursued certification were due to demand from their customers and for marketing reasons. The participants also expected the certification to result in improvements of their product and/or service. This was also a contributing factor for application. When asked about the main function of their quality management system, a majority of the companies stated that their system best represented a tool for continually improving the organization. One tenth, (528 companies as of 2005), of all certified companies were sent surveys and around one third replied, 82% of which were SMEs.

Certificates are annually revised for renewal. This is important, but it also poses a risk. According to a later study by Poksinska (2006), there is a tendency amongst companies to focus too much on passing the revision and pay less attention to satisfying their customers and establishing an improvement culture. Another common mistake is to only view certification as a selling point. This could cause companies to overlook the actual benefits from a certificate – implementing and sustaining a QMS.

Still, the certification seems to be overall advantageous. Another survey conducted at the Norwegian Quality Association (NFK) investigated the effects from ISO 9001 certification. 316 NFK members – all private companies and a majority of which were SMEs – were investigated. The results showed that those companies with ISO 9001 certification performed better with regards to profitability than those without. This was mainly due to that the certified companies were better at reducing quality related costs; (Hongyi, 2000).

Continuous improvement work is an important part of quality management. The ISO 9001 series includes standards on how to work with continuous improvements. However, the standards alone cannot create an improvement culture; they can only provide the platform. It is ultimately the leaders who must strive towards creating and sustaining an improvement culture and also combine it with a process- and customer centric view. It is this combination that can make companies great, (Bergman & Klefsjö, 1995).

3.2 Creating and sustaining an improvement culture

This section will cover the prerequisites for creating and sustaining an improvement culture as well as some of the pitfalls and problems companies can face.

Woods (1997) defines culture as “*the shared beliefs, values, attitudes, institutions, and behavior patterns that characterize the members of a community or organization.*” He states that management plays a crucial role in forming an organizational culture. Only when the culture is in place, the work with continuous improvements can become a natural part of the organization. This will bring about more satisfied employees and customers, and, ultimately, increase companies’ financial performance, (Woods, 1997).

The work with continuous improvements has long term benefits. Small individual improvements usually have miniscule impact on organizational performance, but can together over time result in significant process improvements. An improvement culture acts as an inexpensive substitute to larger reformative work such as re-engineering, re-structuring, and re-organization, (Martichenko 2004; Jha et. al., 1996). It is even suggested that organizations that do not embrace continuous improvements risk developmental stagnation, (Cole, 2001).

3.2.1 Suggestion systems

In 1994, the best country, light-years ahead of the rest of the world, with regards to submission of improvement suggestions per employee and year was Japan, which had an average yearly rate of around 25 suggestions per employee. Sweden was number two with an average of 0.32 suggestions, (Rydbrink, 1995). In 2013, the Swedish industry and commerce had improved to around 1 suggestion per employee and year, (www.sifv.se).

This data can be derived from suggestion systems. The suggestion system is an American invention, initially used by the U.S. Air Force, and brought to Japan after WW2. The Japanese industry embraced the invention and integrated it with the Kaizen concept. By 1994, Japan’s annual savings from suggestion systems was estimated to £ 2,600 per employee, compared to the £ 65 savings in the second best country – Sweden, (Rydbrink, 1995).

The view on suggestion systems was different between U.S and Japan. Japanese industry saw it as a means to boost morale and increase employee participation – much like the way Berger

(1995) describes *Kaizen* – whereas the U.S. saw suggestions as directly related to financial performance, (Rydbrink, 1995). N.b. that the purpose of the present study is not to support the U.S. view. A suggestion system cannot by itself yield increased financial performance.

Kanjiro Yamada, former managing director of the Japan Human Association, stresses the importance of integrating the suggestion system in the company culture. This is done through three stages:

1. Managerial support and emphasis on simplicity in the suggestions to create a broad organizational commitment.
2. Education through the use of quality control tools and statistical methods to increase problem solving abilities.
3. Focus on economic impact.

This process can take up to a decade, and patience and gradual progress is the recipe for success, according to Yamada, who also states that the problem with most western companies is that management skips the first two stages to start at the third, thereby defeating the purpose of *Kaizen*, (Imai, 1986).

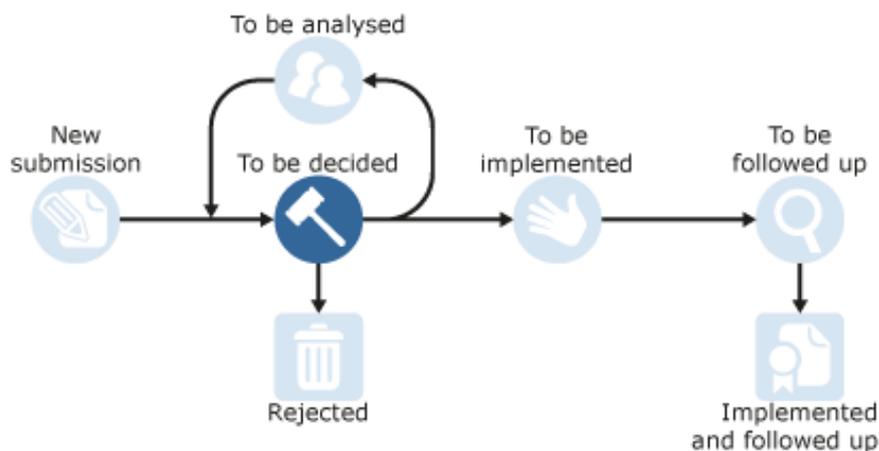


Figure 2: A simple set of arrangements to handle improvement errands. In this example, the suggestion has been submitted and awaits a decision.

An improvement culture is not necessarily reflected in the amount of suggestions submitted or the rate of participation. It is a deeper concept build from the ground and inherent in the

organization. However, the road to cultural alignment within organizations can be rocky and seemingly excellent improvement data can disguise the absence of a culture pretty well. Some pitfalls and possibilities will be discussed below in relation to creating an improvement culture.

3.2.2 The low-hanging fruit trap

During the initial phase of creating an improvement culture, it is usually easy and comfortable to attack and solve the apparent problems – the low hanging fruits. This is not in itself a bad approach and in line with Yamada’s first step. Such problems are usually urgent and solving those yields immediate results and visible benefits. This can create enthusiasm around improvement work amongst the employees, and is therefore a natural starting point in creating an improvement culture. It is then important to harness this enthusiasm by fostering a systematic approach to continuous improvement work and to build in competence around it. This will sustain the culture. The pitfall lies in attacking these problems ad hoc without creating the habits of working together systematically to improve. The enthusiasm will then likely fizzle out and things will go back to normal. Increasing the autonomy and allocating responsibility to the employees can act as a remedy to regain the enthusiasm for continuous improvements, (Ahlström, J., 2014).

3.2.3 Quality circles

Another alternative to increase the interest in improvement work is to engage the employees in quality circles (QCs). Quality circles are in essence people that on a regular basis set aside time to discuss current problems and suggestions for improvements. Involving employees in the improvement work increases their problem-solving abilities, their commitment as well as their sense of ownership over company processes, (Goh, M. 2000). Since quality circles are intended for smaller groups of people, usually within the same departmental division or function, they have limited applicability in solving cross-departmental problems, (Sörqvist, L., 2004). One might therefore argue that quality circles are particularly efficient in creating an improvement culture within SMEs.

QCs originate from the successful Japanese concept of quality control circles (QCCs). The implementation of the concept in the western world is however considered less successful. The fact that the “control-aspect” has disappeared from QCCs could, according to Berger (1997), imply that the management role and responsibility for controlling the quality has been neglected by western organizations, resulting in unsustainable improvement work.

3.2.4 The emperor's new clothes

In the classic story by Hans Christian Andersen, the emperor receives a suit promised by the weavers to be invisible to those unfit their positions or incompetent. Naturally, since the emperor is in fact naked, no one can see the suit, until a child points out the obvious. The perfunctory behavior of the people in the story is also evident in organizations that deny or have forgotten the purpose of continually improving. Such organizations put in a lot of effort and resources into creating the right structure and to implement the right tools and methods, but improvement work is conducted on the side, separate from the value-creating processes. The improvement efforts can therefore look statistically excellent but result in little or no increase in performance. To correct the situation it is important to go back to basics and contemplate the core principles of quality management and how they apply to the organization in question. Who are the external and internal customers, what do they want, and what can be done to meet their needs? (Ahlström, J., 2014).

3.3 The Electrical Installation Organization (EIO)

EIO is a nonpolitical employer's organization consisting of 2800 electrical contracting firms in Sweden as of 2015. The organization was founded in 1906 and has since then worked towards strengthening the competitiveness of its members and of the electrical engineering trade. This is done through lobbying, formation of opinion and acting as a consultative body in important industry-related matters. The member companies operate in a variety of fields, e.g. telephony, construction, security, surveillance and more. A majority of the customer base is part of the public sector, and business is conducted according to specific laws regarding public procurement. As of 2015, the member companies collectively employ 26500 people and 95% of the companies employ 25 people or less, (www.eio.se).

EIO has since the early 1990s offered a quality management system to its members called EIO-Q. The system was developed by the current quality manager at EIO, who, during an interview, explained that EIO-Q provide a set of guidelines and advice on how to work with quality management. Included in this is an IT-system called System C2 which is used for handling suggestions, surveys and a variety of errands and ultimately to help companies establish an improvement culture. EIO-Q also prepares participants for ISO 9001 certification and handles related administrative work. As of yet, around 50 of the EIO members utilize EIO-Q, all of which are ISO 9001 certified. These companies are subject to investigation in the present thesis.

Appendix C shows the development of operating margin of 1360 EIO members from the year 2006 to 2013. The electrical contracting industry is heavily project oriented. This means that the commitment to the customer is usually long term. Effects from market conjunctures are therefore generally delayed a while.

A previous investigation of the first four EIO-Q participants was conducted at Uppsala University in 2008. The purpose of the study was to determine what results the ISO 9001 certification had yielded. A survey study as well as interviews with the CEO and quality manager of each company was conducted. Surveys were sent out to employees in leading positions in all pilot companies in order to investigate the rate of participation in the quality work. One line of questioning was designed to establish the level of awareness of why the certificate was pursued. Reoccurring answers were that it was expected to bring increased quality, competence development, and structure and order. Many also stated that the certificate was pursued due to customer demand and to provide benefits during public procurements. The financial results from ISO 9001 certification were also analyzed, but no precise figures could be presented during the interviews. All interviewees however concurred that the income had increased, mainly due to better handling of customer reclamations and of deviations from customer requirement specifications. In particular, System C2 had provided opportunities to more accurately charge customers during such deviations and to quickly respond to complaints. Costs had also been reduced due to continuous improvement work. The improvement work was facilitated by an increased awareness of waste, that is, non-value adding activities, amongst employees, (Lanner, L. & Neikter, C., 2008).

4. Empirical findings

This chapter is divided into two sections. First, a summary of interviews conducted with four EIO-Q members is presented. The interviews were conducted during the spring of 2015. Second, the results from the statistical analysis are presented.

4.1 Company A

Company A is an electrical contracting firm located in Sollentuna, Stockholm County. The company was founded in 1998 has since its start experienced a stable growth in both turnover and headcount. The company is profitable but its profit margins are low. Today the company employs around 50 people.

In 2009, when the company had around 20 employees, the CEO decided to implement a work order system. The system was initially implemented to support billing, but grew to encompass work orders and routines as well. This was done to support the employees by giving them guidelines and consequently shifting some of the workload from the CEO. In 2012 Company A had doubled in headcount whereupon a more formal quality management practice was needed. A restructuring of the work organization was undertaken during which project groups were formed and project managers were appointed. Meanwhile, the company joined EIO-Q and eventually obtained an ISO 9001 certificate in 2013. Certification was pursued to complement the existing work order system by establishing a more formal work structure, especially for the project managers. Another reason was that it gave the company an advantage during negotiations with potential customers. Initially, the certification was treated as an independent set of standards, in all essence disconnected from quality management work – which was unstructured. This was due to time limitations and a steep learning curve to fully understand the standards. Today, the certification is much more integrated in the work with quality. The quality manager at Company A, who has previously been involved in quality work at Ericsson AB – a company that, at least in Sweden, has embraced Lean Production and QM – has brought experience and ideas to the quality work at Company A. One idea is an incentive system where employee suggestions are acknowledged during monthly meetings and teams are rewarded for best improvement work effort. Rewards are mainly of a symbolic nature.

Work with continuous improvements was in place before 2012 but it was mainly the CEO and a few assemblers who submitted suggestions. There was no improvement culture in place. Furthermore, deciding, implementing and following up on the suggestions was relatively slow, often done on a quarterly basis. This started to change in 2012 when EIO-Q provided access to System C2 and an improvement culture started to take form. Today the company views continuous improvements as an important tool for keeping employees and customers happy. The company has set goals of 2 suggestions per employee and year, and a long term participation rate of 75%. All suggestions and other errands have been directed to the respective project leader in order to speed up the handling process and keep the leaders

continually informed. A time limit of 48 hours for deciding on errands has been set. Employee and customer satisfaction is continually measured and the data indicates an increase in both compared to 2012. Similarly, improvement suggestions are seldom made with regards to direct cost cutting or increased profit but rather to maintain high employee and customer satisfaction.

The work environment has improved significantly since the work with CI started. This is due to efficient reporting of work related incidents and the new way of handling errands through system C2. An area that still needs improvement is finance administration. The company expansion is ongoing to meet the excess customer demand. This mismatch means that customer demand cannot always fully be met and the company is forced to choose between customers. The financial basis for making these decisions is today regarded as insufficient. The quality manager sees no direct correlation between continuous improvement work and financial performance.

4.2 Company B

Company B was founded in 1989. The company is located in Malmö and employs 20 people as of 2015. Company B offers a variety of services, from maintenance work to setting up new hardware systems in e.g. telephony, lighting, surveillance and more. Its primary customers are companies and housing cooperatives. The company business strategy is to establish long term relationships through accurate deliveries and high quality.

The level of work with continuous improvements is statistically high with a participation rate of 46% and 2.8 suggestions per employee and year as of 2014. The company is profitable, however the profit and headcount decreased annually between 2010 and 2013.

Company B joined EIO-Q in 2012 and became ISO 9001 certified soon thereafter. Certification was required by some customers and there was an opportunity to use it as a selling point. The management also expected the changes to result in a more structured and organized work environment. The attitudes towards these changes were, and still are, generally positive, especially amongst upper management, who feel that the changes have brought the previously desired work structure and order. There has however been some resistance towards the changes and a few people have decided to leave the company. The overall employee satisfaction has nonetheless increased and the employee satisfaction survey is used to detect and change eventual divergent attitudes, but the task is difficult, according to the quality manager.

Administrative work has increased since the certification. This is currently seen as burdensome amongst managers, especially during large scale projects where a lot of pre-work and learning is required before getting started. It has even on occasion resulted in choosing ineffective work methods. Long term benefits from documenting the work are however expected and creating guidelines for specific types of projects is currently under consideration.

Work with continuous improvements started shortly after the EIO-Q membership. Suggestions are much more frequently submitted now compared to 2012. The goal, which has been met, is to submit at least 2 suggestions per employee and year. It is however usually the same group of people behind

submission suggestions, the CEO predominantly. The participation rate is high, 63% and 46% for 2013 and 2104 respectively, and the reason is that the management team is actively involved in handling most suggestions. Conversely, the employees do not often partake in the improvement work.

The benefits from working with continuous improvements are hitherto; increased responsiveness and participation amongst employees, a more structured workplace, and an increased customer satisfaction, according to the CEO.

Company B has basically had the same customers for 20 years. This is however partly in line with the company strategy. Although there is a desire to expand the customer base, lack of people and time are currently restricting the company from taking on more work.

4.3 Company C

Company C is an old family-owned company, founded in 1918 and located in Skoby, outside Stockholm. The company offers a broad set of services within electrical contracting. This includes installations of lighting, alarm systems and computer networks. The company also plans to expand within the field of renewable energy, specifically wind- and solar power, as well as, along with a Swedish technical university, investigate the possibilities of installing roads that could charge electrical cars. 25 people are currently employed and no further expansion of the work force is planned. The company has an old and broad customer base, Arlanda airport being the largest customer. Current resource limitations restrict the company from acquiring new customers and the company is on occasion forced to decline work. There is no economic basis for prioritizing what work to undertake other than that it is said to be based on long term benefits. This is however planned to be arranged in the near future. The mismatch between demand and resources is however a conscious choice from the CEO who does not wish to expand beyond 25 employees. The reason is that he wants the company to remain small and personal.

Company C performs above average with regards to continuous improvements as well as turnover- and profit development over time. The CEO views work with continuous improvements as a means to ease everyday work for the employees and keep the employee satisfaction level high. It is important that the employees stay at Company C because competence in electrical installation is valuable and costly to replace. Personal performance reviews are conducted regularly to establish individual plans for development. Employees are also able to partake in shorter educations in order to keep up with technical development and be ahead of competition. Further efforts to create an improvement culture have been made by investing in tablets for the employees. The purpose is to more easily provide information regarding work orders and routines as well as to allow for submission of improvement suggestions and material ordering. This has resulted in an increase in submitted improvement suggestions. The company displays excellent improvement data. In 2013, the level of participation and the number of submitted suggestions were 61% and 2.1 suggestions per employee. Corresponding numbers for 2014 were 72% and 3.1. The company has no annual goals for number of submitted suggestions or participation but the CEO welcomes a further

increase in both. The Company does however have clear measurable goals that are in accordance with common ISO standards. That is, goals regarding work environment, quality management, and environmental impact. Furthermore, identified areas that had potential for improvement were; giving incentives, transportation routes, material ordering and finally that the employees should strive to complete one project before starting another. Improving these areas was also included in the annual company goals.

The company became ISO-certified in 2013. The initial purpose for certification was to gain competitive advantage during public procurement processes. Today, the ISO standards are to a larger extent integrated in the work and the benefits from the certification are, according to the CEO, apparent. Teams have been formed and assigned specific work areas to uphold the certificate and improve the organization in general. One of the teams is dedicated to sustain and increase the work with continuous improvements. A few days per year are set aside as improvement days. These days are dedicated to evaluate the company's work with continuous improvements and to discuss specific suggestions. Improvement work is also conducted to minimize work related injuries, for example by clarifying safety regulations and making these accessible and known to all employees or by arranging physical activities.

4.4 Company D

Company D was founded in 1990 and is located in Älvängen. Company D is an electrical contracting firm that specializes in installation and maintenance of electrical- and computer networks and solar cells. The company targets both industry and private housing. Headcount has grown continuously since 1990, and reached 20 people in 2015. Company D acquired Älvängens Installationsbyrå AB (ÄIAB), which is a firm consisting of four employees specialized in electrical installation in industrial settings. The CEO however expresses his desire that Company D should remain a small, flexible and personal company, and has set the limit at 20 employees. To meet increased market demand, external workforce is utilized – usually around 5 extra people at all times.

Over a ten year period, the company has had a profit margin of around 7% and approximately doubled its turnover. The participation rate regarding improvement work has steadily declined since 2010 from 33% to 17% in 2013. It did however increase somewhat in 2014, corresponding to the average participation rate within the EIO-Q group, 24%. Submitted suggestions per employee and year were 0.5 and 1 for 2013 and 2014 respectively. This roughly corresponds to the Swedish national average as well as the EIO-Q group average. The CEO commented that, these days, employees seldom have time to record their suggestions, which are instead usually submitted verbally directly to the CEO, who records them accordingly. Furthermore, the enthusiasm for improvement work was higher the first couple of years following ISO9001 certification.

Company D obtained its ISO9001 certificate in 2007 which made the company amongst the first within EIO to become certified. The certificate was pursued due to the competitive

advantage it was expected to bring during procurement processes. Today, the CEO claims that the real benefit from the certificate lies internally. Employee satisfaction has increased, work related incidents have decreased and a greater structure and order has been obtained. Improvement work has also increased due to the ISO guidelines, which act as an inspirational source for generating new improvement ideas. Nevertheless, the frequency of submitted suggestions has historically been uneven and somewhat stagnated during the last three years. The purpose of working with continuous improvements is, according to the CEO, to allow all employees to gain a better understanding of the work processes.

The organizational structure has recently changed with the introduction of teams and informal middle management. Each team is responsible for its own work area, e.g. computer network installation, service and passage systems, or contracting. The purpose is for the employees to specialize in one particular field. Each team has 4 days per year that are dedicated to quality management. These occasions are used to follow up on improvement suggestions, competence development and quality work in general. This has increased the autonomy amongst the employees and therefore shifted some of the workload from the CEO to the respective team leaders.

4.5 Results from the statistical analysis

One suggestion per employee and year was the average in 2013 for Swedish companies (www.sifv.se). This is slightly below the average for the sample companies in 2013, which was 1.28, but near equal to the average in 2014. The average participation rates for the sample companies were 28% and 24% in 2013 and 2014 respectively. There is no collective data for the average participation rate for companies in Sweden. These numbers may imply a decline in the work with continuous improvements amongst electrical contractors but a longer observation period is necessary for the establishment of a possible trend. Appendix D shows the improvement efforts made by the 26 investigated companies for years 2013 and 2014.

The percentage distributions of improvement culture and financial performance from 26 investigated companies are presented separately in figure 3 and 4 respectively. The distributions are roughly corresponding.

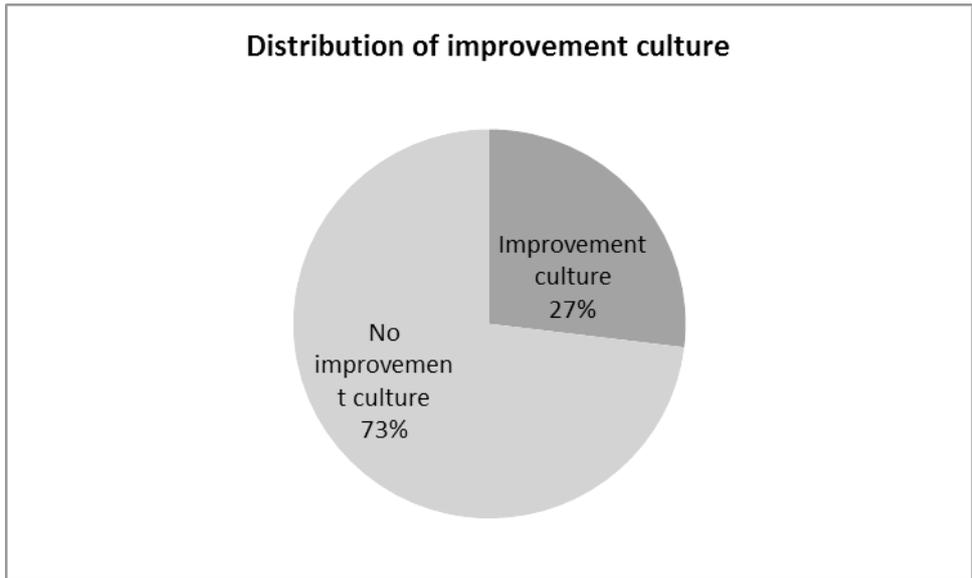


Figure 3: Results from the categorization of 26 EIO-Q members regarding their improvement cultures.



Figure 4: Results from the categorization of 26 EIO-Q members regarding their financial performance.

Figure 5 depicts the outcome of the quantitative analysis, and is a combination of figure 3 and figure 4. 81% of the companies have financial performances corresponding to their continuous improvement efforts, that is, corresponding to the alternative hypothesis. This indicates a relationship. Whether this relationship is coincidental has been determined by Pearson’s chi-square test of independence, presented in appendix A. The result from the test shows that the probability that the observed data has occurred by chance is very low. At a significance level of 0.01, the null hypothesis can be rejected in favor of the alternative hypothesis, that is, continuous improvement and financial performance are associated.

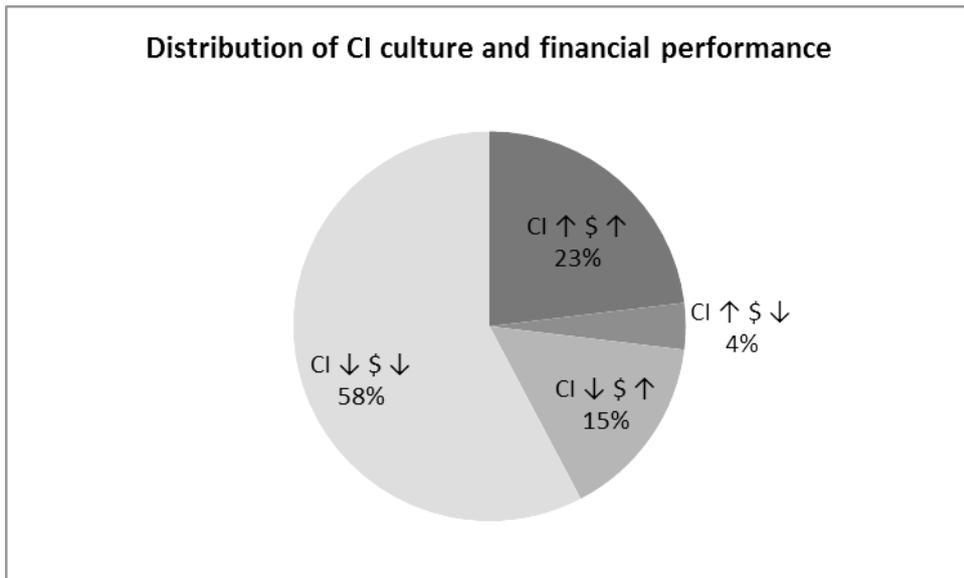


Figure 5: A combination of figure 3 and figure 4.

The test does not determine the nature of the association, only that the two are associated. The following analysis will determine this association through a triangulation of the statistical analysis, the interviews and the literature study, whereby a final conclusion can be drawn.

5. Analysis

A deeper investigation of the four interviewed companies is presented below. Parallels are drawn to the literature study whereupon the result from the statistical analysis will be strengthened and the research question consequently answered.

5.1 Company A

Company A has slowly adapted to working with continuous improvement. In 2009 the company implemented a work order system. The system was gradually developed to include standard operating procedures. Referring back to Imai (1986), this is an essential part of the PDCA-cycle. The expanded work order system resulted in a first step towards allocating responsibilities to the employees. The second step was implemented in 2012, when project groups were formed and project managers appointed. The work became more specific and the process ownership increased. The positive effects from allocating responsibility as explained by Imai (1986) and Ahlström (2014) are that it facilitates learning and enthusiasm for improvement work. These arrangements likely created a benign environment for establishing an improvement culture at Company A. ISO 9001 certification was merely the catalyst for initiating continuous improvement. The improvement work started immediately in 2013, displaying a high number of submitted and followed up suggestions and a high participation rate. This indicates preparedness for working with CI, but also that the company has followed Kanjiro Yamada's advice, that the integration of a suggestion system, and consequently the work with continuous improvement, into organizational culture is a gradual process that needs to take time. However, at Company A the improvement work is seldom focused on economic impact, which is the last stage in Yamada's adaptation process, but rather to keep employees and customers satisfied. This is arguably a natural approach for service companies because they work according to customer specifications that frequently change. The customer centric view at the company therefore corresponds to the recommendations made by Bicheno (2008) and Bitner (1991) regarding the form for improvement work in service companies.

A downturn of the financial performance was seen for 2012 and 2013. One possible contributing factor is the integration of the quality management system with the organization. This endeavor required time and resources – the learning curve was steep, according to the quality manager. Another contributing factor could be the work force expansion in 2013. The company employed 10 additional people in 2013, expanding the work force by 35%. A new employment is usually associated with long term benefits but also certain initial costs. For the average electrical contracting firm, examples of such costs are additional service cars, tools, equipment and costs for eventual training periods. The financial benefits from the expansion were therefore likely delayed until 2014. The results for 2014 were in fact exceptional. The company experienced a great upward swing in both turnover and operating margin, which had increased by 23% and 2.7% respectively, compared to 2013. It is likely that the aggressive expansion contributed to this result, but there are a couple of arguments against this being the only reason. The first is that the company has expanded its work force continuously since its

start and no historical economic upswing of similar magnitude can be found. Secondly, the company expanded the work force in 2014 as well, by 6 people, roughly corresponding to 15%. This likely also induced expenses and affected the financial result that year. It is therefore reasonable to assume that the financial result in 2014 was not a consequence of the expansion alone. The other significant organizational change was the integration of the quality management system and consequently the introduction of continuous improvement. Martichenko (2004) and Jha et. al. (1996) argued that the effects from an improvement culture were only visible over time. The improvement culture at Company A took form in 2013, and its financial benefits are likely reflected in the result from 2014.

5.2 Company B

The interview with the quality manager at Company B indicated that the improvement efforts made were not sufficiently anchored in the organization. A goal of 2 submitted suggestions per employee and year was set and also met. This is ambitious, but the purpose of working with continuous improvement is to involve everybody to create a thriving and culturally aligned organization working towards common goals, (Slack & Lewis, 2011; Weitlaner, et. al., 2012). A majority of the improvement work was conducted by top management and no goals concerning participation rate were presented. This corresponds to the general westernized adaptation of CI but not to Imai's vision of the concept. Structure, order and employee responsiveness were identified as positive effects from the ISO9001 certification and CI. These aspects are naturally important, but not particularly associated with continuous improvement, given the reviewed literature. They rather indicate that the company has fallen into the emperor's new clothes-trap, i.e. the improvement work is conducted on the side, separate from the value adding processes, (Ahlström, 2014).

Company B is undergoing an implementation of a quality management system following ISO 9001 certification in 2012. This process has been shaky. Administrative work has been burdensome and the changes have partly caused the departure of 7 people, corresponding to 28%, from the company. This has made it difficult for the company to expand its customer base.

The company's financial results have declined continuously between year 2010 and 2013. Profit and turnover have declined by 81% and 40% respectively. Therefore the company cannot by definition be considered financially successful. No evident contributing factor was presented to explain the declining financial results, but the above mentioned circumstances are considered likely to have influenced the result. Assarlind's (2014) argument that SMEs generally have difficulties to implement QM seems true in the case of company B.

5.3 Company C

The improvement work at company C is mainly conducted with the purpose of simplifying and improving everyday work for the employees. There are two reasons for this approach. The first is that management values a high employee satisfaction to keep competence within the organization. The second is the starting point that the employees themselves know best how to improve their own work. Improvement suggestions submitted by employees are considered to ultimately be beneficial to the end customer. Eventual costs associated are therefore considered long term investments. These ideas correspond to Imai's third principle. That is, a belief in peoples' inherent desire for quality and value creation, (Imai, 1986). Further parallels to the reviewed literature can be drawn from the improvement work conducted at company C. Investments in tablets have been made to increase enthusiasm for improvement work while the focus on employee health, education, and the efforts made towards personal development can be considered improvement work in itself, (Imai, 1986; Bessant et al. 1994). The division of workforce into teams generally increases process ownership, which is an important complement to CI, (Weitlaner et. al. 2012). Furthermore, a form of quality circles have been implemented and facilitated by the teams, that is, the days per year solely dedicated to improvement work. At Company C, areas in need of improvement have been identified and yearly improvement goals have been set. CI contributes to organizational alignment in the work towards common goals; (Slack & Lewis, 2011; Weitlaner, et. al., 2012). It is therefore arguably logical that unified improvement goals align an organization in its improvement work.

Company C shows a continual above average operating margin of around 12% between 2010 and 2014 and is therefore considered highly financially successful. The best result was obtained in 2014, one year after certification. The turnover had increased by 30% compared to 2013 which indicates that the company has successfully implemented its QMS. The result also followed the increased participation and number of submitted suggestions between year 2013 and 2014.

5.4 Company D

The registered improvement work at Company D has been varying. The CEO almost exclusively handled the suggestion system the first two years after certification. Improvement work started to increase in 2010 and continued to stay relatively high for three years before declining to current levels. Enthusiasm for improvement work can easily be lost after attacking and solving the apparent problems – the low hanging fruits, (Ahlström, 2014). The data indicates that this has occurred for Company D. The CEO however expresses that the employees do not have the time to report all errands in the suggestion system. Instead most suggestions are submitted verbally to the CEO. It is therefore natural that the data shows a lower participation level, but the recorded submission of suggestions has also declined. If the improvements are not recorded, it will become more difficult to follow up and evaluate their

effects as well as to update standards. The importance of maintaining standards is explained by Imai (1986), in his second principle. The verbal approach with fewer recordings therefore defeats the purpose of a suggestion system. It can also make the work with CI more tedious and possibly inefficient.

Nevertheless, the company has the prerequisites to get back to their former improvement levels. The increased autonomy provided by the recent formation of teams along with the days set aside for quality management – in essence quality circles – should contribute to creating an improvement culture. Perhaps the mediocre improvement levels in recent years are the result of a combination of not fully utilizing the suggestion system and the seemingly healthy organizational culture.

Company D has been ISO 9001 certified since 2007 and was one of the pilot companies enrolled in EIO-Q. The turnover has more than doubled between 2005 and 2014. However a 33% decline in turnover can be seen between 2010 and 2012. The acquisition of the smaller company in November 2011 affected the result for 2012 negatively, but the main reason, according to the CEO, was a change in fiscal year, moving it back 2 months in 2012.

The company shows stable financial results and is considered highly financially successful, given the definition stated in the methods section. It therefore becomes difficult to attribute the work with CI to the financial result. No direct relation between continuous improvement and financial performance can therefore be determined from the analysis of Company D.

5.5 General analysis

The statistical analysis showed that 94% of the less financially successful companies had not implemented a CI culture, whereas 61 % of the highly successful companies had such a culture in place. Overall the qualitative study supported the findings from the statistical analysis. For three out of the four investigated companies the analysis indicated a relationship between continuous improvement and financial performance. The qualitative analysis of Company A and Company C indicated a positive correlation whereas the analysis of Company B indicated the opposite. These findings supported the result from the statistical analysis. Company D was more difficult to analyze due to the mediocre improvement work presently performed combined with the high financial performance. However, it is not unlikely that the long term financial effects from continuous improvement work may still be effective for Company D, due to its former improvement efforts, which were extensive. Company D belongs to the 39 % of the highly successful companies that had a mediocre CI culture during the investigated 5 year period.

The common factor for the three financially successful companies; A, C and D, was that the work with CI was performed to increase employee satisfaction. No company conducted CI with the main purpose of cutting cost or increasing profit; improvements were seldom of a direct financial nature.

Management's engagement in CI was high for company A and C. An understanding of the concept and its purpose was obvious during the interviews. For both companies, the work with CI followed Imai's three principles.

6. Discussion

The present chapter presents a reflection regarding particular areas of the study that might question the trustworthiness of the method and the result. These areas are scrutinized and defended.

6.1 Reflections on trustworthiness

It is desirable to have a high rate of participation but it does not necessarily mean that an improvement culture exists. Suggestions can for example be submitted by the same group of people every time but decided on, implemented and followed up by various other people. Such a scenario could result in a high rate of participation without an actual improvement culture. The data examined in the present paper only shows the total participation per year of the investigated companies. It does not show individual contributions to improvement errands. It is therefore difficult to determine if a CI culture exists only by examining this type of data. N.b. that an improvement culture is reflected in the mindset and ways of working amongst the employees. Hence, the data alone cannot prove that such a culture exists; it can only point towards the probability that it does or does not. Nonetheless, the statistical analysis is most likely correct, with the proviso that errors in categorization of individual companies might be present. The size of the sample should mitigate the effects from categorization errors because a large majority of the companies displayed clear indications one way or the other. Also, one such error was also found via the interviews. The error concerned company B and warranted a revision of the statistical analysis.

The competitive situation of each company has not been examined. Many companies are located in smaller rural towns or suburbs. This means that two or more firms within the same area may compete for the same customers. How this effected the analysis is subject to further investigation. However all interviewed companies proclaimed that the demand was generally greater than the supply. This was true for Company B that is located in Malmö, where competition is fierce, as well as for Company C, competing with a handful others in a rural town outside Gothenburg, and utilizing an external workforce of 20% to meet the excess customer demand. It was also the case for Company C and Company B, which operate in smaller adjacent suburbs in the northern part of Stockholm County. Direct competition did however occur between the two during an important public procurement that Company B won on coin-flip! In any event, the four companies are representative for the EIO.

There are also internal factors that can affect the financial performance. Reinvestment of capital for competence development is one example. External education such as conferences or courses as well as competence development within the company such as trainee programs are costly arrangements that can show short term set-backs in the annual reports. Similarly, ISO-certification is in essence an investment for competence development. This is costly, and may significantly change short term financial performance, especially for companies with small margins. It is difficult to assess the costs associated with competence development, but

perhaps that is not the point. Competence development likely indicates a desire to change and to stay ahead. It should from that perspective be considered a part of continuous improvement. It is therefore arguably the associated long term benefits and not the costs that are interesting. The financial investigation performed in this study spans over five years, and is considered likely to capture the benefits from competence development, conditional upon it being continuous.

7. Conclusion

The findings of the thesis were based on a statistical analysis and they were supported by a literature review and four case studies. The purpose was to determine a relationship between continuous improvement work and financial performance.

The research showed that any small- to medium sized electrical contracting firm can benefit financially from adopting continuous improvement. It was found that the presence of an improvement culture had an impact on the financial performance during the 5-year period studied. For the interviewed companies that had embraced the concept, it took one year for the financial effects to show.

For the average electrical contracting firm, management played a crucial role in creating and sustaining an improvement culture. A suggestion system provided a structured way of working with CI and complemented an improvement culture well, but only if it was combined with managerial support, competence development and working with the PDCA-cycle.

7.1 Implications for practice

Employee satisfaction was a common key performance indicator in the electrical contracting industry. Adaptation of CI could support high employee satisfaction and consequently allow for employee engagement in the improvement work. Imai's (1986) third principle may therefore be particularly important for the electrical contracting industry.

The research indicated that resources in terms of time, people and money were limited in the electrical contracting industry. Therefore, implementation of continuous improvement work may be of particular importance for this industry, since it may free up resources in the long run and consequently positively affect the financial performance. It may also allow for maintaining the company financially successful while keeping it small and personal, which was a goal for the owners of some of the companies investigated.

7.2 Future research

This study has focused on the Swedish electrical contracting industry. It would be interesting to apply the research question to other types of industries, both service- and manufacturing oriented. Similar studies could also be performed on larger companies. The present study could for such purposes be used in a broader meta-analysis.

The statistical analysis could be refined. A longer observation period and an increased sample size may increase the accuracy of the results. For a more extensive analysis, additional categories regarding financial performance and continuous improvement work could be included. Finally, other statistical methods could be used to answer the research question. A

canonical-correlation analysis is an example of one such method that has not been discussed in this thesis.

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Appendix A

The chi-square distribution

The Chi-square distribution is a continuous probability distribution. If Z is a standard normal random variable, then Z^2 is distributed according to the chi-square distribution with one degree of freedom.

Similarly, the sum $Z_1^2 + Z_2^2 + Z_3^2 \dots Z_k^2$ has a chi-square distribution with k degrees of freedom. The degrees of freedom are the amount of system parameters that may vary independently.

Figure 1 shows the chi-square distribution for 1 to 5 degrees of freedom. The chi-square distribution is the result of a probability density function, values of which correspond to the y-axis. This function will not be discussed further. The x-axis corresponds to the chi-square values, or the X^2 -values. How to calculate the X^2 -value will be shown in the next section.

The area underneath the curve to the right of the calculated X^2 -value, given the degrees of freedom, corresponds to the probability that the outcome of the observed sample is coincidental and its variables independent. A high X^2 -value gives a small area and therefore also a low probability. This would support the alternative hypothesis. The area is however cumbersome to calculate numerically. Instead, a table containing the set probability values will be used for this study, see table 2.

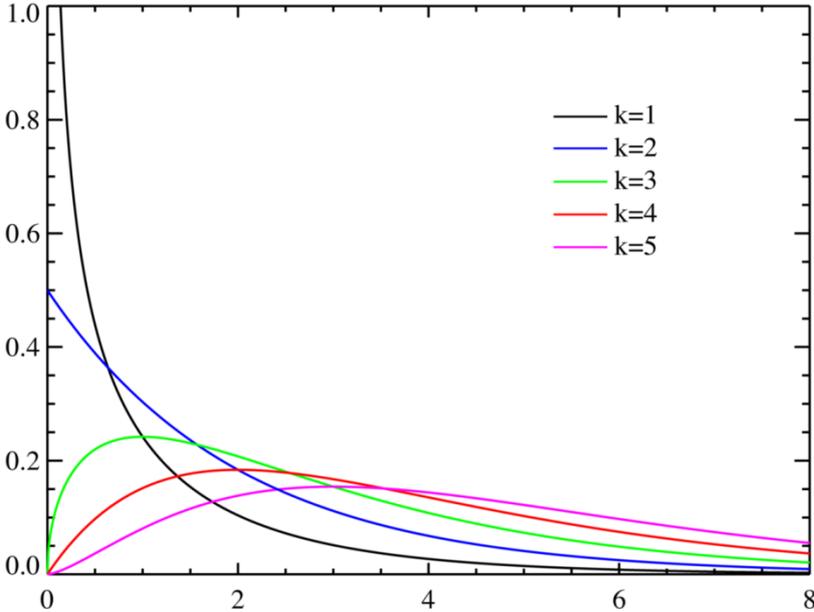


Figure A1: Plot of the Chi-square distribution for values of $k=\{1,2,3,4,5\}$.

The following part will determine the probability that the observed outcome from investigating 26 EIO-Q members regarding their financial performance and their improvement cultures is coincidental.

Pearson's chi-square test of independence

The following hypotheses were tested:

H0: Improvement culture and financial performance are independent.

H1: Improvement culture and financial performance are associated.

Table A1: The table shows the outcome from the categorization of 26 EIO-Q members along with the expected outcome.

	Improvement culture	No improvement culture	Total
Highly financially successful	6	4	10
Expected	2.69	7.31	38.46%
Less financially successful	1	15	16
Expected	4.31	11.69	61.54%
Total	7	19	26

Assuming a normally distributed sample, i.e. assuming that the null hypothesis is true, the expected outcome is calculated as; $\frac{R_i * C_j}{N}$, where R_i and C_j represent the row and column totals and N the grand total.

The chi-square value is defined as:

$$X^2 = \sum \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}} = \frac{(6 - 2.69)^2}{2.69} + \frac{(4 - 7.31)^2}{7.31} + \frac{(1 - 4.31)^2}{4.31} + \frac{(15 - 11.69)^2}{11.69} = 9.05$$

Since table 2 will be used instead of a numerical calculation, the probability level can be chosen. In this test the probability level was set to 0.01.

The degrees of freedom are calculated as:

$$k = (\sum R_i - 1) * (\sum C_j - 1) = (2 - 1) * (2 - 1) = 1$$

With one degree of freedom, the probability that the X^2 -value is larger than 6.63 is 1%. The calculated X^2 -value was 9.01. Therefore the null hypothesis can be rejected in favor of the alternative hypothesis, i.e. continuous improvement and financial performance are associated.

Table A2: Percentage points of the chi-square distribution.

Percentage Points of the Chi-Square Distribution									
Degrees of Freedom	Probability of a larger value of x^2								
	0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01
1	0.000	0.004	0.016	0.102	0.455	1.32	2.71	3.84	6.63
2	0.020	0.103	0.211	0.575	1.386	2.77	4.61	5.99	9.21
3	0.115	0.352	0.584	1.212	2.366	4.11	6.25	7.81	11.34
4	0.297	0.711	1.064	1.923	3.357	5.39	7.78	9.49	13.28
5	0.554	1.145	1.610	2.675	4.351	6.63	9.24	11.07	15.09
6	0.872	1.635	2.204	3.455	5.348	7.84	10.64	12.59	16.81
7	1.239	2.167	2.833	4.255	6.346	9.04	12.02	14.07	18.48
8	1.647	2.733	3.490	5.071	7.344	10.22	13.36	15.51	20.09
9	2.088	3.325	4.168	5.899	8.343	11.39	14.68	16.92	21.67
10	2.558	3.940	4.865	6.737	9.342	12.55	15.99	18.31	23.21
11	3.053	4.575	5.578	7.584	10.341	13.70	17.28	19.68	24.72
12	3.571	5.226	6.304	8.438	11.340	14.85	18.55	21.03	26.22
13	4.107	5.892	7.042	9.299	12.340	15.98	19.81	22.36	27.69
14	4.660	6.571	7.790	10.165	13.339	17.12	21.06	23.68	29.14
15	5.229	7.261	8.547	11.037	14.339	18.25	22.31	25.00	30.58
16	5.812	7.962	9.312	11.912	15.338	19.37	23.54	26.30	32.00
17	6.408	8.672	10.085	12.792	16.338	20.49	24.77	27.59	33.41
18	7.015	9.390	10.865	13.675	17.338	21.60	25.99	28.87	34.80
19	7.633	10.117	11.651	14.562	18.338	22.72	27.20	30.14	36.19
20	8.260	10.851	12.443	15.452	19.337	23.83	28.41	31.41	37.57
22	9.542	12.338	14.041	17.240	21.337	26.04	30.81	33.92	40.29
24	10.856	13.848	15.659	19.037	23.337	28.24	33.20	36.42	42.98
26	12.198	15.379	17.292	20.843	25.336	30.43	35.56	38.89	45.64
28	13.565	16.928	18.939	22.657	27.336	32.62	37.92	41.34	48.28
30	14.953	18.493	20.599	24.478	29.336	34.80	40.26	43.77	50.89
40	22.164	26.509	29.051	33.660	39.335	45.62	51.80	55.76	63.69
50	27.707	34.764	37.689	42.942	49.335	56.33	63.17	67.50	76.15
60	37.485	43.188	46.459	52.294	59.335	66.98	74.40	79.08	88.38

Appendix B

The interview guide provides a platform for discussion regarding quality management and continuous improvement.

This guide will provide information on how to conduct an interview with a company to evaluate how they work with continuous improvement. The guide will also include discussion points on quality management and ISO 9001-certification.

- **Purpose:** The purpose is to facilitate an interview format where reasoning and discussion around continuous improvement is encouraged.
- **Scope, time frame and limitations:** Interviews with four companies will be conducted. The interviews will not exceed one hour.
- **Ethical aspects:** Eventual sensitive information obtained will not be disclosed to others outside the scope of the Masters' thesis project unless permission is granted by the concerned party. The interviewed companies will be anonymous in the report.
- **Method:** A semi-structured format will be used for the interviews. Relevant information will be transcribed by hand. Complementary interviews by phone may be required.
- **Validity of questions:** A literature review regarding continuous improvements will be performed prior to the interviews in order to increase the understanding of continuous improvement in small- to medium sized service enterprises (SMSEs).

Questions and discussion points

Introduction

- Personal background
- Work responsibilities

EIO-Q and ISO 9001 certification

- Purpose with EIO-Q membership
- Purpose with ISO 9001 certification
- Effects from ISO 9001 certification

Continuous improvement

- Personal approach
- Influence on daily work
- Company approach
- Employee attitudes
- General effects from continuous improvement
- Identification of improvement areas
- Improvement statistics
- Financial effects from continuous improvement
- Improvement goals

Appendix C

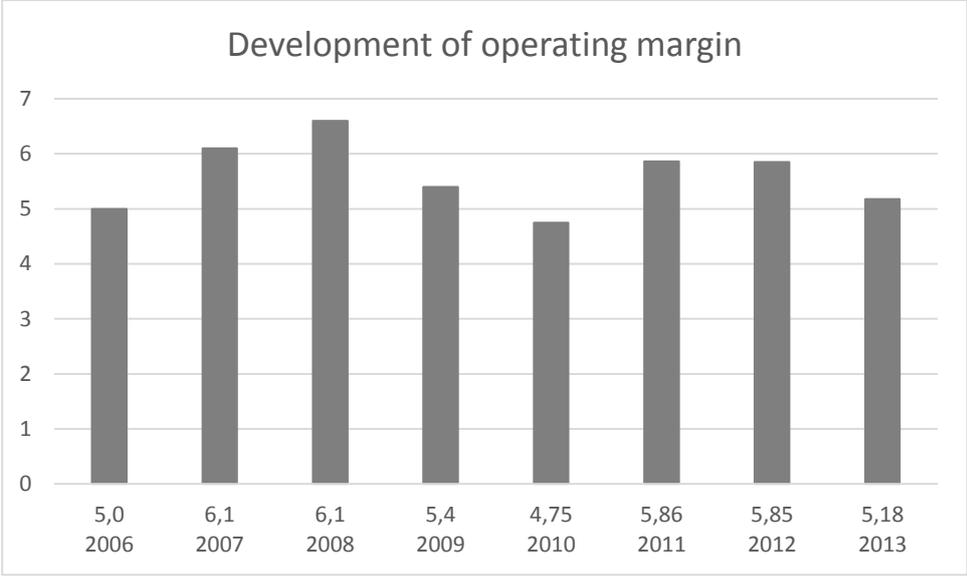


Figure C1: Development of operating margin of the EIO group from the year 2006 to 2013. 1360 member companies are included.

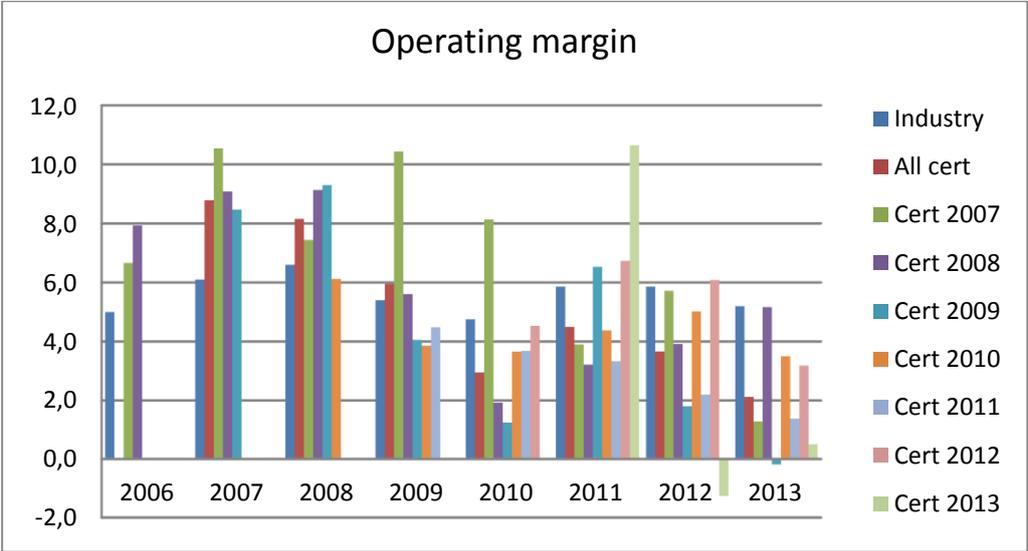


Figure C2: Development of operating margin sorted by certification year. 50 EIO-Q members companies are included.

Appendix D

