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FIRM CHARACTERISTICS AND IMPLEMENTATION OF IT AND TQM

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Abstract
This research is aimed to study the approach adopted by manufacturing industries of Uttarakhand for Quality Management systems. With change in industrialization, lifestyles, competition in marketplace it is very much required to change the way quality was managed earlier. Different companies adopt various approaches to manage the quality and overall management system of the company. Customer satisfaction is vital aspect of sustained business growth and thus quality is one of the important aspects a customer looks for. Quality management system is determined and applied to manage the quality, manufacturing control strategy, customer satisfaction measurement and analyzing data to improve further to remain relevant in marketplace. To control the out going quality level and remain competitive in market it is very much necessary that organizations must adopt quality management system strategies

Keywords: Quality Management system, Quality Management system strategies, Total Quality Management (TQM), Information Technology (IT), Techniques and methods of research, Manufacturing strategies, Quality systems.

Introduction:

With changing global markets and supplies from one continent to another the marketplace is very much dynamic and customer demands are changing at a pace which never was. In Today's era there is very tough competition in the marketplace, companies are under huge pressure to retain their customers and business. Perez-Arostegui M. N. et al, (2013). To run any business organization efficiently and in a competitive way we need to adopt a quality management system strategy. Quality is key to saving resources, efforts, and money. Quality management system is

set of procedures and work instructions established wide organization to execute the operations in compliance and as per organizations goals. Today the Quality is not only limited to product or service, but its importance has increased on entire organizational activities. Starting from product design to process design and process controls. Quality is no longer meeting the customer expectations, now it is the era of exceeding the customer expectations. The former chairman of Motorola Bob Galvin said that the GNP or gross national product of the United States could easily grow by 0.5 to 1 % if the USA had a nationwide quality policy, Daghfoas A., and Barkhi R., (2009). TQM is widely accepted by industries as a quality management strategy Harjeev Kumar Khurana et all (2010). In today's business scenario achieving full customer satisfaction is the only aim, and TQM is the most profound way to achieve that, Khanna H. K. et al, (2010). The TQM is an integrated approach or combination of validated and effective philosophies which are aimed to improve the organizations overall performance. TQM is very widely accepted management approach in modern business management, Small E. P., Ayyash L. et al, (2017).

Objectives and Scope of research

The aim of this research paper is to study the correlation between firm characteristics and status of application of IT and TQM adopted by manufacturing industries of Uttarakhand. The scope is limited to only manufacturing industries of Uttarakhand which has 4 main clusters namely SIDCUL industrial area of Haridwar, Sitarganj, Kashipur and Pantnagar. The objective is to know. The approaches adopted by companies to manage the quality, relationship between firm characteristics and implementation of IT and TQM and the importance given to TQM.

Literature review

Every company has its own strategy to manage quality. The strategies may of many approaches like it may be referred and adopted from globally accepted practices like ISO 9000 series of standards Khanna H. K. et al, (2010), or many companies prefer to develop their own standers to execute quality management strategy over and above globally accepted practices. Global standers of executing quality management strategy also differ from sector to sector except ISO 9001 which is common and serves as guiding document for all sectors Khanna H. K. et al, (2010). The TQM had been part of the industries since 1920 as quality management strategy, when first time some of the statistical concepts were applied to improve quality and productivity. TQM has many tools and aspects now a days like 6 sigma and TQM, BPR (Business process re-engineering), Lean management, JIT (Just In time), and other strategic initiatives are being integrated with TQM to get greater benefits from these tools, Augus A. and Hassan Z., (2011), Zehir C. et al, (2012), and Zu X. et al, (2010). As we can see in introduction section in history of TQM, the principles of TQM have been adopted in ISO 9000 series of standard and it is widely accepted across the world in industries of various spectrum. No. of research shows that customers has set prime criteria for suppliers to get certified from ISO series to do business, Khanna H. K. et al, (2010). TQM is culture centric and is a tool which focus on developing

quality culture and a customer centric long-term vision building for the organizations, Li L. et al, (2008).

Methodology

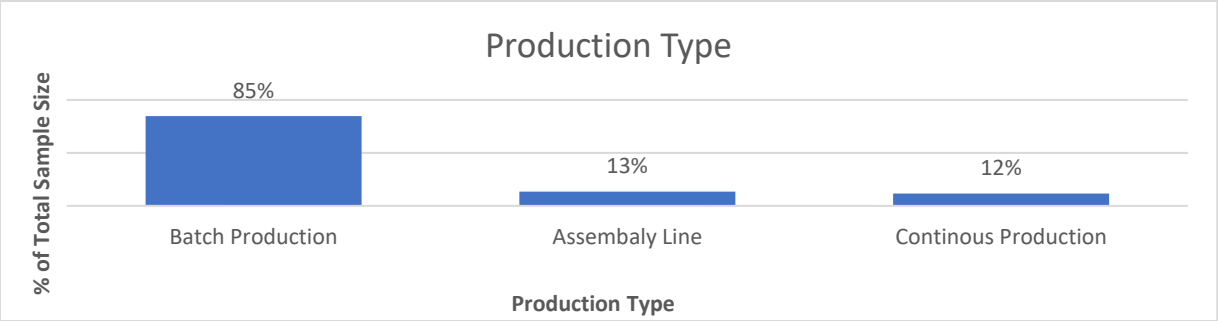
The research was conducted with designed instrument which was surveyed in all major four industrial scoters e.g. Haridwar (including Dehradune), Kashipur, Sitarganj and Pantnagar. Only manufacturing industries of small, medium, and large scale were selected for survey. The survey was through email and a questionnaire was sent to over 339 industries based on sample size and total 110 responses received back. 6 responses were not good to consider hence further analysis was done on remaining 104 questionnaires. The Characteristics of firms was measured with constructs like production Type, Firm size in terms of Number of employees, annual sales turnover, Type of quality management system implemented to adopt TQM requirements, Importance given to Quality etc. similarly the IT implementation was measured by 6 constructs IT for administration, IT for Communication, IT for Planning, IT for Production control, IT for design process, and It for decision support. Total 6 items were there to measure the level of TQM implementation, also the number of standards followed by firm like ISO 9001, ISO 9001 with Industry specific quality management systems, ISO 9001 with companies own developed Quality management System standard were also considered as base for TQM implementation level. It was considered that higher the standards implemented better the TQM implementation is. It also shows the tighten quality requitements in the firm. The analysis with qualitative data like sales turnover, number of employees etc. was done by categorizing the data and assigning them numerical value and further study was done by measuring The Pearson's Correlation 'r' and significance level 'p' of correlation was tested by using Z Test. The means, and standard deviations analyzed to determine the level of implementation and distance from mean value among the respondent companies. Minitab 16 version was utilized to analyze the data. TQM.

Research findings and discussion

Sample profile:

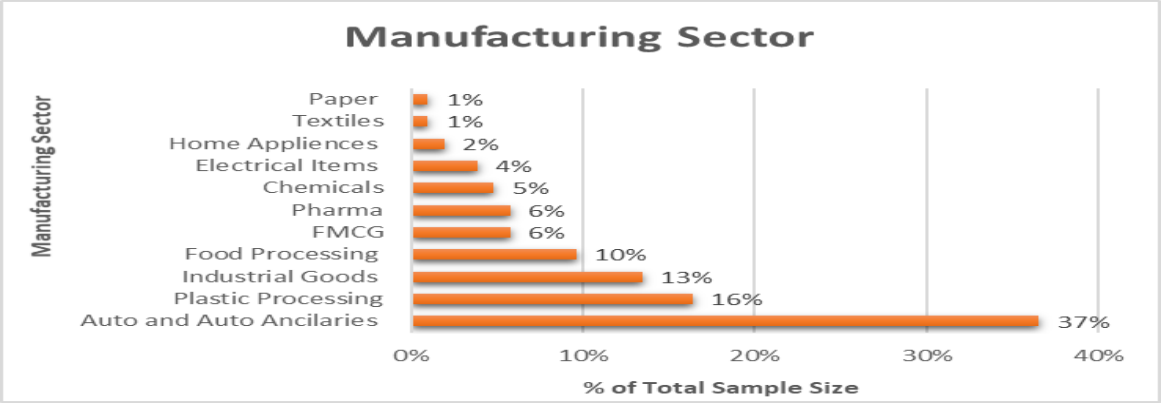
The sample profile of survey was analyzed first to see what kind of production type is used by firms surveyed and selected in the sample of this research and summary is displayed in below bar graph (**Fig 1:** Sample Profile Based on Production Type). As we can see out of total sample

Figure 1: Sample Profile Based on Production Type



Companies surveyed 85 % of them are using batch production technique. It means they are producing the goods in batches. 15 % said that they are using assembly line to produce the goods it means they are assembling different parts at a assembly line, and only 3 % of them said they have continuous manufacturing process where goods are manufactured without breaking the chain. Another analysis was performed based on manufacturing sector of the sample firms and data was presented in bar graph in figure 2 (Fig. 2: Sample Profile Based on Manufacturing sector) where we see very divers data ranging from home appliances to Auto and Auto ancillary manufacturing companies. As we see from data the data based on responses received from survey sample

Figure 2: Sample Profile Based on Manufacturing Sector



Companies, maximum 37 % of respondents said they were from Auto and or auto ancillary manufacturing, next three were Plastic processing like Injection moldings or raw material compounding, Industrial Goods manufacturers were 15 % and Food processing units were 11 %.

Total Quality Management:

The data was further analyzed to figure out what kind of quality management strategies were adopted by different manufacturing sector companies, and we also tried to know based on responses given that if quality strategies are differing from sector to sector. The questions were divided in to four categories and questions were asked if they follow either of them or mix of the categories out of four. The responses received via the questionnaire circulated has been plotted in

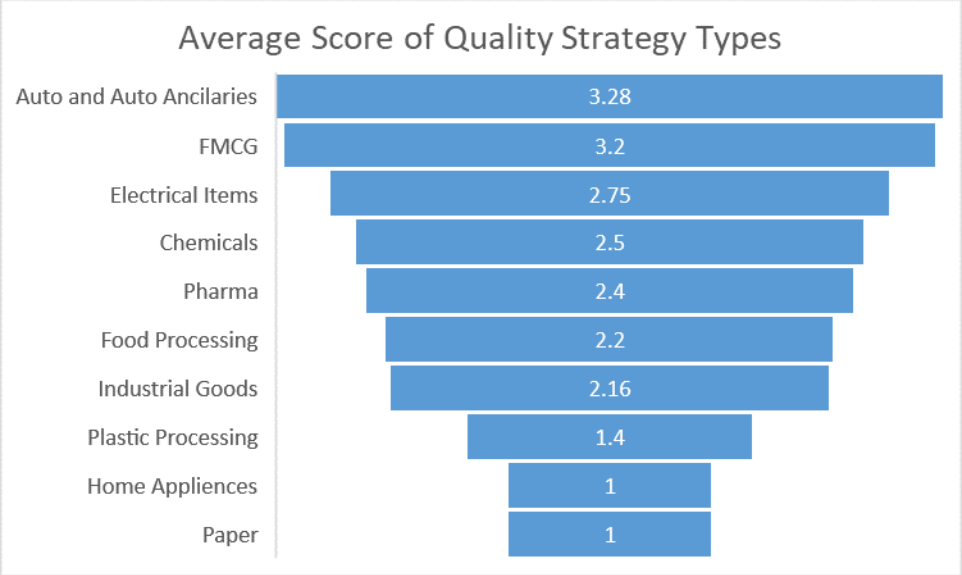
the chart (Figure 3) and we see 99 % firms said they do have ISO 9001 certification as base of managing the quality system and that is the base of their quality management system strategy. Only 1 % of respondents said they don't have ISO 9001 certification. As we analyze further, we see 66 % of total respondents said they do have industry specific certifications and or following some of industry specific standards to manage their quality management system strategy requirements. 38% have some customer specific quality standards along with ISO 9001 and very importantly 46 % said they do have their own Quality Management System strategy along with ISO 9001, while significantly 30 % of total respondents have multiple (ISO 9001, Industry specific and their own) standers to manage their quality management system strategy requirements.

Figure 3: Types of Quality Management System Strategy Adopted to mange TQM requirements

Manufacturing sectors and quality strategies:

On further analysis of data by averaging out number of quality standards adopted by different manufacturing sector companies we see significant difference from sector to sector. For this analysis we counted the responses given by respondents against the question asked in four groups for quality strategy adoption 1. ISO 9001, 2. ISO 9001 with Industry specific, 3. ISO 9001 with customer specific and 4. ISO 9001 with companies own quality strategy standard. 5th category was developed based on multiple selections made by respondents. The number of strategies adopted were counted firm wise and then an sector wise average score prepared to plot the graph and understand sector specific status on quality management system strategy in manufacturing industries of Uttarakhand. As we see from graph in Figure-4, Auto and Auto ancillaries are following more no of standards to fulfill their quality management system strategy compare to others. Fast moving consumable goods companies comes to second with an average standard adoption of 3.2. paper and home appliances industries we see they have only one certification i.e., ISO 9001.

Figure 4: Average Number of Quality Management System Strategy Adopted by Firms



Comparison with Global standards:

If we see the analysis presented in Figure 3 all the manufacturing companies surveyed in this research show that they have adopted global standards like ISO 9001 as a base. 99 % of the respondents said that they have ISO 9001 as base of Quality management system strategy which means we can say that manufacturing companies of Uttarakhand have adopted Quality Management strategy which is comparable to global standards.

Firm Characteristics and TQM Implementation:

The firm characteristics like Number of employees, sales turnover, type of quality system implemented as base of TQM etc. were categorized and qualitative data was assigned to numeric values to analyze it further. The summary for the findings is listed in Table 1, below:

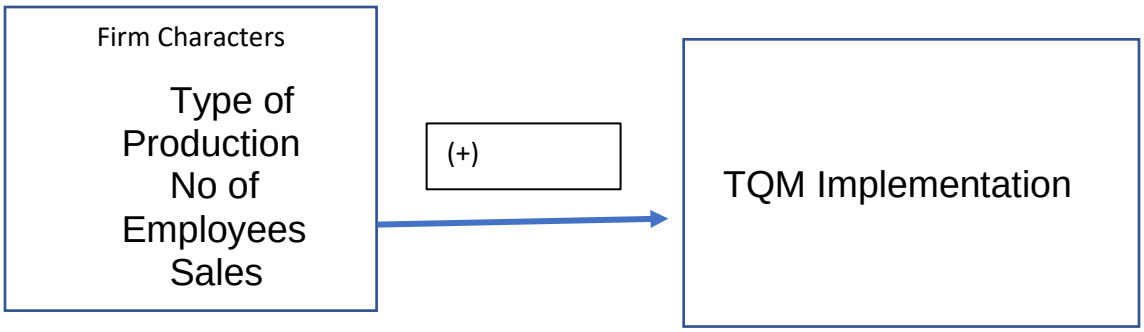
Table 1: Firm Characters and TQM Implementation correlations

	Batch Production	Assembly Line	Continuous Production	No. of employees < 100	No. of employees 100 - 500	No. of employees > 500	Sales Turnover Less Than 50 Cr	Sales annual Turnover 50-100 Cr	Sales annual Turnover 100 Cr and above	Importance to Quality
Mean	4.48	4.97	4.36	4.50	4.32	4.96	4.02	4.74	4.45	_
Standard Deviation	0.67	0.12	0.66	0.61	0.74	0.12	0.75	0.49	0.73	_
Pearson's Correlation	-0.069	0.212	-0.049	-0.002	-0.336	0.373	-0.588	0.194	0.406	0.16

As we see form the table firm characters do have an impact over TQM implementation level. When we see production types normally, they don't have much impact on TQM implementation levels, but assembly productions have better TQM implementation than others, this may be due to most of the assembly companies were automotive companies as we see from sample profile.

Similarly, when organization is bigger in size in terms of employee Number like greater that 500, it has a positive impact over TQM implementation level with 'r' 0.37 and significance level 'p' 0.00. Same is case with sales turnover as it grows bigger so is the perception of TQM implementation companies with greater that INR 100 cr turnover has better TQM implementation level with correlation level 0.73 and significance 'p' 0.00. When it comes to importance to quality it does has positive impact over TQM implementation hence the summary can be given through below model:

Figure 5: Relationship of Firm Character and TQM implementation



We also found after data analysis that firm character does have significant role in importance of quality management systems, bigger the size of organization in terms of number of employees, sales turnover they have implemented multiple standards to fulfill their TQM needs as we see in table, batch production companies normally have only 2.33 average of standards implemented where's assembly production it is 3.07. similarly greater than 500 employee size company has the mean of 3.25 and when the sales turnover is more than 100 Cr it is 3.49. This shows increasing requirement and importance to TQM with increasing size of firm.

Table 2: Firm Character and quality strategy to achieve TQM.

	Batch Production	Assembly Line	Continuous Production	No. of employees < 100	No. of employees 100 - 500	No. of employees > 500	Sales Turnover Less Than 50 Cr	Sales annual Turnover 50-100 Cr	Sales annual Turnover 100 Cr and above
Standerd Deviation	1.18	0.92	1.24	1.00	1.16	0.74	0.48	0.83	0.74
Mean	2.33	3.07	3.08	2.00	2.13	3.25	1.33	2.65	3.49

Firm Characteristics and IT Implementation:

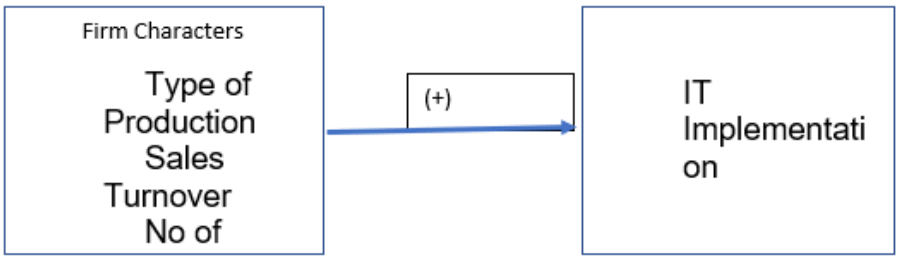
When we analyzed the data for understanding the relationship with IT implementation, we found that firm characters do have an impact over the IT implementation however it is not at same level as TQM. As we see summary in below table in production types assembly Line production is using more it than other types with mean x = 4.30 and Pearson's correlation 'r' is 0.206 which means relationship is significant.

Table 3: Firm Character and IT implementation relationship

	Batch Production	Assembly Line	Continuous Production	No. of employees < 100	No. of employees 100 - 500	No. of employees > 500	Sales Turnover Less Than 50 Cr	Sales annual Turnover 50-100 Cr	Sales annual Turnover 100 Cr and above
Mean	3.55	4.30	3.49	3.73	3.15	4.63	2.53	4.11	3.48
Standard Deviation	1.25	0.71	1.22	1.12	1.22	0.56	1.14	0.83	1.29
Pearson's Correlation	-0.058	0.206	-0.004	0.022	0.410	0.471	-0.699	0.239	0.505

Similarly, when we see other categories like employee number, we don't see any clear correlation here and it seems it does not have same impact as production type. Whereas sales turn over has significant positive co-relation with level of IT implementation in the company as the sales turn over increase, we see greater IT implementation when 50 – 100 Cr turn over companies has correlation 'r' as 0.23 whereas companies with turn over more than 100 Cr having Pearson's correlation 'r' as 0.50 which strong positive relationship with significance level 'p' 0.00. however, with standard deviation more than 1.29 it shows greater variations among company to company when it comes to IT application. The relationship can be summarized in below model:

Figure 6: Relationship of firm Characteristics and IT implementation



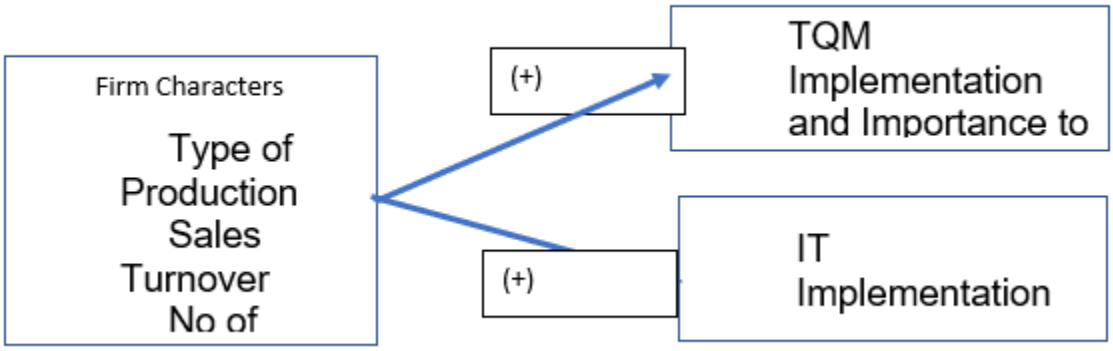
Conclusion:

The research papers objectives were described in objectives section and after analyzing the data we can conclude that manufacturing Industries of Uttarakhand has applied quality management system strategy to fulfill the TQM requirements and IT implementation is also at significant level with average not less than 3 at 5-point scale.

1. Data shows that there is significant relationship between firm Characteristics and TQM implementation
2. Data shoe that there is significant level of correlation between firm character and IT implementation.
3. We also see greater importance to quality is resulting greater implementation of TQM
4. Bigger the company size more the level of TQM implementation and importance attached to TQM

The final correlation is depicted in figure 7 below:

Figure 7: Firm Character and its impact over IT and TQM implementation



Further study can be done to see if different characters of firm have any impact over different dimensions of TQM and IT. The stud has limitation of data as only 30 % responses received also the sector studied is only manufacturing sector. The region wise it is only Uttarakhand may be another study can be done capturing different regions and states as every industrial area may have its own type of industries which may vary in application of IT as well as TQM.

References

Martinez-Lorente, A. R., Sanchez-Rodriguez C., Dewhurst F. W., (2003) The effect of information technology on TQM: an initial analysis, *International Journal of Production Economics 89(2004) 77-93*

Li L., Markowski C., Xu L., Markowski E. (2008) TQM - A predecessor of ERP implementation. *International Journal of Production Economics 115 (2008) 569-580.*

Augus A., Hassan Z., (2011) Enhancing production performance and customer performance through TQM: strategy for competitive advantage. *Procedia Social and Behavioral Sciences 24 (2011) 1650-1662.*

Prajoge D. I. and Sohal A. S., (2004) The Integration of TQM and Technology / R&D management in determining quality innovation performance. *OMEGA - The international journal of Management Science 34 (2006) 296 -312.*

Choi T. Y., and Eboch K. (1997) The TQM Paradox: Relations among TQM practices, plant performance and customer satisfaction. *Journal of Operations management 17 (1998) 59 - 75*

Bolatan G. I. S., Sitki G., Alpkan L., Zaim S., (2016) The Impact of Technology Transfer performance on TQM and Quality performance. *Procedia Social and Behavioral Sciences 235 (2016) 746 – 755.*

Perez-Arostegui M. N., Bustinza-Sanchez F., Barrales-Molina V., (2013) Exploring the relationship between information technology competence and Quality management. *Business research Quarterly (2015) 18, 4 – 17.*

Au G., and Choi I., (1998) facilitating Implementation of Total Quality management

through information technology. *Information and management journal 36 (1999) 287 – 299.*

Daghfoas A., and Barkhi R., (2009) The Strategic Management of information technology in UAE Hotels: an exploratory study of TQM, SCM, and CRM implementation. *Technovation 29 (2009) 588 – 595.*

Bou-Llusar J. C., Escrig-Tena A. B., et al, (2008) An empirical assessment of the EFQM Excellence model: evaluation as a TQM framework relative to MBNQ Model. *Journal of Operations management 27 (2009) 1-22.*

Khanna H. K., Laroiya S. C., Sharma D. D. (2010) Quality management in Indian manufacturing organizations: Some Observations and results from a pilot Survey. *Brazilian Journal of Operations & Production management Vol. 7, 2010, 141 – 162.*

Anil A. P., Satish K. P., (2016) Investigating the relationship between TQM practices and firm's performance: A conceptual framework for the Indian organizations. *Procedia Technology 24 (2016) 554-561*.

Small E. P., Ayyash L., Hamouri K. A., (2017) Benchmarking performance of TQM principles in Electrical Subcontracting in Dubai: a case study. *Procedia Engineering 196 (2017) 622-629.*

Cua K. O., McKone K. E., Schroeder R. G., (2001) Relationship between Implementation of TQM, JIT, and TPM and manufacturing performance. *Journal of Operations management 19 (2001) 675-694.*

Jain R. K., Samrat A., (2015) A study of Quality Practices of manufacturing Industries in Gujrat. *Procedia Social and Behavioral Science 189 (2015) 320-334.*

Sahoo S., Yadav S., (2018) Total Quality management In Indian SMEs. *Procedia manufacturing 21 (2018) 541-548.*

Yamada T. T., Poltronieri C. F., Gambi L. N., Gerolamo M. C. (2013) Why does the Implementation of Quality management practices fail? A qualitative study of barriers in Brazilian Companies. *Procedia Social and Behavioral Science 81 (2013) 366-370.*

Mahmud N., Hilmi M. F., (2014) TQM and Malaysian SMEs performance: The mediating role of organizational learning. *Procedia Social and Behavioral Science 130 (2014) 216-225.*

Jayaram J., Ahire S. L., Dreyfus P, (2009) Contingency relationships of Firm size, TQM duration, Unionization and Industry context on TQM implementation - A focus on Total effects. *Journal of Operations management 28 (2010) 345-356*.

Zehir C., Ertosun, O. G., Zehir S., Muceldilli B., (2012) Total Quality Management Practices Effects on Quality performance and Innovative performance. *Procedia - Social and Behavioral Science 41 (2012) 273-280.*

Zu X., Robbins T., Fredendall D. L. (2010) Mapping the critical links between organization culture and TQM/Six sigma practices. *International Journal of Production Economics 123 (2010) 86-106.*

History of TQM, *http://asq.org/learn-about-quality/total-quality-management/overview/tqm-history.html., Retrieved on August 10, 2018*

Bari M. W., Fanchen M., Baloch M. A., (2016) TQM Soft practices, Mediating role of relational Psychology Contract. *Procedia - Social and Behavioral Science 235 (2016) 453-462.*

Marefat D., Faridfathi A., (2015) Relationship between information Technology and Total Quality management in sports federations. *Journal of applied Environmental and Biological Sciences 5(3)52-58, 2015.*

Khanam S., Siddiqui J., Talib F., (2013) Role of information technology in Total Quality management: A Literature review. *International Journal of Advanced research in Computer Engineering and technology - Vol 2, 2013.*

Khanam S., Siddiqui J., Talib F., (2015) Prioritizing the TQM enablers and IT resources in ICT industry: An AHP approach. *International Journal of information and communication engineering. Vol. 9, No. 5, 2015.*

Dewhurst F. W., Martinez-Lorente A. R. and Sanchez-Rodriguez C., (2003) An Initial assessment of the influence of IT on TQM: A multiple case study. *International Journal of Operations and Production management Vol. 23 No. 4, 2003.*

ISO9001:2015, (2015) Quality management systems requirements, Fifth edition, 15-9-2015. *Retrieved on August 10, 2018*

EFQM excellence model (2013) *http://www.efqm.org/the-efqm-excellence-model. Retrieved on August 10, 2018.*

MBNQA Malcolm Baldridge National Quality Award (2017-2018) model. *https://www.nist.gov/baldrige/how-baldrige-works. Retrieved on August 10, 2018*

Siam A. Z., Alkahteeb K. and Al-Waqqad S., (2012) The role of information systems in total quality management. *American journal of Applied Sciences 9 (5): 666-672, 2012.*

Odoh M, (2015) Application of Information Technology in Total Quality Management. *Journal of Software Engineering and Simulations, Volume 2 ~ Issue 8 (2015) pp: 09-15.*

*nces 9 (15): **2701**-2713, 2009.*