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Research paper

A novel approach to identify the best practices of quality management in SMES based on critical success factors using interpretive structural modeling (ISM)

Satyabrata Aich [1] *, Kamalakanta Muduli [2], Md. Mehedi Hassan Onik [1], Hee-Cheol Kim [1]

[1] Department of Computer Engineering/IDA, Inje University, Gimhae, South Korea
[2] Papua New Guinea University of Technology, Morobe Province, Papua New Guinea
**Corresponding author E-mail: satyabrataaich@gmail.com*

Abstract

In recent years, most small and medium scale enterprises (SMEs) worldwide looking for improvement in their business practices in order to gain competitive advantage and total quality management(TQM) as a means by which SMEs could achieve the desired result. The objective of this study is to discover the critical success factors that are affecting the quality management practices in SMEs. In this work eight factors were identified through the literature review and experts from academic as well as industries. The factors are commitment to quality, employee involvement, customer focus, information technology, improved production planning and control, recognition system, supplier quality management, and management vision and mission. Interpretive structural modeling(ISM) is used to understand the complex relationships among the factors and classify the factors into various categories as per the driving and the dependence capacity. The result shows that information technology (IT) is a key success factor for implementing TQM in SMEs. It is observed that SMEs have to increase the use of IT to improve the quality of the product and productivity.

Keywords: *Total Quality Management; SME; It; Critical Success Factor*

1. Introduction

In recent years the demand of the small and medium scale enterprises touched to a new height because of the development of technology that makes it easier to connect to the big industries which indirectly increase the amount of contribution towards the economy across the world. According to the latest report of 2017 Indian SMEs contributes around 45% towards the total manufacturing output,40% towards the export, and 8% towards GDP of the country [1]. The effect of globalization changes the perspective of total quality management in such a way that every industry would like implement total quality management to improve the performance across sectors in SMEs as well as in big industries [2]. Indian Cement Industry has shown positive effect because of effective implementation of the TQM [3]. It is important to understand the significance of critical factors of TQM for the success of Indian automobile industries. The failure of TQM practices happens because of deficiency of understanding of the complex relationships among the key factors [4]. The implementation level of TQM in Indian manufacturing industries is low, but the level of awareness is high [5]. Implementation of TQM has shown positive impact on Indian service Industries [6]. ISM is easy to use and widely used approach for most of the complex situation [7]. The structure of the paper is as follows: Section 2 represents the past work related to the factors affecting TQM in a tabular form and Section 3 describes about the methodology. The Questionnaire survey has been discussed in Section 4 and Section 5 focuses Interpretive Structural Modeling Approach. MICMAC analysis has been carried out in Section 6 and section 7 presents the ISM model. Section 8 and 9 discusses the results of MICMAC analysis and conclusion drawn based on ISM respectively.

2. Literature review

The critical success factors are identified from the previous literature and presented in Table 1.

Table 1: Critical Success Factors for TQM Identified by Previous Researchers

Critical Success Factors	Authors
Top Management Commitment	Crossby,1979; Deming, 1982; Garvin, 1986; Brown et al., 1994;Siam et al,2012; Siddiqui and Rahman, 2006; Jörgensen, K.B., Nielsen, A.F.(2013)
Employee Involvement	Raiborn and Payne, 1996; Juran and Gryna, 1993; Zhang, 1999
Customer Focus	Ishikawa, 1985; Karuppusami & Gandhinathan, 2006; Saravanan & Rao, 2006; Rahman and Bullock, 2005; Jörgensen, K.B., Nielsen, A.F.(2013)
Information Technology	Pearson et al., 1995; Matta et al., 1998; Ang et al, 2000; Brah and Lim, 2006;Khanam et al 2013
Improved Production Planning and Control	Porter and Parker, 1993; Zhang, 1999; Kanji, 2002; Jörgensen, K.B., Nielsen, A.F.(2013)
Recognition System	Dale and Plunkett, 1990; Brown et al., 1994; Zhang, 1999
Management Vision and Mission	Zhang, 1999 ; Mallur & Hiregoudar, 2010
Supplier Quality Management	Saraph et al., 1989; Flynn et al., 1995; Demirbag, 2006; Turkyilmaz et al., 2010; Jörgensen, K.B., Nielsen, A.F.(2013)

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3. Methodology

The flowchart of the methodology is shown in Figure 1

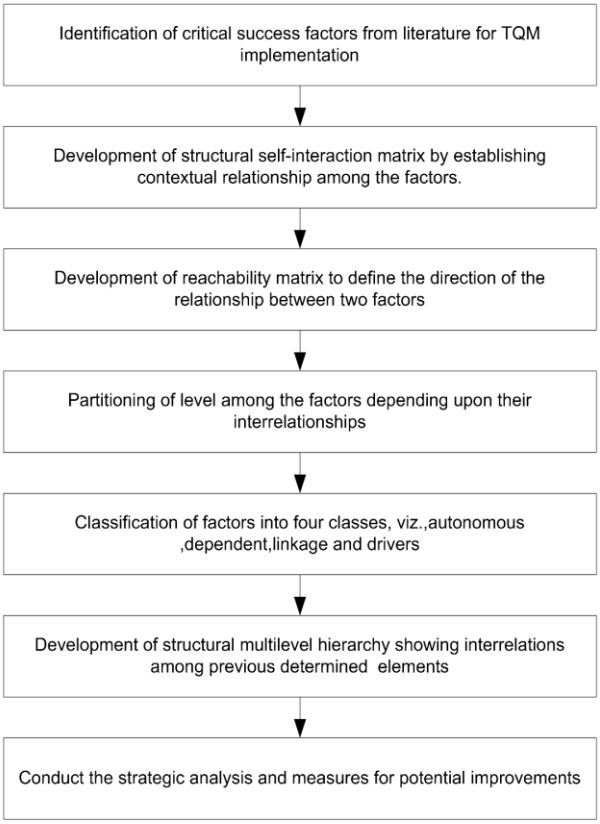


Fig. 1: Flow Chart of Methodology.

4. Questionnaire survey

The analysis of the profiles of the correspondents reveals that 35 selected SMEs from different parts of India participated in the questionnaire survey, those having quality control departments. All the firms belonged to the private sector and mainly from the automobile part manufacturing sector. The characteristics of the manufacturing firms, which are represented by the respondents, are summarized in Figure 2.

Out of all the firms surveyed, 45.71% had a workforce less than 50, 42.86% had a workforce in between 50 and 200 and the remaining 11.43% firms had a workforce of more than 200. Referring to the employees who filled up the questionnaire, 17.14% had a diploma degree, 42.86% held undergraduate degree, and 40% had a post graduate degree to add to their accolade. As far as their industrial experience is concerned, 11.43% had an experience below 3 years, 8.57% had 3-6 year's experience, 17.14% had 6-12 year's experience, 37.14% had 12-18 year's experience and 25.74% had more than 18 years of industrial experience to decorate their arsenal. Talking in terms of the turnover of these SMEs, 34.28% earned revenue of less than [5] crore. per annum, 51.42% earned in between 5 and 50 crores, and 14.28% of the firms had revenue exceeding 50 crores.

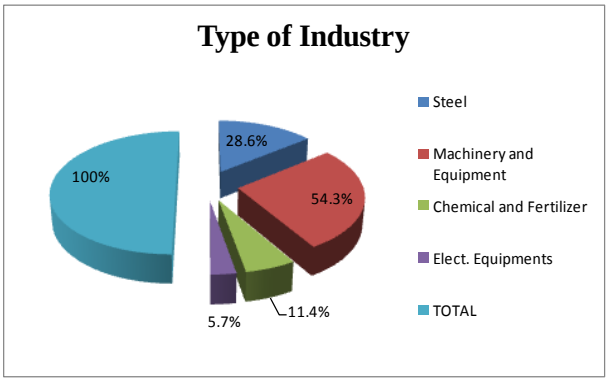


Fig. 2: Respondents Based on Type of Industry.

5. ISM approach

Identification of the structure within a complex system is of great value in dealing efficiently and effectively with the system and better decision making. Interpretive structural modelling (ISM) is an approach that can be used in any situation, regardless of its content. A set of elements should be identifiable and an appropriate contextual relation must be established. The set of elements may be measurable in ordinary scale of measurement or even beyond it. So, we can say that ISM is more flexible compared to other modeling approaches that works only on the quantitative data. Hence, ISM extends a qualitative modeling approach enabling the users to build a structural model to map their thought on an issue after going through a process of taking expert opinion. Eight factors have been identified by early literature review and it is essential to develop a structure of interrelationship among the identified critical success factor using an interpretive structural model. The steps are 1) Structural self-interaction matrix 2) Framing of reachability matrix 3) Drawing out level partitions 4) Classification of factors 5) ISM formation. The MICMAC analysis is done using the diagram shown in the figure 3.

6. Micmac analysis

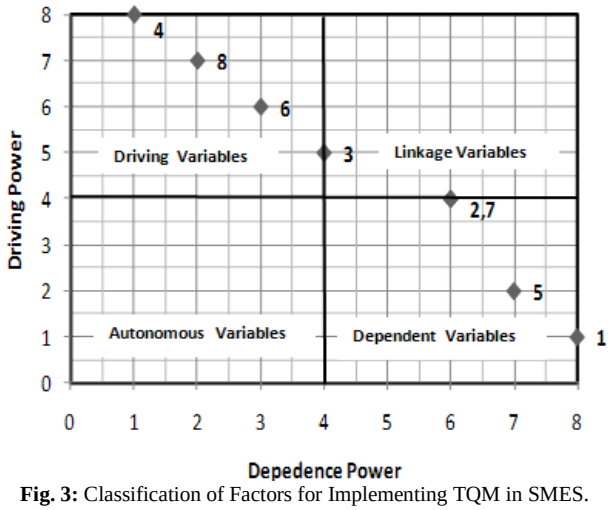


Fig. 3: Classification of Factors for Implementing TQM in SMES.

7. ISM model formation

The structural relationships among the different CSFs are represented in the Interpretive Structural Modeling shown in the figure 4

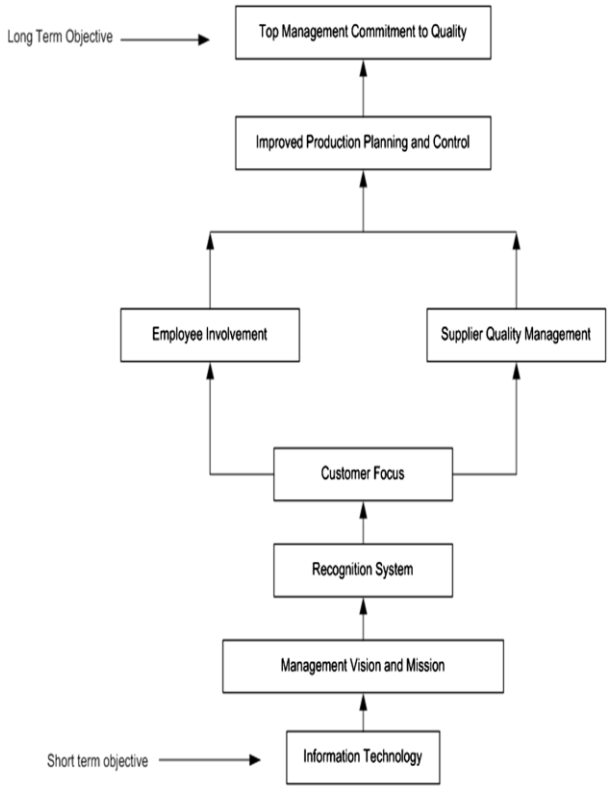


Fig. 4: ISM Model of Factors for Implementing TQM in SMES.

8. Results and discussion

In the present study, eight critical factors have been identified for implementing the TQM in Indian SMEs. The different hierarchy shows the classification and categorization of different critical success factors. The important findings of this research are as follows.1) There is no autonomous variable. Autonomous variables are unfocussed and disconnected from the system due to their weak dependencies and weak driving powers. So, selected eight factors are rightly significant for Indian SMEs.2) There are four factors such as Top Management Commitment to Quality, Improved Production Planning and Control, Employee Involvement, and Supplier Quality Management (figure 3), appear at the top level of the ISM hierarchy (figure 4) come under dependent category as the desired long-term objectives of the Indian SMEs. Out of these factors, Employee Involvement, Supplier Quality Management factors are slightly unbalanced because of its closeness towards the linkage factor and it should be more focused by the managers of Indian SMEs for a better TQM structure. The ISM model shows that Top Management Commitment to Quality and Improved Production Planning and Control depend on the other factors.3) Linkage factors are unstable due to strong driving powers and dependencies. In this paper all the selected eight factors are stable because there are no linkage factors (figure 3).4) In the ISM model (figure 3), four factors such as Information Technology, Management Mission and Vision, Recognition System, and Customer Focus are classified as drivers due to their high driving powers and less dependency and they are appeared at the bottom of the hierarchy. These factors are considered as independent and the key drivers to achieve the organizational objectives. Therefore, the decision makers should emphasize more weightage to information technology, so that it influences Management Mission and Vision and finally persuades other factors.

9. Conclusion

In this research paper, a detailed study has been carried out to identify the critical success factors for implementing quality management practices in Small and Medium Enterprises (SMEs). A hierarchical structure has been developed to find out the position of the critical success factors and the complex relationship among them using Interpretive Structural Modeling.

The study will assist the quality managers of SMEs to pay more focus to the above eight critical success factors for implementing TQM to enhance the efficiency and effectiveness of the organization. The research is a systematic approach to visualize the short term and long-term objective of TQM and it establishes the interdependencies among the selected eight success factors. So, it is a strong road map for the managers of Indian SMEs to know the drivers and dependents from the complex relationship of different factors to move forward the organization in a right path. This research shows that information technology influences management vision and mission to achieve the top management commitment towards quality.

The proposed model has been tested with limited number of factors in the Indian SMEs, which are competitive in nature. In future, more factors can be added to get a better and transparent view of Indian SMEs in implementing TQM.

References

[1] http://www.smeventure.com/role-smes-economic-development-india retrieved on 6 June 2018.
[2] R. Al-Ettayyem, M.F. Zu'bi, "Investigating the effect of total quality management practices on organizational performance in the jordanian banking sector," International Business Research, vol. 8, no. 3, pp. 79-90, Feb. 2015.
[3] O.K. Gupta, R. Dubey, T. Singh, "TQM Strategy for Superior Business Performance: A Case Study," International Conference on Technology and Business Management, 26-28 March 2012.
[4] V.K. Khanna, B.S. Sahay, P. Vrat, R. Shankar, "TQM implementation in the Indian automobile sector: insights using system dynamics approach", Journal of Advances in Management Research, Vol. 4, no. 1, pp.49 – 62,2007.
[5] H.K. Khanna, S.C. Laroiya, D.D Sharma, "Quality Management in Indian Manufacturing Organizations: Some Observations and Results from a Pilot Survey", Brazilian Journal of Operations & Production Management, Vol. 7, no. 1, pp. 141-162,2010.
[6] F. Talib, N. Faisal, "Assessment of Total Quality Management Implementation in Indian Service Industries, "Proceedings of 2016 Annual Meeting of the Decision Sciences Institute Conference (DSI-2016), held between Nov 19th-22nd, 2016, Austin, TX, USA.
[7] R. Attri, N. Dev, V. Sharma, "Interpretive structural modelling (ISM) approach: an overview," Research Journal of Management Sciences, Vol. 2, no. 2, pp. 3-8,2013.
[8] P. Crossby, "Quality is free: The art of making quality certain," Mc Graw Hill, New York, NY, Vol. 94, 1979.
[9] W. E. Deming, "Quality, Productivity and Competitive Position," MIT Institute for Advanced Engineering study, Cambridge, MA, 1982.
[10] D.A. Garvin, "Quality Problems, Policies, and Attitudes in the U.S. and Japan: An Exploratory Study," Academy of Management Journal, Vol.29, pp.653-673, 1986.
[11] M.G. Brown, D.E. Hitchcock, M.L. Willard, "Why TQM fails and what to do about it," Irwin, Burr Ridge, Illinois, 1994.
[12] A.Z. Siam, K. Alkhateeb, S. Al-Waqqad, "The Role of Information Systems in implementing Total Quality Management," American Journal of Applied Sciences, Vol.9, no.2, pp.666-672, 2012.
[13] Z. Rahman, J. Siddiqui, "Exploring total quality management for information systems in Indian firms: Application and benefits," Business Process Management Journal, Vol. 12, no. 5, pp.622 – 631, 2006.
[14] K.B. Jørgensen, A.F. Nielsen, "The effects of TQM Critical Success Factors on Organizational Performance: An empirical study on small and medium sized Danish manufacturing companies," Master Thesis, MSc. Finance & International Business, Aarhus University, 2013.
[15] C.Raiborn, D. Payne, "TQM: Just what the Ethicist ordered," Journal of Business Ethics, Vol.15, no.9, pp.963-972, 1996.
[16] J.M. Juran, F.M. Gryna, "Quality planning and analysis," third edition, McGraw-Hill, New York, NY, 1993.
[17] Z.H. Zhang, "Developing an instrument for measuring TQM implementation in a Chinese Context," SOM Research Report, 99A48, University of Groningen. The Netherlands, 1999.

[18] K. Ishikawa, "What is total quality control? The Japanese way," Prentice-Hall, London, 1985.
[19] G. Karuppusami, R. Gandhinathan, "Pareto analysis of critical success factors of total quality management. The TQM Magazine," Vol.18, no.4, pp. 372-385, 2006.
[20] R. Saravanan, K. Rao, "Development and validation of an instrument for measuring total quality service," Total quality management & business excellence, Vol.17, no.6, pp. 733-749, 2006.
[21] S. Rahman, P. Bullock, "Soft TQM, hard TQM and organizational performance relation-ships: an empirical investigation," The international journal of Management Science, Vol.33, no.1, pp. 73-83, 2005.
[22] J.M. Pearson, C.S. McCahon, R.T. Hightower, "Total quality management: Are information systems managers ready?" "Information and Management, vol.29, pp.252- 163, 1995.
[23] K. Matta, H. Chen, J. Tama, "The information requirements of total quality management, "Total Quality Management, vol. nine, pp. 445-461, 1998.
[24] L.Ang Chooi, M. Davies, N. Finlay Paul, "Measures to assess the impact of information technology on quality management," International Journal of Quality &Reliability Management, vol. 17, pp.42 – 66, 2000.
[25] S.A. Brah, H.Y. Lim, "The effects of technology and TQM on the performance of logistics companies," International Journal of Physical Distribution & Logistics Management, vol.39, pp.192 –209, 2006.
[26] S. Khanam, J. Siddiqui, F. Talib, "Role of Information Technology in Total Quality Management: A Literature Review," International Journal of Advanced Research in Computer Engineering &Technology, Vol. 2, no. 8, pp.2433-2445,2013.
[27] L.Porter, A. Parker, "Total quality management - the critical success factors," Total Quality Management, Vol. 4, no. 1, pp. 13-22,1993.
[28] G.K. Kanji, "Measuring Business Excellence," Routledge, Advances in Management and Business Studies, 2002.
[29] B.G. Dale, J.J. Plunkett, "Managing quality," Philip Allan, New York, NY, 1990.
[30] S.B. Mallur, N.L. Hiregoudar, "A Survey of TQM Practices in North Karnataka Manufacturing SMEs: an Empirical Evaluation," Proceedings of the World Congress on Engineering 2010 Vol III WCE 2010, June 30 - July 2, London, U.K,2010.
[31] V.Saraph, P. Benson, R. Schroeder, "An instrument for measuring the critical factors of quality management," Department of Operations and Management Science, Curtis L. Carlson School of Management, University of Minnesota, MN55455,1989.
[32] B.B. Flynn, R.G. Schroeder, S. Sakakibara, "The Impact of Quality Management Practices on Performance and Competitive Advantage," Decision Sciences, Vol. 26, No. 5, pp. 659-691, 1995.
[33] H. Demirbag, E. Tatoglu, M. Tekinkus, S. Zaim, "An analysis of the relationship between TQM implementation and organizational performance: Evidence from Turkish SMEs," Journal of Manufacturing Technology Management, Vol.17, no.66, pp. 829-847, 2006.
[34] A. Turkyilmaz, E. Tatoglu, S. Zaim, C. Ozkan, "Use of partial least squares (PLS) in TQM research: TQM practices and business performance in SMEs," In Handbook of partial least squares (pp. 605-620). Springer, Berlin, Heidelberg, 2010.