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TQM Practices and Innovation Performance: A Review of Current Literature

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Authors' contributions

This paper is a combined effort by both authors. Author MWR has collected the relevant research articles and analyzed the trends in the existing literature while author SW has helped in identifying the relevant sources for the review and both authors have proof read and approved this paper.

Review Article

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ABSTRACT

This study explores the trends identified in previous research studies in the area of quality management and innovation performance and has reviewed many research articles from various industries. The study explains why different quality practices are used for better innovation performance in different industries and also explains different scenarios in which the quality practices have a positive or negative influence on innovation performance. The paper firstly categorized these studies according to the journal in which these studies are published then further divide them according to their research design into quantitative, qualitative and review types. The studies are analyzed on set criteria of industry, quality indicators, outcome indicators and results. The trends identified in this paper shows that irrespective of type of industry most studies have found a positive relationship between quality practices and firms innovation performance and in cases where the relationship is week or negative is because of various contextual factors like uncertainty in business environment, firm size, financial resources and firms culture that has modified this relationship.

Keywords: Total quality management; innovation; performance.

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1. INTRODUCTION

In all developed and most developing countries firms now a day's faces unprecedented levels of competition and find themselves in direct competition with both local and international competitors and the reason for this intense competition lies in fast technological changes and globalization of trade. In this scenario in order to survive firms must show higher level of efficiency at low cost to produce customer oriented novel products/services that are innovative as well as cost effective. There are many different management philosophies which can help firms achieve this goal and total quality management is among one of these philosophies.

Empirical studies from various industries have shown that TQM practices have a positive relationship with firm's performance especially its innovation performance but others have also found a negative relationship as well so the main objective of this paper is to clearly explain TQM and innovation performance relationship from a broader perspective. Therefore this paper has reviewed various research studies undertaken in the area of quality management and firm innovation performance from different industries and it has helped to answer the following questions.

- What are the latest trends in total quality management literature?
- Which quality management practices are frequently used among different industries?
- How effective are these quality practices in terms of results in enhancing firm's innovation performance?
- Which conditions can make TQM and innovation performance relationship positive and vice versa?

2. BACKGROUND OF TOTAL QUALITY MANAGEMENT

Quality management is one of the most popular and durable management concepts and it has passed through a number of phases since 1920,s. The roots of quality management go back to the teachings of Drucker, Juran, Deming, Ishikawa, Crosby, Feigenbaum and countless other people that have studied, practiced, and tried to refine the process of organizational management. Before exploring the different quality management practices it is better to understand what is meant by the term quality and different people interpret quality differently and few authors had defined quality in measurable terms that can be operationalized. Various practitioners have defined quality in different ways as mentioned below.

2.1 Definitions of Quality

- "Fitness for use" where fitness is defined by the customer.(Joseph M. Juran)
- "Conformance to requirements" but the requirements may not fully represent customer expectations and Crosby treats this as a separate problem.(Philip B. Crosby)
- "Uniformity around a target value" the idea is to lower the standard deviation in outcomes, and to keep the range of outcomes to a certain number of standard deviations, with few exceptions.(Genichi Taguchi)

- Quality and management are linked "costs go down and productivity goes up as improvement of quality is accomplished by better management of design, engineering, testing and by improvement of processes.(W. Edwards Deming)
- Quality in a product or service is not what the supplier puts in, it is what the customer gets out and is willing to pay for.(Peter Drucker)
- The characteristics of a product or service that bear on its ability to satisfy stated or implied needs.(American Society for Quality)

Source: Paul W. Hyland, Robert Mellor and Terry Sloan (2004)

2.2 The Quality Practices

In today's business world there is a growing recognition that isolated improvements in particular aspects of the organization are no longer adequate and that a holistic strategy is needed to bring competitive advantage and this can be done by adopting one of the few quality practices mentioned below.

2.3 Quality Control

In this quality tool organizations consider laboratory and testing of products as a main activity of quality management and invest in and develop their products/services management systems, these firms usually have quality control labs and departments testing and measurements make them react to non conformities. Quality controls include the use of affinity diagrams, pareto charts, histograms, arrow diagrams and run charts.

2.4 Quality Assurance Standard: (ISO)

According to these quality standards a product is a result of many processes and unless these are controlled effectively quality cannot be delivered therefore they try to control all these processes that effect product/service quality and most companies assure quality by using quality programs like ISO 9000, ISO 9000-2000, ISO 14000 etc.

2.5 Continuous Quality Improvements

Continuous quality improvement is based on the Japanese philosophy Kaizen and firms which implement this quality tool do not just confer to the quality assurance standards but they realize that process improvements are directly proportional to competence, commitment and team work of employees, such organizations mobilize companywide campaigns for continuously developing skills of quality management at all levels and give assignments on weekly and monthly basis in cross functional teams.

2.6 The Quality Excellence Models

These days' practitioners working in the field of quality management are using quality models to assess and evaluate the contribution of quality practices in achieving better organizational results, and among these models the Deming application prize, MBNQA model also known as Baldrige award and the EFQM excellence model are mostly used as mentioned in Table 1.

Table 1. The quality award models and their sub categories

Deming Award	MBNQA Model	EFQM Excellence Model	China Quality Award
Policy Organization & its Management	Leadership Strategic Planning	Leadership Strategy	Leadership Strategy
Standardization Controls	Customer Focus Measurement, Analysis, Knowledge Management	People Management People Management	Customer & Market Resources
Education & Dissemination	Work Force Focus	Partnership & Resources	Process Management
Quality Assurance	Operations Focus	Process, Products & Service Management	Measurement Analysis & Improvements
Collection & Dissemination of information on quality	Results (Customer, Product quality, Work force, Leadership, Financial outcomes)	Results (Customer, People, Society, Key Performance Results)	Operating Results
Analysis			International Best Practices
Results Planning for the future			Social Factors Government Strategic Initiatives

3. DEFINING INNOVATION TYPOLOGIES BASED ON LITRATURE

According to Porter innovation means.

Innovation = Invention + Commercialization

So according to Rycroft [1] innovation can be a new product or service or an improvement in them and many innovation do not come from laboratory but from the market place so if these new inventions and properly commercialized they become innovations. Damanpour [2] defines innovation as adaptation of internally generated or purchased device, system, policy, program, process, product or service that is new to the adopting firm so according to him innovation can be anything new that the firm adopts which could be a new process, program or a product/service. While according to Huiban & Bouhsina [3], Sciulli[4] innovations can be divided in two main categories i.e. product/process innovations and incremental and radical innovations so the former is in terms of area where the innovation is being done and later is on the way innovations are being adopted.

Hipp et al [5] divides innovations to be of four types i.e. firstly product/service innovations which includes innovations in the form of introduction of new and improved products or services. Second type are process innovations which include new and improved work methods in the processes and third type are organizational innovations which are not limited to the individual production processes but also involve significant improvements in overall

organizational structures and processes and fourth type of innovations include communication innovations both inside and outside the firm.

3.1 Measurement of Types of Innovations

According to Robert [6] innovations can be measured.

3.2 Product/Service Innovations

Are measured by rates of new product /service introduction or intervals between the new product/service generations.

3.3 Organization Innovations

Are measured by rates of change in organizational structures, routines and capabilities.

3.4 Process Innovations

Are measured by the rate of capital equipment obsolesce rates.

3.5 Communication Innovations

Are measured by the introduction of rate of change or adaptation of new communication channels used.

4. METHODOLOGY

In this paper we had reviewed 49 research articles from top ranking research journals assessed different academic data bases like EBSCO, EMERALEDINSIGHT, ELSEVIER, INFORMS and SPRINGER , TAYLOR & FRANSIS, BLACKWELL. Other details about journal name and type of study are mentioned in Tables 2 and 3.

In this paper among the forty nine articles reviewed thirty three articles have used quantitative techniques and used several different types of statistical techniques to evaluate the data like regression, correlation, factor analysis, structural equation modeling etc so these studies are placed in the quantitative group while fourteen studies have used the case study, stories and interview approach and used respondents and experts judgment to assess the TQM and innovation performance relationship so such studies are placed in the qualitative group of articles the rest of two articles are literature reviews in a particular industry to assess the trends in literature in these sectors.

Table 2. Journal papers reviewed

S. no	Name of Journal	Number of Articles	Articles Reference
1	The TQM Magazine	7	Ali Bayati [6], Gill [7], Gotzamani [8], Jung [9], Kumar and Grag [10], Kakkar and Nrag [11], Arumugan [12]
2	Technovation	2	Ana [13], Parajogo and Hong [14]
3	Technology in Society	4	Robert [15],Shui [16], L A Clark [17], Kiran [18]
4	Structural Change and Economic Dynamics	2	Djellah [19], Bloch [20]
5	International Journal of Production Economics	3	Brun [21], Sadikoglu [22], Bayazit [23]
6	The Qualitative Report	2	Psychogios [24], Psychogios [25]
7	International Journal of Quality & Reliability Management	4	Fotopoulus [26], Pinho [27], Jitaiboon & Rao [28], Kumar [29]
8	Management Science	3	Itner [30], Eric and Jong [31], Morrison [32]
9	European Journal of operations Management	1	Parajogi [33]
11	Journal Kemanvsiaan	1	Metheus [34]
12	Journal of Technology Management	1	Singh and Smith [35]
13	Omega	1	Parajogo [36]
14	International Journal of Operation and Production Management	1	Soltani [37]
15	Organization Science	3	Cardinal [38], Dahalander [39], Rothermel [40]
16	International Journal of Innovation Management	1	Hippel and Miles [41]
17	Journal of Operations Management	3	Sila [42], Liusar [43], Jayaram [44]
18	Regional Studies	1	Chen and Guan [45]
19	Asia Pacific Journal of Management	1	Pratoom [46]
20	International Journal of Health Care Marketing	1	Ooi and Tee [47]
21	International Journal of Project Management	1	Awan and raouf [48]
22	Journal of Business and Applied Management	1	Parast [49]
23	Service Science	1	Letica [50]
24	International Journal of Business Research	1	Sukwadi [51]
25	Journal of Decision Support System	1	Hosseini [52]
26	International Journal of Productivity & performance Management	2	Matook and Indulska [53], Salahedin [54]
27	Industrial Management & Data Systems	1	Sit & Ooi [55]
	Total	49	

Table 3. Type of study

S. no	Study Type	Number of Articles	Article Reference
1	Quantitative (Empirical Studies, Meta Analysis)	33	Ali Bayati [6], Gill [7], Gotzamani [8], Jung [9], Kumar and Grag [10], Kakkar and Nrag [11], Arumugan [12], Ana [13], Parajogo and Hong [14], Brun [21], Sadikoglu [22], Bayazit [23], Psychogios [24], Metheus [32], Lin and Chen [45],Fotopoulus [26], Pinho [27], Jitaiboon and Rao [28], Kumar [29], Eric and Jong [31], Jousoh [34], Singh and Smith [35], Parajogo [33], ,Rothermel [40], Sila [42], Jayaram [44], Chen and Guan [45], Pratoom [46], Ooi and The [55], Awan and raouf [48], Parast [49], Letica [50], Sukwadi [51], Hosseini [52] , Matook & Indulska [53], Salahedin [54], Sit and Ooi [55].
2	Qualitative (Case Studies, Interviews)	14	Dahalander [39], Itner [30], Hippel and Miles [41], Morrison [32], Cardinal [38], Soltani [37], Psychogios [24], Liusar [43], Psychogios [56] Robert [15],Shui [16], L A Clark (217), Kiran [18] Djellah [19], Bloch [20].
3	Quantitative (Empirical Studies, Meta Analysis)	2	Parajogo [36], Kaihua and Guan [57]
	Total	49	

5. LATEST TRENDS IN QUALITY MANAGEMENT LITRATURE

From the review it is quite clear that in most industries i.e. manufacturing, service, IT , marketing etc most practitioners and managers now a day's implement quality techniques based on quality control standards (ISO series) or quality excellence models (MBNQA, EFQM) and among these models quality management techniques like top leadership training and behavior toward quality, customer focus, information sharing, participation, autonomy etc have mostly proven to be very effective in enhancing firm performance especially its product/service quality and innovation performance.

6. DISCUSSION

As mentioned in Table 4, researchers like Abrunhose, Moura [13] argues that in an organization culture which gives its employees more autonomy and decision making power these employees show higher level of innovation performance as compared to organizations with lower level of autonomy.

While Zehir [22] argues that organizations with a free flow of information sharing makes the employees innovation skills improved and provides a very fertile ground for the generation of new ideas and Dahalander [39] argues that an effective way of information sharing is through the use of crass functional teams where people from various diverse back ground work together to come up with more novel ideas and create new innovations but on the other hand researchers like Parajogo [33]says that in some cases team performance hinders in the way of employees individual level of innovations due to strong level of pressure from group opinion.

According to Arunugum & Chang [12] leadership emphasis towards quality outcomes and innovation performance leads firm employees to show higher number of initiatives towards innovation and quality performance. Clark & Jones [17] suggests that strong customer focus leads firms to offer more customized products and services according to the changing demands of its customers which intern improves the firm innovation performance but on the other hand researchers like Kumar [10] suggests that too much customer centered firms fail to see future opportunities and this effect on their long term performance and success.

Parajogo & Sohal (36) argues that those firms which invest high amounts of money in their research and development areas show more successful innovation especially the firms which are operating in the high technology areas while Sila (42) suggests that continuous improvements have more negative impact on firms radical innovations as this philosophy forces employees to make small and incremental changes in their work to improve quality so it supports more incremental innovations then radical innovations Similarly Parast (49) says that quality controls and quality assurance models and techniques limits firms innovation performance due to rigid procedures aimed to maintain a certain level of quality in the delivery of products and services.

Table 4. Some important research studies about quality & innovation performance

Reference	Study Size	Data Collection Method	Quality/Innovation Indicators	Results
Ana Abrunhose & Patricia Moura [13]	500 employees	Survey instrument	Autonomy, communication, consultation, flexibility and supportive people management Technological innovations	The study suggests that the introduction of innovations is effected a lot by organizational cultural dimensions.
Joo Jung & Xuemei Su [9]	186 MNCs managers	Survey instrument	MNBQA (1995) indicators and Hofstede,s national cultural factors and organizational innovations.	Power distance, long term orientation, individualism are more critical effect on successful TQM/ innovation implementation.
Daniel I Prajogo & Soon W. Hong (14)	130 R&D Korean manufacturer	Survey Questionnaire	MNBQA model criteria (leadership, strategic planning, customer focus, information and analysis, people management, process management)	TQM practices have strong positive impact on R&D performance and help increase both product quality and innovation
Esin Sadikoglw and Cemal Zehir [22]	500 ISO certified firms	Detail research questionnaire	Leadership, training, employee management, information and analysis, supplier management,& product innovations	All TQM practices are significantly and positively correlated with employee performance, innovation performance
Karun Pratoom & Gomon Savatsomboo m [46]	1,526 group members in 138 producer groups	interviews	Knowledge management and self leadership	Results show that creativity fully mediates the effect of self leadership and knowledge management on innovation among group members
Linus Dahlander [39]	70 social interaction website data	Reviews	Self management, communication networks and Individual Innovations	Communications by users in online communities can create value to contributors and firms and help them improve individual innovations.
Eric Von Hippel & Jeroen P.J. De Jong [31]	163 plant managers	Survey Questionnaire	Innovation performance & consumer orientation, Leadership , top management support, continuous improvements	Firm's innovation performance is impacted by consumer orientation results, top management training programs and leadership initiative towards innovations.
Alessandro Brun [21]	Sample of 1720 ISO certified companies	Survey Questionnaire	Technological innovation capability, Management commitment, employee empowerment, fact based decision making,	The results show that the lack of financial resources limit companies to implement TQM initiatives and hinders the technological innovations.

Keng Boon Ooi [55]	394 plant managers	Survey instrument	Performance appraisal , selective hiring processes, reward system, customer focus, process innovations	To foster HRM and TQM practices that have positive effect on process innovations firm should develop a performance appraisal system to encourage knowledge management behavior.
Raj Kumar, Dixit Grag and T.K Grag [10]	299 employees	Self administered questionnaire	Management effective participation, reward scheme, communication systems, & innovation outcomes	The study concludes that customer focus must be the prime objective for any industry and all the TQM factors must be used systematically to achieve effective TQM implementation.
L A Clark & D L Jones [17]	345 SMEs managers	Questionnaire	Customer focus, process management, continuous improvements. Innovation Policy	The study Argues that organization, social and cultural norms play very important role in innovation strategy and adaptation.
V. Arumugam , Hiaw Wei Chang, Keng Boon Ooi and Pei lie Teh [12]	446 Spanish companies,	Structured research questionnaire	Leadership, strategic planning , customer focus, information analysis, people management, and process management, process /quality innovations	The strength of the company in its quality management implementation lie in the leadership, customer focus and process management and this also leads to high levels of leadership commitment, strategic planning and human resource development.
Maria Leticia [50]	200 research articles	secondary data sources i.e journal articles	EFQM excellence model indicators	The results have confirmed that firms adopting EFQM model outperform their competitors in terms of quality and innovation performance.

6.1 Arguments Supporting Positive Relationship between TQM Practices and Innovation Performance

The following arguments are made on the basis of this review.

1. Those firms which give autonomy to its employees to make decisions according to their judgment in this scenario autonomy has a positive effect on innovation performance as employees feel less bounded by rules and procedures which in turn improves their creativity and innovation potential.
2. Information sharing also proves to be very effective way to enhance employee innovative skills in a high information sharing plate forms more ideas are generated which intern leads to introduction of new products/services.
3. Cross functional teams are also proven to be very effective way to enhance creativity and innovation especially in project based organizations.
4. In this review we have found that leadership that emphasizes on innovation and reward new and effective ways to deliver product/services also lead to higher levels of innovation at both group and individual level in their firms.
5. In some cases continuous improvements leads to more incremental innovations as it concentrates on step wise improvements in all organizational processes.
6. Customer focus can enhance firm's innovation performance and firms which try to fulfill the needs of their customers are forced to introduce new products/services that can satisfy their changing demands.
7. Firms with high level of investment in R&D had shown better innovation performance then those who invest less in R&D and this is especially applicable for firms operating in a more uncertain business environment.

6.2 Arguments Supporting Negative Relationship between TQM Practices and Innovation Performance

1. Sometimes firms that give too much attention to customer needs fail to foresee new opportunities and markets and fail to come up with new products and services as they are reacting only towards customer's needs and demands.
2. In some cases continuous improvement philosophy has hindered in the way of radical innovations as its main emphasis is on increasing and improving efficiency of current products and services.
3. Quality controls also sometimes effect negatively on firms innovation performance as firms following this technique gives more attention to fulfill and control quality at a particular level which reduces chances for firms to make any radical innovations.
4. Employees who work in teams usually decrease their level of individual innovative performance as people who work in groups try to stick with the group opinion which decreases their individual level of creativity.

7. CONCLUSION

Based on the review of these research articles this paper concludes that most TQM practices inherently have a positive relationship with firms innovation performance and in those cases where we find a negative relationship is because of the contextual factors like uncertainty in business environment, firm size, financial resources and firms culture etc so positive results can only be guaranteed through TQM practices for enhancing innovation

performance if the management selects the best TQM technique which fits according to its internal and external environmental conditions.

8. LIMITATIONS OF STUDY

This study was done on a small scale and include only forty nine research articles from well known research journals but if a more comprehensive Meta analysis approach will be adopted it can provide detail trends about innovation and quality management practices among different industries. So for future researches there is a wide scope for contribution in this area.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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