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Lean Six Sigma Implementation: Does Success Means Sustainability?

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Abstract

Lean Six Sigma (LSS) has proven as an effective methodology and strategy for business success in both private and public sectors. LSS views business processes as engines that drive performance excellence and help to deliver business value. Hence LSS offers a comprehensible road map, tools and techniques for achieving superior process improvement for business success. However, prior researches of LSS were predominantly focused on the study of success factors for LSS implementation. Whereas, this research aims to explore does the LSS success factors still serve as the driving agents to sustain the continuation of LSS success through a case study on a company that had implemented LSS for 15 years (company D). Five LSS success factors are identified from literature review, which are Continuous Improvement Culture, Innovative Culture, Top Management Support, Employee LSS Knowledge and Communication. The study is quantitative based, the important level of each success factors and the perceived level of LSS project's performance are assessed via survey questionnaire which answered by 50 engineers or managers from company D. Data are analysed via Person Correlation to gauge the correlation between the 5 LSS success factors and LSS project's performance. Finding from the research suggests that LSS success factors Innovative Culture, Communication and Top Management Support which are commonly agreed by prior researchers as important factors for LSS implementation; are viewed by respondents via this research as factors that endorsing weak impact or correlation with LSS project's performance. Outcome from the research implies that there is/are other underlying variable within the scope of Employee LSS Knowledge and Continuous Improvement Culture that contribute to the sustainability of LSS implementation which is worth for further study.

Keywords: Lean Six Sigma; Success Factor; Sustainability; Lean; Six Sigma

Introduction

Company D is an automotive multinational company (MNC) operating in Singapore as a manufacturing plant for 35 years. The company is a highly automated plant that manufactures

and ships a wide-range of automotive products to all major vehicle customers at 166 locations around the world. The automotive products including powertrain (gas and diesel), active safety, passive sensors, crash sensors, semiconductors, and in-car entertainment system.

The main challenge for the company at this moment is to deal with the intense cost pressure in the fierce competitive globalized market as well as internal competition with the two sister companies located at Mexico and China. For the last 15 years, Lean, Six Sigma followed by Lean Six Sigma has been successfully implemented in the company as the main business improvement tools. As such, to maintain the company competitive advantage, the main focus for the management team is to sustain the Lean Six Sigma drives of continuous business improvements, with the ultimate aim to enhance and sustain the company business performance.

In the current literature of LSS, majority of the prior Lean Six Sigma (LSS) researches are focused on the study of success factors for LSS implementation (Okpala, 2013 ; Alessandro and Antony, 2012; Zhang et. al., 2012) . There is lack of research that explores the sustainability factors or factors for the continuation of LSS's drive post the first LSS implementation stage. As such, this research aims to explores does the LSS success factors still serve as the driving agents to sustain the continuation of LSS success through a case study on company D.

Literature Review

Lean Six Sigma(LSS) is a business strategy which adopts the lean and six sigma concept and tools. Lean concept and tools emphasize on waste and lead time reduction as well as value creation. While Six Sigma concept and tools focus on minimizing variation and create value in term of quality improvement, cost and delivery of product and service to the customers (Staats et. al., 2011). The adoption of these two concepts reinforces organization's competitive advantage, as the result sustain organization growth in term of sales and profitability (Yadav and Desai, 2016).

DMAIC model refers to the five interconnected stages for problem solving and process improvement via LSS (Staats et. al., 2011), which are Define, Measure, Analyze, Improve and Control. The DMAIC model presents a step by step process framework on how problems should be identified, analyzed and addressed via LSS tools (Yadav G. and Desai, 2016). DMAIC model provides users the platform to make decisions based on real and scientific facts rather than on experience and knowledge (Thomas, 2016).

LSS approach in Company D focuses on the training of employee on LSS's DMAIC methodology and LSS tools. A lead LSS Black Belt (BB) is appointed to plan and guide employees on the application of LSS tools via DMAIC methodology. DMAIC methodology has been widely applied across the company where every leaders and engineers are required to be trained on LSS tool and DMAIC methodology. There are total of 60 engineers and managers who are trained and certified as Green Belt (GB) or BB within the company. There is a pool of 10 BB in the company who provided training and guidance to engineers, with the ultimate aim to continuously improve business performance via LSS methodology.

To sustain LSS implementation, a culture of continuous improvement must be nurtured and promoted. Hence, for an organization to succeed in promoting culture of continuous improvement, the organization must emphasize on the application of the LSS tools on a regular basis (Alessandro and Jiju, 2012). This concept is applied in Company D where the top management team of the company expected all problems solving approach should be following the framework of DMIAC and application of LSS tools. In addition, the company also appointed a fulltime LSS Champion to drive LSS initiatives. The roles played by champion including to lead, coordinate, teach, coach and drive monthly LSS workshop in each business unit or functional group with the ultimate aim to ensure continuation of the LSS drive.

Base on the finding from literature review of LSS success factors and by taken into account the setting of the company under study, five LSS success factors are identified in this research, which are Continuous Improvement Culture, Innovation Culture, Top Management Approach, Employees LSS Knowledge and Communication.

(a) Continuous Improvement Culture

Continuous improvement culture is the key driving agent for long term competitive advantage (Botin and Vergara, 2015). Lean Six Sigma is built on the principle of relentlessly pursuing on problem solving and continuous improvement in order to sustain company performance as well as competitive advantage. As such, continuous improvement culture is the fundamental requirement and factors for LSS success.

(b) Innovative Culture

Study done by Lubowe et. al. (2007) suggested that innovative leaders and culture and are the main attributes that set the best LSS practice and success companies apart from those average company that practicing the traditional incremental improvement approach. Hence, to foster business improvement, organization leaders should apply innovative approach and bring other resources along with whatever support mechanisms (such as new technology, equipment) to foster improvement via creative and innovative thinking (Hauser, Tellis and Griffin, 2006).

(c) Top Management Support

The approach and role of top management in related to LSS can be illustrated by four analogies; top management should play the roles as investors, customers, coaches and partners throughout the LSS implementation cycle (Hauser, Tellis and Griffin, 2006). The support from top management team including the process of identify and bring the right people together to form a LSS team, offering LSS training, identifying business constraints and issues, LSS planning and execution.

(d) Employees LSS Knowledge Level

Lean Six Sigma have evolved to as a comprehensive management systems, encompassing features such as an emphasis on customer satisfaction, high quality, and comprehensive employee training and empowerment (Arnheiter and Maleyeff, 2005). Employees play an important role on delivering valued service to customers in order to ensure company growth and success (Jeyaraman and Teo, 2010). Hence, continuous upgrading of employees knowledge on LSS is crucial to ensure the sustainability of lean six sigma drive.

(e) Communication

According to Yadav and Desai (2016), innovative and improvement are not confined within the scope of developing innovative and improvement ideas and plan, but also involved how the idea is being communicated vertical and horizontally within the organization base on two-ways communication basis. The nature of LSS project that operate bases on teamwork basis makes communication as another crucial factor for LSS success (Thomas, 2016).

(f) LSS Project's Performance

The success of LSS project is typically measured by operational performance (Jeyaraman and Teo, 2010). Operational performance reflects the performance of internal operations of the company in terms of cost and waste reduction, product quality improvement, delivery performance, flexibility and productivity improvement (Jeyaraman and Teo, 2010). In the case of Company D, a balanced scorecard model is used to assess the LSS project's performance. The scorecard makes up of 4 key measurement scopes, which are cost, safety, delivery and customer satisfaction.

Research Methodology

This research is quantitative based. A questionnaire that consist of 39 items and is designed based on the finding from the extensive literature review of LSS success factors and LSS project performance measures. The population for the study are engineers and managers from company D who had lead minimum one LSS project, there are 60 of them. Respondents are asked to rate the perceived important level of LSS success factors and level of LSS project performance based on the five point scale ranging from (1) very low to (5) very high. In term of analysis, scale reliability via Cronbach's Alpha is used to assess the consistency of homogeneity among items. A reliability coefficient of above 0.7 will be considered as statistically significant (Rasli, 2006). Subsequently, Pearson correlation test is used to gauge the strength and direction of the relationship between the 5 LSS success factors and LSS project performance.

Result

There surveys were responded by 51 engineers and managers. Returned questionnaires were screened through to ensure data in the questionnaires are all in place, and accounted for. The total useable respondents is 50, this made up a useable response rate of 83.3%.

The Cronbach Alpha reliability values for the 39 survey items are 0.924, which is higher than 0.7. This implies that the consistencies of homogeneity among items are statistically significant to proceed for further analysis.

The analysis result from Person Correlation test between LSS success factors and LSS Project's Performance are summarized in Table 1.0.

Table 1.0

Correlation between LSS Success Factors and LSS Project's Performance

LSS Success Factors	Correlation with LSS Project Performance (r)	Significance at 95% confidence level (sig)
Employee LSS knowledge	Positive Moderate (0.423)	Significance (0.002)
Continuous Improvement Culture	Positive Moderate (0.402)	Significance (0.004)

Innovative Culture	Positive Weak (0.312)	Significance (0.028)
Communication	Positive Weak (0.286)	Significance (0.044)
Top Management Support	Positive Weak (0.213)	Not significance (0.138)

Discussion

Base on Table 1.0, finding from the research suggests that the correlation between Employee LSS Knowledge and LSS Project's Performance is positive, moderate and significant at 95% confidence level. This is in line with finding of prior researches (Antony and Banuelas, 2002; Robinson and Schroeder, 2009; Jeyaraman and Teo, 2010) which highlighted that employee knowledge in term of skill, ideas and creativity are among the most important factor that have impact on both organization's incremental and radical improvements, hence they are important to ensure company growth, success as well as sustainable.

Finding from the research also reveals that Continuous Improvement Culture is also moderate, positive and significantly correlated with LSS Project's Performance at 95% confidence level. The finding echoes research done by Jeyaraman and Leam (2010); Zailani, Shaharudin and Saw (2015) which suggested that continuous improved culture is one of the most important factor for building up organization dynamic capabilities and to sustain company competitive advantage.

However from the research, LSS success factors Innovative Culture, Communication and Top Management Support are found positive but weakly correlated with LSS Project's Performance. In addition, the correlation between Top Management Support and LSS Project's Performance is not significant at 95% confidence level. All the three finding are not in line with most of the prior studies.

According to Sameer and Michael (2009), organization innovation atmosphere will directly affect the employee's innovative behavior, capability and ultimately organization performance through attitudes, beliefs, motivations and values of members of the organization. Communication is also regarded by most of the prior researchers (Gelei, 2015; Yadav and Desai, 2016; Thomas, 2016) as the central of organization success. Communication is even more essential during the implementation of change. Top management support and commitment is also regarded by prior researchers as being crucial for successful innovation (Ronald, 2010). The subject of leadership is even more important when innovation is concerned with radical change as it requires a level of learning and change that is often disruptive, risky and costly. Hence, this requires energy (resources and power), which is primarily owned and controlled by top management (Ronald, 2010; Sameer and Michael, 2009).

Company D has implemented LSS improvement approach for 15 years and the approach still remains as the key attribute for the company to sustain competitive advantage with significant improvement on company performance. The fundamental approach adopted by the company in the implementation of LSS is associated with LSS's DMAIC framework. The framework provides a system matric guideline on the discovering of business improvement opportunity; methodology of identify critical variables or indicators for business processes; tool and technique used for data collection, analysis and reporting. A substantial training in term of LSS methodology had been conducted among the employee ranging from staff to

managers. In addition Company D is producing high technology products which require knowledgeable workforce to handle high technology equipment. As such Company D has relatively higher percentage of knowledgeable workforce and majority of them are LSS certified Green Belt (GB) and Black Belt (BB), i.e. the LSS experts. This group of experts has been trained, applied and continuously practicing the LSS approach on their daily works across the company. According to Mitch and McCrimmon, (2010), knowledge workers are group of people who can manage themselves and they viewed management as a default process. Finding from this research suggests that perhaps the knowledge workforce of company D has reached a mature stage where they are knowledgeable to drive new improvement initiatives, they are self-driven for the planning, execution and communication of improvement projects and they are motivated by the continuous improvement culture (Mitch McCrimmon, 2010). Hence possibly these are the reasons that trigger the weak relationship between LSS project's performance with Innovation Culture, Communication and Top Management Support.

Conclusion

The study integrates the finding of Lean Six Sigma success factors proposed by prior research with the actual setting or practices within company D, which had implemented LSS for 15 years. Hence, the factors and framework used in this study carries a descriptive value in terms of studying and defining the relationships between organizational LSS sustainability factors and LSS sustainability. Finding from the research reveals that, within the setting of the company under study, factors that suggested by prior researchers as important for the success of LSS implementation are generally found have less or no significant impact toward sustainability of LSS. LSS success factors Employees LSS Knowledge and Continuous Improvement Culture are the only two factors that shown significant and moderately correlated with LSS Project's Performance. Hence, within the context of company D, this research suggest that there is/are other underlying variables within the scope of Employee LSS Knowledge and Continuous Improvement Culture that contribute to the sustainability of LSS implementation which is worth for further study.

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