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Critical Success factors for Six Sigma Implementation in Gaziantep Carpet companies

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Abstract

Aim of this study was to determine the critical factors that will support the success of the six sigma implementation and to investigate the different obstacles that make difficult to implement Six Sigma (SS) in the Gaziantep Carpet companies. Survey data collected from 108 companies that chosen randomly around Gaziantep and analyzed by SPSS. The research concluded that the highest requirements of SS available were Top management support and commitment that according to previous literature of the most important requirements or factors. According to the results of research, the teamwork and employee training & education on Six Sigma (SS) are the most critical factors for SS success. Also, there are important factors about implementing SS such as effectiveness of communication on SS Program, support and involvement of Top management, changing the culture effectively for SS and Project Management Skills. Research results have shown that; Lack of project management, lack of resources and lack of involvement in management are the most common problems in the SS implementation. A large amount of companies does not show resistance to the implementation of SS.

Key Words: Six Sigma, Critical Success Factors, continuous improvement

1. Introduction

Technology is changing rapidly in today's world, and with the appearance and enlargement of the global marketplace, successful companies must stand their ground in a highly competitive environment, continuously adapting their products to meet new market demands .At the same time, customers are placing increasing demands on companies for high quality, reliable products. The increasing abilities and functionality of many products make it more difficult for manufacturers to maintain quality and reliability. Meanwhile, the greater complexity of modern production and service systems has created a demand for engineers who can control the technical and managerial tools and concepts needed for the economic implementation of quality systems "(Moehrle, Wenzke 2006)" .Successfully operating within the area of conflict between cost, deadline and quality requires that efficient tools be made available to the production teams, allowing a continuous improvement in manufacturing processes. Any product deficits that could cause customer grievances must be eliminated during the development stage as far as possible .Failure detection and failure management are not the customers' responsibility but must be carried out by the development engineers. "Komashie, Mousavi, Gore (2007)" stated that quantifying and improving quality requires the use of specific methods or tools. argued that the use and selection of quality management tools and techniques are vital to support and develop quality improvement processes.

To keep a competitive edge, companies have to continuously improve their products. Quality is the most important part of this goal, including improving the quality and reliability of products at reduced cost. On the other hand, the use and selection of proper quality tools and techniques is vital to support and develop the quality improvement process "(Yusof and Aspinwall, 1999)". Quality management approaches have been utilized by companies since the 1930s "(Dahlgaard-Park, 2011)". Built on the work of Shewart and Deming, and the Total Quality Management (TQM) approach "Proudlove, (2008)" SS appeared in the 1980s as a system that involves the strict pursuit of learning, problem-solving and process improvement "(Easton and Rosenzweig, 2012)" which produces highly significant benefits to firm profitability "(Swink and Jacobs, 2012)". SS has been defined as "an organized, parallel-meso structure to lessen variation in organizational processes by using improvement specialists, a structured method, and performance metrics with the aim of achieving strategic objectives" "Schroeder et al., (2008)". This approach has similarities to the ideas and philosophies of quality programs of the past which have been trained for years, but varies in scope and complexity due to its applied method followed to achieve these ideas and philosophies "(Kumar et al., 2008)". This practical and rigorous method for managing SS improvement activities is known as the Define - Measure - Analyse - Improve - Control (DMAIC) process "(Linderman et al., 2003)".

The carpet industry companies in the Gaziantep province of important companies in the province, Turkey, where Gaziantep carpet companies produces about 82% of total production capacity of Turkey "(Gaziantep Chamber of Commerce)". And due to rapid changes in the business environment in the competition among the organizations and in order to improve the products in many carpet companies which apply the modern management concepts to address deficiencies in its management. To improve the output of production and service, and the concepts of SS; which is one of modern management techniques that carry out reduction of variability and defects. In addition, it reduces costs and improves quality and boosts satisfaction of customer as well as product life cycle . In view of the urgent need for the productive sector research and explore for new and effective strategies and ways to improve the production process, the problem of the study focuses on the implementation of SS technique in the carpet companies located in Gaziantep which will identify the availability of the requirements for the introduction of SS. Critical success factors that will help for implementing SS will be identified. Totally, one of the purposes of this study is highlighting SS implementation problems. This study, it's aimed:

1. To identify the critical success factors of SS implementation in the Gaziantep Carpet companies.
2. To understand the difficulties in implementing SS in the Gaziantep Carpet companies.

2. Literature Review

SS have been defined and review of academic and professional literature of critical success factors of SS are also discussed.

2.1.Six Sigma

SS is a business enhancement initiative that purposively finds and eliminates reasons of defect or error in business and prepares continuous improvement proses by focusing on output process in manufacturing process "(Evans and Lindsay, 2005; Antony, 2011)". As such, SS is seen as a model of a holistic quality initiative that emphasizes the importance of structured method "Zu et al., (2008)". "Hahn and Hill (1999)" also recommended that an organization that implements SS initiatives will reorganized its operational system by designing every activity and function so as to ensure smooth operation for each transaction.

TQM focuses on the methodology of plan, do, check, and act (PDCA) which was introduced by Edward Deming to assist in process of handling, process of solution and operational fixing processes. In relation to that, the implementation of SS also has developed a methodology known as DMAIC. D is define that identifies priority and selects the right project, M is measure as the main step in process criteria, parameter scope and performance, A is analyze by locating the main cause and process determinant, I is improve through changing the process and optimizing performance and C is control by maintaining profit "Basu et al, (1999)".

DMAIC methodology refers to some sort of applicable problems that is altered into statistics-based problems that is triggered and applied through SS method by enhancing definite areas of business processes. SS initiative using Statistical tools and techniques plays an important role in enhancing structural performance from the aspect of financial, customer, process, innovation and capability. Apart from that, SS also gives positive impacts toward organization especially to the manufacturing industry, among them are achievement in the increase of profit creation, improvement in quality product and productivity, defect and cost reduction, increase in market share and customer satisfaction "(Coronado and Antony, 2002a)".

In conjunction to the improved performance "Parast (2011)" suggested that implication of successful SS practice from the aspect of process management has given a view on the capability of SS initiatives in improving organizational process, and firm performance.

2.2. Critical Success Factors of Six Sigma

From the perspective of the SS project implementation, Critical Success Factors for implementing SS denotes the crucial components in the eve the projects has slight chance of success. It is important to know SS's CSFs to implement SS projects successfully. This study is trial to discover the CSFs for SS in Turkish carpet industry. The CSFs method has been widely implemented and used in a multiplicity of different areas of study to define key factors which are essential to the success of any program or technique. For instance, "Achanga et al., (2006)" has ordered four CSFs of lean in SMEs, namely; leadership and management, finance, skills and proficiency; and culture of the continuous improvement.

According to "On, C. C. (2006)", recognition on CSFs is important for SS implementation effectiveness. Many studies argued management obligation, cultural change, organization infrastructure, training and education, business strategy, customer focus, human resource management, supplier management, project management

skill, project selection and priority, and understanding tool, techniques, and DMAIC methodology as critical success factors for employing SS (Define-Measure-Analyze-Improve-Control) "(Henderson and Evans, 2000; Goldstein, 2001; Caulcutt, 2001; Sandholm et al., 2002; Coronado and Antony, 2002a; Coronado and Antony, 2002b; Spanyi and Wurtzel, 2003; Antony, 2004; Antony and Fergusson, 2004; Waxer, 2004; Antony et al., 2005; Kumar and Antony, 2008; Sujar et al., 2008; Antony and Desai, 2009; Kumar et al., 2009; Mahanti and Antony, 2009)". "On, C.C. (2006)" developed the SS performance model for China enterprise.
This was designed by using the CSFs of SS which was then used to degree performance of SS application. Eight elements such as leadership, people management, process management, management by fact, methodology and tool application, continuous improvement, customer focus, and result were used to measure the SS performance in the firm. "Baba M. D., et al, (2011)" later combined all the CSFs for SS application proposed in the current literature, and concise twelve CSFs as follows: Management involvement and commitment, Deployment infrastructure, Training program, Linking SS to business strategy, Connecting SS to human resources, Enthusiastic resources, Concerning finance in SS, Incentive and recognition program, Cultural change to data determined and learning organization, Linking SS to customer, Project selection and objective setting, and Connecting SS to suppliers. "M. F. Ahmad, et al, (2016)" it showed the results of their studies the SS's critical success factors are participation and undertaking of management, teamwork and organizational infrastructure factors show high level while training and education and cultural change show moderate level. However, there are not many studies within the context of Turkish manufacturing industry.
"Mehmet Tolga Taner (2013)", for example, explored the CSFs of SS application in Large-scale Turkish Construction Companies. The Pilot study involving 71 companies CSFs and delaying factors are recognized and analyzed. Contribution and obligation of top management, connecting quality initiatives to customer and linking quality initiatives to provider are found to be the most significant CSFs to the construction companies. Leadership and obligation to the top management, cross-functional teamwork and commitment of middle managers are counted to be the most CSFs for fruitful introduction of SS. However, lack of data on the system to initiate and contentment are initiated to be hampering its implementation.
From the literature review above following CSFs of SS are identified:

- Creating an effective change culture for SS
- Top management support and involvement
- Effective communication on SS Program
- Employee training & education on SS
- Teamwork
- Organizational infrastructure for SS
- Linking incentive system with SS Program
- Understanding and effective use of SS tools
- Project Management Skills
- Effective use of SS Methodology

3. Research Methodology

The research was conducted by collecting quantitative data and analyzing the data with appropriate statistical tools. The method of research selected for this research project is Survey. The survey was applied by using the Questionnaire forms. The survey instrument was analyzed using the statistical (SPSS) Version 23.0 for Windows.

3.1. Population and Sampling of the Study

The study population includes all the carpet industry companies in the province of Gaziantep / Turkey. The sample consists of 115 companies were selected randomly. The questionnaires were distributed to all the companies selected by hand. All the questionnaires were responded, and after the checking were excluded seven questionnaires due to the lack of the required conditions to the survey, bringing the number of questionnaires under study is 108 questionnaires.

3.2. Design of Questionnaire

A questionnaire was designed to collect quantitative data for research and delivered to related companies. The questionnaire consisted of sections that questioned the different dimensions of the SS. The questionnaire included different sections seeking information on various aspects of SS. In addition to scale-type multiple-choice questions, open-ended questions were asked to obtain objective response from the participants. To rate the

availability of the requirements and the critical success factors of SS implementation, the most appropriate scale form of 1 to 5 Lickert Scale was used.

3.3. Validity and Reliability

In order to check the validity and reliability of the scale, expert opinion was sought first. After that the questionnaire has been translated into the Turkish Language and adjusted through the experts feedback. After reviewing the questionnaire, a pilot survey was conducted on a group of Turkish colleagues. The purpose of the pilot test is to refine the questionnaire so that respondents will have no problems in answering the questions and there will be no problems in recording the data. According to pilot test results, the last corrections were made in the questionnaire.

In this study, Cronbach's Alpha was used to assess reliability for each construct (lean SS, strategic control system, and organizational performance) to measure the internal consistency and indicate how different items can reliably measure the construct. These alpha value range from 0 to 1, where means higher value indicates higher levels of internal consistency.

4. Findings and Discussion

4.1 Reliability Test

Reliability refers to the consistency in scale which purposely measure construct by internal consistency analysis with estimation using Cronbach alpha (Saraph et. al., 1989; Flynn et. al., 1994). In this research, the latter method was adopted and internal consistency was conducted on 10 items divided into eight axes or sections by using SPSS reliability analysis procedure. Cronbach's Alpha value was good reliability for all factors are (0.671).

4.2 Correlation Result

Pearson Regression Method was used in analyzing the data from the respondents in stating whether there is significant correlation between factors of SS and SS implementation. From the result in Table (1), there is positive correlation between dominant factors of SS and SS implementation. The correlation value which is (r) between change culture and SS implementation is (r=0.249), Top management support and involvement (r=0.494), Effective communication (r=0.321), Employee training & education (r=0.470), Teamwork (r=0.344), Organizational infrastructure (r=0.513), Linking incentive system with SS Program (r=0.403), Understanding and SS tools using effectiveness (r=0.408), Project Management Skills (r=0.361), Effective use of SS Methodology (r=0.531), Role of Information Technology (r=0.516) and Use of external consultants (r=0.587). Hence, all of the correlation values are more than 0.01 indicates there is a positive correlation between factors of SS and SS implementation. For all factors are shows significant positive correlation towards SS implementation.

4.3 Descriptive Analysis for factors of Six Sigma

In this section, exploring the critical success factors (CSFs) for SS implementation in Gaziantep carpet companies have been determined. Table (2) shows the result of the Critical Success Factors of SS implementation in Gaziantep carpet companies. The overall mean for each factor was obtained to investigate the level of SS practice perceived by respondents. These mean values range from (4.40) to (4.06) was good at SS practice level. The two highest CSFs were Teamwork (4.40) and Employee training & education on SS (4.37). The next CSFs were Effective communication on SS Program (4.36), Top management support and involvement (4.30), and changing the culture of organization for SS effectively (4.29), Project Management Skills (4.28), Linking incentive system with SS Program (4.26), Use of external consultants (4.25), Organizational infrastructure for SS (4.24), Role of Information Technology (4.19), Effective use of SS Methodology (4.15), Understanding and effective use of SS tools (4.06).

Table (1) *Correlation result CSFs of SS implementation in Gaziantep carpet companies*

Factors		Six Sigma implementation	Result
Creating an effective change culture for Six Sigma	Pearson Correlation	.249**	Positive
	Sig. (2-tailed)	.009	Significant
Top management support and involvement	Pearson Correlation	.494**	Positive
	Sig. (2-tailed)	.000	Significant
Effective communication on Six Sigma Program	Pearson Correlation	.321**	Positive
	Sig. (2-tailed)	.001	Significant
Employee training & education on Six Sigma	Pearson Correlation	.470**	Positive
	Sig. (2-tailed)	.000	Significant
Teamwork	Pearson Correlation	.344**	Positive
	Sig. (2-tailed)	.000	Significant
Organizational infrastructure for Six Sigma	Pearson Correlation	.513**	Positive
	Sig. (2-tailed)	.000	Significant
Linking incentive system with Six Sigma Program	Pearson Correlation	.403**	Positive
	Sig. (2-tailed)	.000	Significant
Understanding and effective use of Six Sigma tools	Pearson Correlation	.408**	Positive
	Sig. (2-tailed)	.000	Significant
Project Management Skills	Pearson Correlation	.361**	Positive
	Sig. (2-tailed)	.000	Significant
Effective use of Six Sigma Methodology	Pearson Correlation	.531**	Positive
	Sig. (2-tailed)	.000	Significant
Role of Information Technology	Pearson Correlation	.516**	Positive
	Sig. (2-tailed)	.000	Significant
Use of external consultants	Pearson Correlation	.587**	Positive
	Sig. (2-tailed)	.000	Significant

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table (2) *CSFs of SS implementation in Gaziantep carpet companies*

Factors	Mean	Std. Deviation	Rank
Creating an effective change culture for Six Sigma	4.29	.798	5
Top management support and involvement	4.30	.742	4
Effective communication on Six Sigma Program	4.36	.633	3
Employee training & education on Six Sigma	4.37	.573	2
Teamwork	4.40	.655	1
Organizational infrastructure for Six Sigma	4.24	.882	9
Linking incentive system with Six Sigma Program	4.26	.925	7
Understanding and effective use of Six Sigma tools	4.06	1.096	12
Project Management Skills	4.28	.774	6
Effective use of Six Sigma Methodology	4.15	1.048	11
Role of Information Technology	4.19	.870	10
Use of external consultants	4.25	.987	8

4.4 OBSTACLES TO SIX SIGMA IMPLEMENTATION

- **Level of organizational resistance**

The question in this section, were asked of the respondents as what was the level of organizational resistance to the SS initiative. The Figure (1) gives the results of the responses received from the companies.

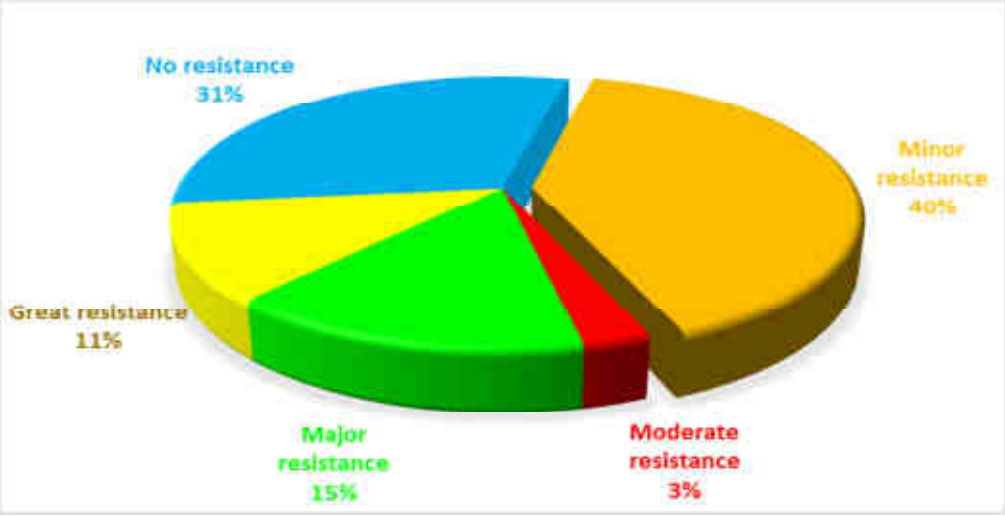

Figure (1) *Level of organizational resistance*

The figure displays that in greatest cases (40%), minor resistance level of organizational resistance was confronted of the SS initiative, 31% no resistance, 15% major resistance, 11% great resistance, and 3% moderate

resistance. Indicates the minor level of resistance to the implementation of SS that most companies were applied other quality initiatives, such as ISO 9000, TQM, etc., before applied SS, thus creating the culture and environment conducive to the new change initiative.

- **Obstacles faced in Six Sigma implementation**

The question in this section, were asked of the respondents about the nature of obstacles faced in SS. The figure (2) shows the results of the findings.

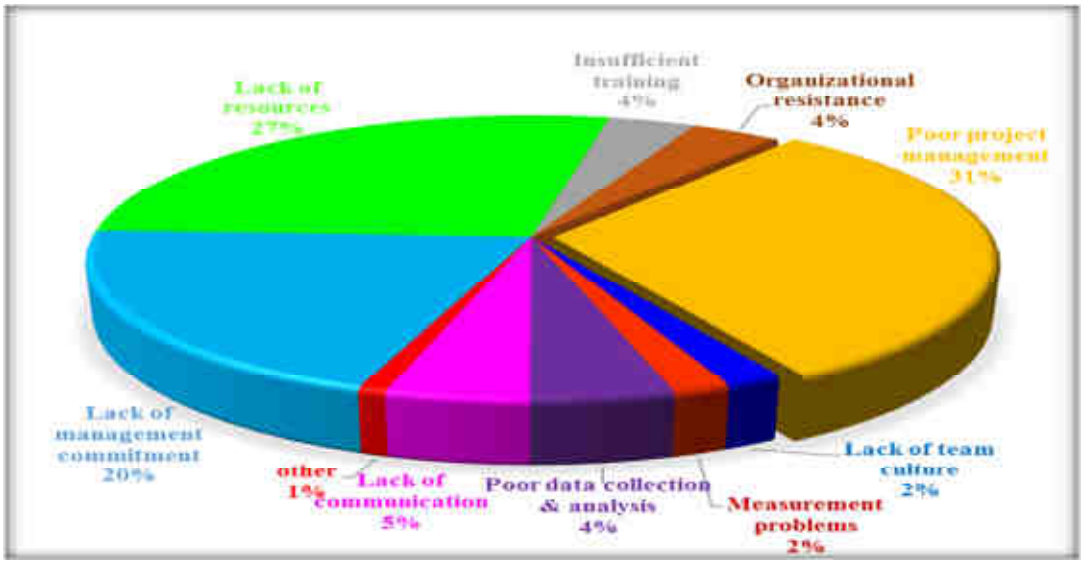

Figure (2) *Obstacles faced in SS implementation*

As can be shown from the figure, poor project management, lack of resources and lack of management commitment were the biggest problems faced, in 31%, 27% and 20% Respectively of cases. Other significant obstacles were the lack of management commitment in 5% of cases, Poor data collection & analysis, Organizational resistance, Insufficient training in 4% each one of them of cases and measurement problems and lack of team culture in 2% each one of them of cases.

- **Communication media used for Six Sigma**

The question in this section**,** were asked of the respondents with regard the media of communication used to defeat the resistance to change and create SS buy-in. The Figure (3) in the figure shows the findings.

Figure (3) *Communication media used for SS*

The figure Shows that the most widely used means of communication was newsletter (in 33% of cases), followed by individual communication with employees (in 27% of cases), Q&A sessions (in 16% of cases), conducted workshops (in 9% of cases), Videos/Visits of other companies (in 8% of cases) and kick-off meetings with managers (in 4% of cases).

5. Conclusion

The objective behind this study was to detect the contributing critical factors the successful implementation of SS implementation and to investigate the different obstacles that have to be solved in implementation of SS in the Gaziantep Carpet companies.

According to the results of research the most important critical factors for the success of SS are, teamwork and employee training & education on SS were found as the most critical success factors. Effective communication on SS Program, Top management support and involvement, changing the culture effectivity for SS and Project Management Skills were also important factors.

Research results have shown that; Lack of project management, lack of resources and lack of involvement in management are the most common problems in the SS implementation. A large amount of companies does not show resistance to the implementation of SS.

As to all other researches, our research will also not escape from having certain limitations and weaknesses. Limitations of this study are caused by factors including of time, financial, and technical that make this study only able to focus on the carpet industry in province of Gaziantep / Turkey. It is a daunting experience in collecting data even through this research is in Gaziantep only. It is suggested that future researchers consider data collection by means of a more strategic and systematic such as getting information of respondents more broadly, to engage in expos, seminars and annual meetings of the association to obtain information widely, easily and fast.

In conclusion, it is hoped that the findings of this research can be benefited, used, and contribute not only to academic but also to the industry, especially to the supplier development and improvement division and to the Turkish textile practitioners as a whole in making the model and the tool of this study as a benchmark to serve as a guide, and reference resources to implement SS initiatives and others quality initiatives which in turn assists in strategic decision making process in the assessment of suppliers. The need to adopt standards the SS as a fully integrated system to rationalize the cost of quality in industrial companies and to achieve a high level of quality,

the need to provide all the elements and the necessary ingredients for the introduction of SS and the need to provide a suitable environment for the success of its application to increase the attention of senior management in industrial companies.

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