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THE ROLE OF MANAGERS IN THE CONTEXT WITH THE IMPLEMENTATION OF LEAN SIX SIGMA IN SMALL AND MEDIUM-SIZED ENTERPRISES

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Abstract

The aim of the paper is to examine the influence of managers during the implementation of Lean Six Sigma in small and medium-sized enterprises. A systematic literature review consisted of published journal papers from academic databases is conducted. The active participation during the Lean Six Sigma implementation process and in Lean Six Sigma trainings as well as the motivation of the employees are the most important responsibilities of the management for the successful LSS implementation in small and medium-sized enterprises. The greatest strength of the management in small and medium-sized enterprises would be the easy support due to fewer hierarchical layers while the greatest weakness is the low Lean Six Sigma awareness and knowledge. The training, resource and financial limitations in small and medium-sized enterprises are the largest hurdles for the management to implement LSS successfully.

Keywords: Lean Six Sigma; small and medium-sized enterprises; Managers; Leadership.

1 INTRODUCTION

Since a decade the pressure started rising throughout small and medium-sized enterprises (SMEs) to use established quality management techniques like Six Sigma (SS) or Lean Six Sigma (LSS) as well as other approaches. The growing importance of supply chain management issues in a global market environment make large firms heavily dependent on SMEs for the provision of high quality products or services at low costs. This fact leave no choice for SMEs to consider the introduction of a business strategy like SS or LSS (Antony et. al. 2005).

The current literature shows that there are very few research papers about SS or LSS in smaller organizations which indicate that these initiatives in the SME sector have not been studied very critically so far. Many key questions remain unanswered as the LSS discourse in the SME literature is emergent in nature (Antony et al. 2008; Kumar and Antony, 2008, 2009). However, various authors argue that LSS can be implemented successfully in any organizations, irrespective of the size of the company. There is nothing inherent in SS or LSS that makes it more suitable in larger companies (Kumar and Antony, 2009). Until now, LSS has been extensively implemented in the larger industrial units successfully and not in SMEs due to resource and financial limitations (Deshmukh and Chavan, 2012) although SMEs are considered according to Antony et al. (2005) as the lifeblood of a modern economy.

Top management commitment and a strong leadership are the key characteristics for the successful implementation of quality initiatives in enterprises (Tennant, 2001; Kumar and Antony, 2009). Nevertheless, management skills and styles in SMEs and larger enterprises differentiate with each other (Wolf et. al. 2009). Due to this reason this paper examine the management role in the context with the implementation of LSS in SMEs.

In order to achieve the proposed objective the research is organized into seven chapters. In chapter 2, the research questions and methodology will be presented, followed by theoretical fundamentals about terms like management, LSS and SMEs (chapter 3). Chapter 4 provides an overview about the requirements and responsibilities of the SME management while chapter 5 discusses the SME management strengths and weaknesses. In Chapter 6 are the challenges for the SME management derived and finally, the paper ends with a summary and conclusion in chapter 7 about the key findings of the research.

2 RESEARCH AND METHODOLOGY

The study was prepared to answer the following research questions:

RQ1: What are the requirements and responsibilities of the SME Management in the context with the implementation of LSS in SMEs?

RQ2: What are the strengths and weaknesses of the SME Management in the context with the implementation of LSS in SMEs?

RQ3: What are the challenges for the SME Management in the context with the implementation of LSS in SMEs?

To answer these research questions a systematic literature review consisted of published journal papers from academic databases will be conducted. The "journal" search for research literature was undertaken through four well-known academic databases: Emerald, Elsevier, ProQuest and Taylor & Francis. Search strings were used as follows: [(lean six sigma) or (six sigma) AND (management) AND (sme)].

3 THEORETICAL BACKGROUND

3.1 Management

The current literature consists of many papers where differences between the terms management and leadership are debated. It is very often thought that management and leadership have the same meaning, however this is not the case. Management creates rules and constancy while leadership creates change and moving (Kotter, 2008). Leadership is rather defined as a process which involved the leaders personality and behaviours. It can be considered as commitment, enthusiasm, beliefs and values needed to motivate employees to apply their talents to help implementing companies plans (Pamfilie et al. 2012). Managers rather ensure that the processes and organization function well and smoothly (Kotter, 2008). Kotter (2008) defined for both terms 3 core processes. For the term "management" these are planning and budgeting, organizing and filling vacancies as well as controlling and problem solving whereas for the term "leadership" these are showing and directing, aligning employees accordingly as well as motivation and inspiration. Nevertheless, the paper continue with the term "management" in the following chapters because for the scope of this article a differentiation of these two terms is not needed.

3.2 Lean Six Sigma

SS is a disciplined and data driven business improvement methodology that was developed to enhance the quality of processes with the objective to establish an almost zero-defect quality strategy and thus to increase customer satisfaction and to improve financial results. Bill Smith from Motorola/USA developed SS in 1987. Based on the ideas of statistical process control, Motorola defined "six sigma" as 3,4 defects per million opportunities in a given production process. Sigma (σ) is used to represent the variation (standard deviation) of a process mean. "Six" means that the distance between the mean and the critical tolerance limits shall be 6 standard deviations constantly. It is initially applied in the manufacturing sector but has now spanned over service, financial, healthcare and public sectors (Arnheiter and Maleyeff, 2005; Pyzdek, 2003). SS is also being widely recognized as an effective leadership development tool. After 1995, SS was enhanced by GE as a business strategy used to improve business profitability (Coronado and Antony, 2002). In 2003, LSS was established as part of the evolution of SS. It is the combination of Lean Management and SS which are the most popular business strategies for enabling continuous improvement and improved bottom-line results (Albliwi et al. 2015). It achieves these by merging tools and principles to overcome the weaknesses and bring out the advantages of both programs. Lean focuses on removing all types of waste from the process (the efficiency issue) while SS concentrates on controlling the process statistically and removing variation from the process (the effectiveness issue). The phrase “Lean Six Sigma” is therefore used to describe the integration of these both approaches as a comprehensive management system (Arnheiter and Maleyeff, 2005).

3.3 Small and medium-sized enterprises

From 1990s onward, with the globalization of the world market, a continuous trend toward downsizing large firms and outsourcing businesses to smaller firms seems to be the latest trend (Antony et al. 2005; Kumar and Antony, 2008). SMEs hold up to 99.8% of the total number of enterprises, representing 66.5% of total employees and contribute 57.6% of the total value added to the EU. Moreover, more than 50% of the employees from manufacturing companies in the countries of the European Union are working in SME manufacturing companies (Gagliardi et al. 2013). For this reasons, SMEs moved into the focus of the scientific work of many authors. Table I presents a detailed definition of SMEs, which was proposed by the European Commission (2005), adopted by the European Union Member States and entered into force in 2005.

Table 1 Definition of SMEs. Source: European Commission (2005)

Enterprise size	Employees		Annual turnover		Annual balance sheet total
Large	> 250	AND	> €50 million	OR	> €43 million
Medium-sized	< 250		< €50 million		< €43 million
Small	< 50		< €10 million		< €10 million
Micro	< 10		< €2 million		< €2 million

4 REQUIREMENTS AND RESPONSIBILITIES OF THE SME MANAGEMENT

According to the results from different empirical studies management involvement and commitment is the most important critical success factor irrespective from the organization size (Kumar and Antony, 2008; Antony et al. 2008; Antony and Desai, 2009; Brun, 2010). Taking now into consideration the many differences in SMEs, it must be understood that LSS requires the same leadership and commitment with the same responsibilities as in larger companies (Burton, 2004). A high management participation in the LSS implementation process and training as well as the employee motivation to LSS are the most important responsibilities discussed in the literature and therefore detailed in the next subchapters (Raghunath and Jayathirtha, 2013; Arnhneiter and Maleyeff, 2005).

4.1 Active management participation in the Lean Six Sigma process

Cultural changes assume to be a difficult and realizable long-term process and also present a high degree of anxiety, on which the leader should focused his attention in order to make changes within the organization and to implement a new organizational culture (Pamfilie et al. 2012). An obsessive, compulsive and visibly management commitment and support is absolutely required to drive LSS deep into a company´s culture. According to many authors experiences can be said that if the management actively gets involved, support and drive the initiative, it will definitely work. And if one important person is actively against SS, then this attitude must be changed immediately (Pande et al. 2000; Coronado and Antony, 2002; Tennant, 2001; Kumar and Antony, 2009). Similar results found Leyendecker et al. (2011) in their study that if SS is accepted by the management, the program is overall more active and more projects achieve the targets regarding time, costs and quality.

The level of the target achievement should be controlled by the management via key performance indicators (KPIs). Until now, not many enterprises have implemented such KPI-system, however in these companies who have it, the achievement of the project targets is 15% higher than in enterprises which have no KPI-system (Leyendecker et al. 2011).

Raghunath and Jayathirtha (2013) state that a poor leadership and lack of management commitment can actually lead to the result that SS is viewed as just a passing management fad which only adds to cost without significant financial gains. Others argue that if the team members feel a lack of confidence in their leaders, they will start the project with many doubts and they will not give all their efforts in order to complete the project with good results (Pamfilie et al. 2012; Leyendecker et al. 2011). LSS shall be therefore driven hierarchically from the senior management team and deployed effectively throughout an organisation like a top-down strategy which is the best approach for successful LSS implementation. Additionally, it is recommended to link any quality improvement initiative directly with the management strategy, culture and change into a sound corporate strategy plan (Tennant, 2001; Antony, 2004). Pande *et al*. (2000) for instance suggest to link LSS into the mission and vision of their organization.

4.2 Active management participation in Lean Six Sigma trainings

If leaders may choose to implement the LSS methodology because they just heard about its success in other organizations, the project will fail in most cases when this is the only argument in driving the implementation. First of all, leaders as well as the top management has to be familiar with the methodology, tools, techniques, processes and should also have knowledge how to create an organization that works together for proper implementation of LSS. Therefore, training is a very serious critical success factors (Pyzdek, 2003; Pande et al. 2000). Pande et al. (2000) recommend managers to understand the concept, benefits and implementation steps by participating in an overview training of LSS.

To produce the expected results with LSS, organizational roles on higher management level are clearly defined in the LSS approach. On top of that is the Sponsor who is responsible for the overall initiative and develop a deployment strategy with a time plan. Sponsors shall participate on a basic awareness and understanding training for approximately a half day so they can fund projects appropriately and understand what will be delivered. Champions, who are also on executive level, usually receive training on technical aspects as well as on how to lead an initiative. They are responsible to identify the right projects, ensure the availability of resources for training and projects as well as being involved in project tollgate reviews. They request the quality managers to form a team from respective departments where there is a problem. If the business leaders and their team cannot invest two days of their own time in learning more about SS and their role, then they are not ready to start such initiative (Pande et al. 2000; Pyzdek, 2003).

4.3 Active employees motivation to Lean Six Sigma

As described in subchapter 4.1 LSS shall be de deployed effectively throughout an organisation like a top-down strategy which is also related to the training approach. Training shall start at the top of the organization and then be cascaded through the organizational hierarchy to transfer the knowledge into the organization effectively for a company-wide commitment regarding the introduction of new quality initiatives (Raghunath and Jayathirtha, 2013). The number and range of tools and techniques available in the LSS tool kit is vast and it is critical that staff are aware of them and trained well enough in their use as well as being able to follow the DMAIC methodology. For this reason, it is very important that the management provide regular training opportunities to their employees and formulating newer training methods which promote their commitment (Deshmukh and Lakhe, 2009). According to Leyendecker et al. (2011) the share of successful projects increase from 70% to over 80% by a higher quality of the own training programs. Beside the classifications on higher management level (Sponsor, Champion) exist the following four main classifications for employees who are trained in the LSS approach: Master Black Belt, Black Belt, Green Belt and Yellow Belt (Chakraborty and Tan, 2007). Additionally, the management should give their employees commitment of support and communicate how important their participation will be towards the success of the program and the business before a training program for employees start (Raghunath and Jayathirtha, 2013).

Training for employees is only one important key requirement for their motivation. Hoerl et al. (2004) conclude that LSS offers statisticians and quality professionals a unique opportunity to play a leadership role in their organizations. For this reason, it is essential to attract the best people with good leadership to be involved in the company's first wave SS Black Belt training (Pyzdek, 2003; Leyendecker et al. 2011). Enterprises, that consider for the selection of Black Belts and Green Belts various criteria, achieve better results. They manage twice as many projects and the portion of successful projects is on average 15% higher than in enterprises that have no structured personnel selection procedures (Leyendecker et al. 2011). The selection of top talents would give a clear message to the organization that the management is committed and serious about LSS which will also motivate other employees to get involved in the journey (Pyzdek, 2003).

Furthermore, the involvement of all employees in the implementation phase is also an essential success factor for the successful introduction of LSS (Deshmukh and Lakhe, 2009). As in subchapter 3.1 already described leadership is crystallizing a direction for employees. It is the source of beliefs and values that has the ability to motivate people in order to achieve the organization objectives. Through their involvement by the management, employees are encouraged to contribute to change. If the implementation of LSS has resulted in improved processes within the organization and the employees are informed of the benefits brought, whether they were directly involved in the implementation flow or not, this will give a state of positive spirit and confidence in their workplace and within the organizations. By applying this approach, the employees will follow the model of their leaders and will focus their work (Pamfilie et al. 2012). Biolos (2002) report that Subir Chowdhury, executive vice president of the American Supplier Institute and author of Design for Six Sigma, has found that many SS efforts fail because the leadership fails to ensure that everybody "gets it".

Moreover, the introduction of a reward and recognition system would be a very effective motivational tool to increase the performance of LSS employees. This can be in terms of gifts, promotions or celebrating parties (Arnheiter and Maleyeff, 2005). As example is here Antony et al. (2006) study to mention where resistance from employees occurred in regards to the implementation of the LSS framework. The employees thought that LSS could endanger their job opportunities. This attitude was corrected by the top management, convincing the employees that their jobs would not be in danger and that they would be rewarded for better performance what boosted confidence in the employees and therefore they were ready to embrace the proposed LSS framework in their processes.

5 STRENGTHS AND WEAKNESSES OF THE SME MANAGEMENT

Beside the requirements and responsibilities of the SME management there are specific strengths of the SME management which make it easier on the one hand but also specific weaknesses which make it more difficult on the other hand to carry out the needed tasks in the context with the successful implementation of LSS in SMEs.

Starting with the benefits can be said that smaller companies are more agile because of a smaller number of sites, management members and direct stakeholders as well as a strong owner influence. These aspects make it much easier then to buy-in management support and commitment as opposed to large organizations. Furthermore, the fewer layers in the management hierarchy ensure a better top management physical presence and involvement, a faster decision making process and more effective, open and faster communication channels (Antony et al. 2005; Rowlands, 2004). Additionally, Freiesleben (2006) mentioned in his article the better control of policy implementation because of the smaller management in SMEs.

As weaknesses of the SME management Wessel and Burcher (2004) report the little awareness of LSS which also lead to the fact that training needs are not recognized. Many SMEs in Germany for instance even do not know about SS or do not believe their organization is suitable for its implementation (Wessel and Burcher, 2004). Deshmukh and Lakhe (2010) found in their study that the majority of SMEs located in central India are aware of SS but most of them have never used it. Additionally, various authors found in their studies also a lack of intellectual capacity of the management in regards to statistics compared to large organizations. In many cases the management even become frightened when statistical tools are required and discussed (Wessel and Burcher, 2004, Deleryd et al. 1999).

According to Jie et al. (2014) lacking management skills and knowledge of LSS is one of the main causes that bring such projects to fail. The lower the knowledge about LSS benefits, the more difficult convincing the top management what was discovered as the most arduous task during the case study of Kumar et. al. (2006) undertaken by implementing a LSS framework into an Indian SME. The management was not ready to compromise on production to improve the quality. For the top management investing in quality meant to increase the cost of production. Examples of other companies about their significant production cost reduction as well as enhanced bottom-line results by using LSS principles have been shown to convince them. Also in Jie et. al. (2014) case study analysis in the label printing production the management was not able in the beginning to identify the benefits of LSS due to little awareness. They preferred focusing on production rather than spending time and money to improve the quality aspect of it and were additionally worried that these cultural changes in the production would bring negative impact towards the production. Therefore LSS was implemented in stages, where changes are not too drastic in order to visualize the improvement made in a practical way to the management.

6 CHALLENGES FOR THE SME MANAGEMENT

A such weakness like the low LSS awareness and knowledge of the management result to a low level cultural readiness and make it therefore difficult to implement a quality culture like LSS in SMEs. The management of SMEs must therefore face the challenge to especially motivate itself by participating in regular trainings to get more aware about this methodology. Wessel and Burcher (2004) recommend an one-day awareness training for the management and their employees of SMEs to facilitate the cultural implementation element and consequently to promote willingness to change organizational structures.

Beside this weakness of the SME management there are also general weaknesses of SMEs which could bring special challenges for the SME management to implement LSS. For instance are inadequate resources with insufficient knowledge a reason for non-implementation of LSS in SMEs. Statistical tools like process control theory or experimental design concepts are relatively low applied in SMEs because their employees do not have experiences and are therefore unmotivated to use it. So far, statistical concepts are mainly used in the domain of the larger industries in which resources are available to train the workforce to apply these concepts. Unfortunately, only a limited talent pool exist in smaller companies (Isenberg, 2000). Small companies do not have the slack to free up top talented people to engage in training as they are crucial to the day-to-day operations within the company. SMEs have less spare resources than larger enterprises and usually every employee has beside its key role several other (Isenberg, 2000; Wessel and Burcher, 2004). The lack of resources in form of time and manpower, limitations in financial resources and the non-recognition of training by the management really hinder small companies to provide training and thus to implement LSS (Wessel and Burcher, 2004; Antony et. al. 2005). And these enterprises which recognize the need for training also often do not have a clear vision of what is required (Rowlands, 2004; Antony et. al. 2005; Deshmukh and Chavan, 2012). Due to this facts can be concluded that the training component is much harder in smaller companies. The management of SMEs must motivate their employees to participate in regular trainings and communicate how important it is to understand statistics for LSS. In future, a deeper understanding of statistical concepts is really required in SMEs to improve their manufacturing processes (Wessel and Burcher, 2004, Deleryd et al. 1999).

7 SUMMARY AND CONCLUSION

The objective of this paper is the investigation of the management role in the context with the implementation of LSS in SMEs based on the current literature. Core results of this paper are summarized in table 2 which provides an overview about the SME management requirements and responsibilities, strengths and weaknesses as well as challenges. It is a good overview for managers of SMEs to see the expectations in itself as well as the potential hurdles which could arise during the implementation of LSS.

Management commitment is the most important critical success factor for the implementation of LSS. The most essential requirements and responsibilities of the management are the active participation during the LSS implementation stages and in LSS trainings to receive a better understanding of this methodology as well as the motivation of their employees to achieve a company-wide commitment for the LSS program. The smaller management with fewer layers in the hierarchy make it easier for SMEs to buy-in management support which is to be considered as the greatest strength for SMEs. On the other hand are the low LSS awareness and methodology understanding of the SME management the major weakness which make it difficult to implement LSS. Furthermore must be mentioned the training, resource and financial limitations in SMEs as further challenge for the management to implement LSS. To avoid these problems the management must deepen its focus there. In future, a detailed concept with guidelines must be developed how to avoid these weaknesses to ensure an easier implementation of LSS in SMEs. This can only be achieved by undertaking more and more practical studies, empirical studies and expert interviews in different regions of the world.

Table 2 Summary of the SME Management role for the implementation of Lean Six Sigma

<table>
<tr><th colspan="2">Requirements and Responsibilities</th></tr>
<tr><td colspan="2">1. Obsessive and compulsive commitment
2. Visible supportive as well as active participation and involvement
3. To communicate the need and importance of LSS to the employees (especially statistics)
4. To develop a LSS deployment strategy plan
5. To develop a LSS implementation time plan (3-5 years)
6. To link LSS with the management/business strategy
7. To link LSS into the mission, vision and values of the company
8. To ensure an effective hierarchically top-down strategy (e.g. training, communication, commitment, implementation etc.)
9. To understand the LSS techniques, methodology, tools and processes
10. To participate in a LSS overview training
11. To participate in project reviews and monitor the level of target achievement by KPIs
12. To identify the right projects
13. To ensure budget and resource availability for projects and training
14. To provide regular training opportunities to their employees and formulating newer training methods
15. To attract the best people for training with good leadership by a structured personnel selection procedures
16. To involve and motivate all employees in the implementation phase
17. To inform employees about successful LSS results
18. To indtroduce a reward and recognition systém
19. To incorporate LSS into their leadership development process</td></tr>
<tr><th>Strengths</th><th>Weaknesses</th></tr>
<tr><td>• More agile management, easier to buy-in management support/ commitment as well as better control of policy implementation due to smaller number of sites, stronger owner influence and a smaller management
• Faster decision making process and more effective communication channels due to fewer layers in the management hierarchy</td><td>• Little LSS awareness and knowledge
• Lack of intellectual capacity (statistical tools) by the management
• Non-recognition of LSS training needs by the management</td></tr>
<tr><th colspan="2">Challenges</th></tr>
<tr><td colspan="2">• Difficult to train and motivate employees due to limited talent pool, little personnal spare resources, financial limitations and non-recognition of the training needs by the management
• Difficult to implement LSS due to lacking LSS skills, low LSS awareness and low methodology understanding by the management</td></tr>
</table>

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Abbreviations

Six Sigma	SS
Lean Six Sigma	LSS
Small and medium-sized enterprise	SME

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