

Manufacturing Competitiveness Improvement through Six Sigma – Analysis of Readiness Level of Micro, Small and Medium Enterprises by Identification and Modelling the Critical Success Factors

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Abstract

This paper aims at implementing the quality tool six sigma at the micro, small and medium enterprises (MSME) in order to improve the manufacturing competitiveness. MSMEs are the backbones of the industrial growth within India. In this context, it is essential to analyse the MSMEs' readiness to implement the six sigma practices so as to improve their competitiveness. Readiness evaluation has been done using linear multiple regression approach using SPSS

Keywords: MSME, Competitiveness, Multiple Regression, SPSS

I. INTRODUCTION

Everywhere, MSMEs are recognized as an important constituent of the national economy, contributing significantly to employment, expansion and poverty alleviation. Recognizing the importance of small and medium enterprises, which forms an important segment of the Indian economy [14], for its contribution to country's industrial production, exports, employment and creation of entrepreneurial base, the Central and State Governments have been implementing several schemes and programmes for their promotion and development. Among the six basic principles of governance underlying the National Common Minimum Programme (NCMP) of the Government, "Sustained economic growth in a manner that generates employment" has a pride of place. The NCMP also describes the small-scale industries sector as "the most employment-intensive segment." It has been ascertained that, by implementing Quality Technology Tools (QTT), like 6-Sigma, TQM, TPM, in certain sectors or group of industries in the small and medium sectors, the performance of the industries has improved substantially in terms of productivity (Confederation of Indian Industries, Quality Council of India, etc. have reported improvement by 50 to 100 percent in one year), improvement in quality (up to Parts Per Million level) and reduction of rejections and customers complaints (by 50% in one and half years' duration). Similarly, adoption of Quality Management Systems (QMS) like ISO 9000 / 18000 / 22000, etc, by MSMEs has shown improved performance. It is therefore essential for MSMEs to adopt the best manufacturing practices to enable them to be competitive in the current scenario of global competition. This project is directed towards conducting a research in this direction of analyzing the impact of the implementation of Six Sigma practices within the MSME sector. This project conducts a detailed study into those, and identifies areas requiring improvement and formulation of suitable strategies.

II. SIX SIGMA

Six Sigma is a statistical term that refers to 3.4 Defects per Million Opportunities (DPMO) (or 99.99966 percent accuracy), which is as close as anyone is likely to get to perfect. A defect can be anything from a faulty part to an incorrect customer bill [1]. MSMEs have a much closer proximity to customers. This proximity not only made it easier that the customer voice can be incorporated without prolonged and formalized, but also may let MSMEs have higher degree communication with customers than larger companies [2]. Professionalism implies a commitment to the needs of customers and an obligation to meet their needs by employing

the most appropriate quality management practices. Industries should improve the quality of their products to meet to the highest possible standards. So, MSMEs need to go towards an improved approach for quality, and the Six Sigma initiative is a good choice [3].

The larger customers are beginning to mandate Six Sigma to their supply base as a condition for doing future business. Since many large organizations employ Six Sigma as Quality Management System (QMS), it is a logical consequence that large organizations would encourage their suppliers, which are most likely MSMEs, to apply the well proven QMS or Six Sigma. Focusing on the needs of the customers, which is at the heart of quality, is one of the most effective means of facing the competition and surviving. There is increasing demand for high-quality products and highly capable business processes by large organizations have left no choice on the medium scale industries to consider the introduction of Six Sigma business strategy. Failure to meet even one of these imperatives can jeopardize industries’ well-being and survival. Also, if industries fail to provide the quality products and services, there is risk losing customers who will opt for one their competitors. Based on the results of the study, it then aims to identify the critical factors that contribute to the successful implementation of Six Sigma and readiness of accepting it among the MSMEs.

III. LITERATURE REVIEW AND HYPOTHESIS

CSFs is defined as an element that is necessary for an organization or project to achieve its mission and it is a critical factor or activity required for ensuring the success of a company or an organization [4,5]. CSFs are required to ensure success of an organization; therefore, it must be given special and continual attention to bring about high performance. CSFs include issues vital to an organization's current operating activities and to its future success [6]. CSFs include issues vital to an organization's current operating activities and to its future success [7]. In any organization, certain factors will be critical to the success of that organization, i.e. if objectives associated with the factors are not achieved the organization will fail. CSFs are identified in exploratory way. Exploratory research is the conducted for a problem that has not been clearly defined. It often occurs before we know enough to make conceptual distinctions or posit an explanatory relationship. Exploratory research helps determine the best research design, data collection method and selection of subjects

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In order to correctly direct the project, exploited an extensive literature survey encompassing books and papers. Many papers discuss the implementation of six sigma. The actual idea is to sort out the attributes that are leading to the base of a successful six sigma implementation which are termed as Critical Success Factors [8]. From the papers the resulting list follows [5, 10, 11, 12]:

This research aims mainly to identify the differences alternative hypothesis are proposed

- H1:** Managerial Involvement influences six sigma readiness
- H2:** Co operation influences six sigma readinesses
- H3:** Communication influences six sigma readinesses
- H4:** Organisational Infrastructure influences six sigma readinesses
- H5:** Education & Training influence the six sigma readiness

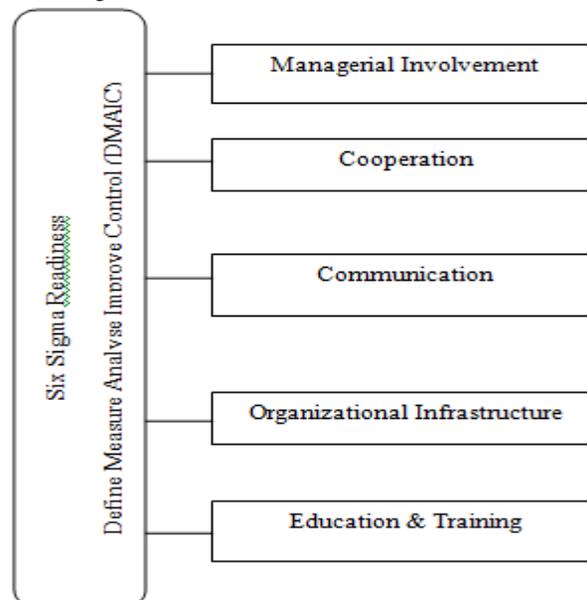


Fig.1. Hypothetical model

IV. METHODOLOGY

A survey instrument that had 1-5 Likert scale was designed using the extensive literature review. The initial version of the of the questionnaire was tested by conducting the interviews with the experts and edited for the accuracy. Five identified CSFs were subdivided to 25 items in order to explain clearly. These 25 items were made to a questionnaire on a 1 to 5 scale of likert s scale was developed. Questionnaire was administered to various organizations .The questionnaire developed were look into:

- Five CSFs identified
- DMAIC status

A Population and sample size

Primarily, this research helped in identifying the main MSMEs in Kerala. With the help of District Industries Centre, Kerala Productivity Council and Confederation of Indian Industries, a database of MSMEs was made. A total of 130 small and medium scale industries were identified. These companies were then contacted via phone and the online questionnaire was mailed to their official email id. Upon completing the survey, only 30 companies responded and 8 of them were incomplete. Therefore, response from 22 companies can only be considered as standard responses.

V. RESULTS

Linear multiple regression method is used to develop a mathematical model representing the six sigma readiness and CSFs.

Table I summarizes the result from the test conducted. Preliminary finding from this data indicates that Communication has the most significant effect while Education & Training has the least effect. Managerial Involvement and Co-operation also play a prominent role whereas Organizational infrastructure and culture does not affect at all.

The P columns in Table I give the p values for each of the possible interaction with the factors that are considered as the CSFs. All the factors except Organisational Infrastructure & Culture have the p value less than the level of 0.5. . They are identified

Table I Effect and Co efficient table

	<i>Effect</i>	<i>P Value</i>
<i>Constant</i>	4.052	0.001
<i>Managerial Involvement</i>	0.486	0.020
<i>Co operation</i>	- 0.728	0.014
<i>Communication</i>	1.795	0.001
<i>Organisation Infrastructure & Culture</i>	-0.738	0.095
<i>Education & Training</i>	-0.832	0.009

Hypothesis 1-Tested the relationship between the six sigma readiness and managerial involvement. The null hypothesis which says that the six sigma readiness is not influence on the managerial involvement. The table 1shows that the calculated p value at 5% significance level is <.05 so null hypothesis is rejected and alternate is accepted

Hypothesis 2-It stated that there is no significance difference between the six sigma readiness and cooperation. It is supported with the p value which is less than the .05 so the null is rejected and alternate is accepted

Hypothesis 3-it says that there is no relation between the six sigma readiness and communication. The hypothesis is fully supported with the p value <.05 so reject the null and accept the alternative

Hypothesis 4-The relationship between the six sigma readiness organisation infrastructure and culture. Out of these five hypothesis it is interested to note that the value of p is .09from the table 1and negative relationship between the six sigma readiness and organisation culture. It is evident from the p value there is no significance difference between the six sigma readiness and organisation culture so accept the null hypothesis and reject the alternative.

Hypothesis 5- The null hypothesis which says that there is no significant association between the the six sigma readiness and evaluation and training. The calculate p value at 5% significant level confirm that the null hypothesis will reject so accept the alternate hypothesis.

VI. DISCUSSION

In this research we have investigated the six sigma readiness level of Micros Small and medium enterprise. We found that the six sigma readiness in MSME sector impact on managerial involvement, cooperation, communication and education training. we found strong empirical alignment between six sigma readiness and critical success factors(CSF).

VII. CONCLUSION

A mathematical model was developed to reflect the current research result of the CSFs influencing the six sigma readiness. The model was created using the effects from Table I and its p value. The concluding regression equation is:

$$\text{Six Sigma Readiness} = 4.052 + 0.486*(\text{Managerial Involvement}) - 0.728*(\text{Co operation}) + 1.795*(\text{Communication}) - 0.832*(\text{Education \& Training})$$

The mathematical model confirms to the hypothesis developed. That is for making the MSMEs ready for six sigma adoption; the following CSFs must be adequately maintained

- (1) Managerial Involvement
- (2) Co operation
- (3) Communication
- (4) Education & Training

While Managerial Involvement and Communication form the main attributes that influences the six sigma readiness, co-operation and Education & Training also play a role.

Organisational Infrastructure and Culture does not have any impact on six sigma readiness.

Six Sigma methodologies, as reviewed and concluded by many fellow researchers, will help to position a business into an effective competitive model. However, it is widely also known that most of the productivity or business improvement models have failed during or after early phase of implementation, mainly due to lack of understanding of the tools, cultural rejection of the idea or partial implementations for quick return of the bottom line savings [13].

We hope that the results from this research will be useful as a foot print for local MSMEs in Kerala in applying Six Sigma and other best practices derived from fellow research studies into their business model. Th is will help to increase our local MSME's competitiveness, product quality, lean and efficient processes.

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