A comparative study of TQM practices and organisational performance indicators with and without ISO 9000 certification in Indian Manufacturing companies

[1]Priyanka C P, [2]Anu P Anil, [3]Dr. Satish K P
[1]M.tech student, [2]P.hd Research scholar, [3]Professor
[1]Department of Production Engineering,
[1]Government Engineering College Trichur, Thrissur, India

***Abstract*—Recent studies suggested that quality policies and standardization can lead to the growth and success of industries. Based on this suggestion, this study aims at providing empirical evidence on the differences in total quality management (TQM) implementation and organisational performance of Indian manufacturing companies with and without ISO 9000 certification. With the literature support a questionnaire with 128 items was developed for the data collection, checked for reliability and validity and used to measure the influence of ISO 9000 on TQM practices and Organization performance indicators. The results showed that there was a significant difference between companies with and without ISO 9000 certification in Indian manufacturing companies with respect to TQM implementation and organisational performance. The factors influenced by the ISO 9000 are Supplier quality management, Education and training, Quality assurance, Quality culture and Benchmarking.**

***Keywords*—ISO 9000, TQM, Organisation performance, t-test, Indian manufacturing**

I. INTRODUCTION

Total quality management is an integrated management philosophy aimed at continuous improvement to improve the quality of products and process to achieve better customer satisfaction in effect organization performance. It plays a vital role in the development of management practices [20][13]. Many researchers asserted TQM as an approach to improve effectiveness, flexibility, and competitiveness of a business to meet customers' requirements [17], as the source of sustainable competitive advantage for business organizations [26], as a source of attaining excellence, creating a right first-time attitude, acquiring efficient business solutions, delighting customers and suppliers [15] and above all as a source of enhancing organizational performance through continuous improvement in organization's activities [8][25].

Different indicators used for measuring organizational performance have been identified from the literature. Arumugam et al. (2008) measured organizational performance from quality performance (example quality of product and service, customer relations, customer satisfaction with products quality, and level of quality performance relative to industry norms).

In the recent days, many studies have reported on the implementation of total quality management (TQM) principles and organization performance in organizations around the world. Still there have been only a few attempts to empirically establish the link between TQM practice and organisational performance in India. For example, Faisal Talib et al., (2013) studied the relationship between TQM practices and quality performance in Indian service companies. Bemowski (1991) studied quality practices of over 500 organizations and concluded that some of the quality practices such as process improvement methods, strategic plan deployment, and supplier certification programs, have a significant impact on performance regardless of type of industry and country of location.

Thus, managers and supervisors need to know which elements are necessary in order to change a firm's performance. Starting from an extensive literature review, the purpose of this paper is to : a) identify critical factors of total quality management and performance indicators b)developing an instrument for measuring the variables c) testing these measures for reliability and validity and d)comparing the ISO 9000 and non-ISO 9000 companies for TQM practices and organization performance using data collected from different organizations.

II. LITERATURE REVIEW

Critical factors of TQM

These studies provide different sets of quality practices essential for successful TQM implementation. This leads to reach an inconclusive approach for implementing TQM [12][18]. As such no study has identified a universalistic set of practices for successful implementation of TQM. Anu and Satish (2016) has identified the critical factors relating to TQM practices and firms performance. Thirty critical factors are identified in this study and shown in table I. Through the comprehensive review of the TQM

literature, the present study identified a set of 18 TQM practices which are given in Table II.

Table I: Critical TQM factors identified for the study

SL NO	Critical factors identified in past TQM literature
1	Leadership and top management commitment
2	Supplier performance
3	Customer focus
4	Supplier quality management
5	Continuous improvement
6	Team work
7	Communication
9	Quality improvement systems
8	Employees involvement
10	Employees empowerment
11	Rewards and recognition
12	Education and training
13	Strategic quality planning
14	Strategic management
15	Quality information and analysis

SL NO	Critical factors identified in past TQM literature
16	Quality assurance
17	SPC usage
18	Quality citizenship
19	Quality culture
20	Benchmarking
21	Role of quality department
22	Quality policy
23	Process and product design
24	Quality management environment
25	Operational quality planning
26	Quality information availability
27	Process management
28	Product quality and innovation
29	Quality information usage
30	Knowledge management

Table II: Critical factors selected for the present study

SL NO	Critical factors selected for the present study
1	Leadership and top management commitment LTMC
2	Continuous improvement CI
3	Supplier quality management SQM
4	Customer focus CF
5	Employees involvement EI
6	Employees empowerment EE
7	Education and training ET
8	Strategic management SM
9	Quality information analysis QIA
10	Quality assurance QA
11	Quality citizenship QCZ
12	Quality culture QC
13	Benchmarking BM
14	Process and product design PPD
15	Process management PM
16	Product innovation PI
17	Knowledge management KM

Performance measures indicators

Zakuan et al. (2010) in their study measured organizational performance through two categories which are satisfaction level (example employee satisfaction and customer satisfaction) and business results (example productivity, number of successful new products, cost performance and profitability). Considering the comprehensive study and the availability of data in this study, organization performance will be measured through ***quality performance*** and ***customer satisfaction level***.

III. METHODOLOGY

Research instrument

A self-administered structured instrument was designed in this research based on the manufacturing TQM literature specifically, the works [22], [4], [7], [24], [23], [1] were adopted and most of the items were taken from these studies. The instrument was modified by consulting with academicians and quality experts, and was initially validated through a pilot survey before it was actually used for primary data collection. The instrument developed was divided into three sections. First section is company profile, second section consisting of 17 TQM practices with 116 items and third section evaluates the performance of the company, i.e. the manufacturing company performance result which was measured by using two performance indicators – "quality performance" and "customer satisfaction level" through six items for each hence a total of 12 items [3][6][19][20]. The instrument comprises of a

non-comparative-itemized rating scale utilizing a seven-point Likert scale, with 1 (Strongly disagree), 2 (Disagree), 3 (Somewhat disagree), 4 (Neutral), 5 (Somewhat agree), 6 (Agree), 7 (Strongly agree), depending on the type of question. This is in line with those suggested by [14][4][22].

Types of organizations

The study analyses the effect of ISO 9000 and Non-ISO 9000 on the companies TQM practices and Organization performance indicators. In the database out of 221 companies' 85 companies have ISO 9000 certification and rest are not certified. The pie diagram showing the data is shown in the fig. 1.

Reliability

The reliability of the factors needs to be examined in order to support any measures of validity that may be deployed [16]. It is most commonly followed technique to measure internal consistency among a group of items combined to form a single scale and reflects the homogeneity of the scale. Using the SPSS Statistics 22, reliability analysis program software, an internal consistency analysis was performed separately for the items of each TQM practice (17 independent variables) and on two dependent variables (quality performance and customer satisfaction level). The alpha values of the study variables are summarized in Table III. The reliability coefficients of the study variables exceeded the minimum acceptable level of 0.70, as per the suggestion made by [16]. As can be seen in Table III, the alpha values range from 0.816 to 0.999, thus, provides strong evidence that the scales developed are judged to be reliable.

Table III: Reliability analysis

Factor	No: of Items	Cronbach's Alpha (α)
Leadership and top management commitment (LTM)	9	0.892
Customer focus (CF)	7	0.816
Supplier quality management (SQM)	8	0.909
Continuous improvement (CI)	8	0.952
Employees involvement (EI)	8	0.955
Employees empowerment (EE)	4	0.877
Education and training (ET)	9	0.956
Strategic management (SM)	8	0.914
Quality information analysis (QIA)	7	0.952
Quality assurance (QA)	7	0.999
Quality citizenship (QCZ)	6	0.978
Quality culture (QC)	7	0.963
Benchmarking (BM)	2	0.886
Process and product design (PPD)	9	0.945
Process management (PM)	7	0.848
Product innovation (PI)	7	0.981
Knowledge management (KM)	3	0.985
Quality performance	6	0.771
Customer satisfaction level	6	0.818

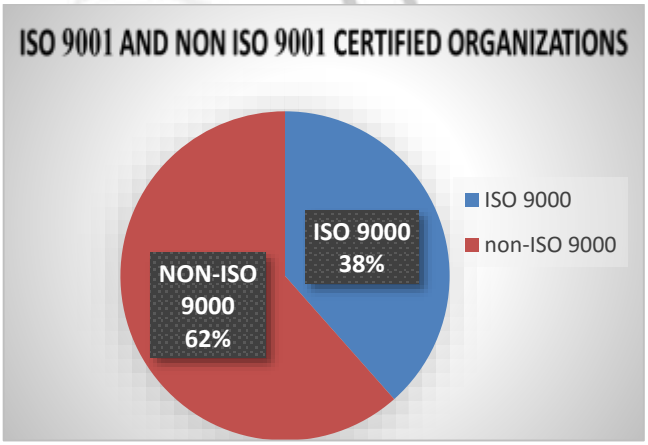

Figure 1: ISO 9001 and NON ISO 9000 certified companies

Validity

The validity of a measure is defined as the extent to which a construct or a set of measures correctly represents the concept of study, and the degree to which it is free from any systematic or non-random error. The seventeen critical factors for measuring TQM implementation should have content validity, as the measurement items were developed based on both an extensive review of the literature and detailed evaluations by academicians and practicing managers. Moreover, the pretest subjects indicated that the content of each critical factor was well represented by the measurement items employed.

A measure has construct validity, if it measures the theoretical constructs that it was intended to measure. Factor analysis can be used for evaluating construct validity. Factor analysis helps to analyze the interrelationships among a large number of variables and explains these variables in terms of their common underlying dimensions (constructs). It also helps reduce data that do not correlate with any of the underlying dimensions. The general purpose of factor analysis is to find a way to condense the information contained in a number of original variables into a smaller set of new, composite dimensions or constructs with minimum loss of information – that is, to search for and define the fundamental constructs or dimensions assumed to underlie the original variables [11].

This measurement is calculated through a factor analysis for each of the 128 factors. In this analysis, each factor must be one dimensional. Hence the developed tool is found to be valid. Further, after performing factor analysis, eight items were deleted due to low loading value (<0.50). Hence, the total items covering 17 TQM practices, quality performance and customer satisfaction level were reduced from 128 to 120. The summary of factor analysis of each measure is shown in Table IV.

Table IV: Factor analysis summary

Factor	No: of Items	No. of items having loading value above 0.50
Leadership and top management commitment (LTM)	9	8
Customer focus (CF)	7	6
Supplier quality management (SQM)	8	8
Continuous improvement (CI)	8	8
Employees involvement (EI)	8	8
Employees empowerment (EE)	4	4
Education and training (ET)	9	8
Strategic management (SM)	8	8
Quality information analysis (QIA)	7	7
Quality assurance (QA)	7	7
Quality citizenship (QCZ)	6	5
Quality culture (QC)	7	7
Benchmarking (BM)	2	2
Process and product design (PPD)	9	9
Process management (PM)	7	4
Product innovation (PI)	7	7
Knowledge management (KM)	3	3
Quality performance	6	5
Customer satisfaction level	6	6
Total	128	120

The convergent validity is also determined by using multitrait multimethod matrix (MTMM). Multitrait multimethod matrix analysis allows us to detangle correlations between instruments due to similarity of test methods from and similarities due to tapping the same attribute. The MTMM is simply a matrix or table of correlations arranged to facilitate the interpretation of the assessment of convergent validity. The basic principle of MTMM matrix is coefficients in the reliability diagonal should consistently be the highest in the matrix. MTMM matrix of nineteen factors is shown in Table V. Hence we conclude that the tool developed is valid.

Table V: Intra and inter attribute correlation values using MTMM method

Factor	Intra Attribute Correlation	Inter Attribute Correlation
Leadership and top management commitment (LTM)	0.738803	0.217468
Customer focus (CF)	0.715815	0.327393
Supplier quality management (SQM)	0.634490	0.317574
Continuous improvement (CI)	0.755654	0.403680
Employees involvement (EI)	0.797534	0.369520
Employees empowerment (EE)	0.999029	0.362046
Education and training (ET)	0.996525	0.339252
Strategic management (SM)	0.912387	0.435762
Quality information analysis (QIA)	0.846729	0.384926
Quality assurance (QA)	0.996834	0.412514
Quality citizenship (QCZ)	0.903660	0.315401

Quality culture (QC)	0.843660	0.317795
Benchmarking (BM)	0.991520	0.320778
Process and product design (PPD)	0.807759	0.312166
Process management (PM)	0.605528	0.244308
Product innovation (PI)	0.914285	0.291399
Knowledge management (KM)	0.999297	0.446194
Quality performance	0.531344	0.312367
Customer satisfaction level	0.589822	0.301467

Hypothesis test

The study also analyses the effect of ISO 9000 and Non-ISO 9000 on the companies TQM practices and Organization performance indicators. In the database out of 221 companies' 85 companies have ISO 9000 certification and rest are not certified. T-test is used in this study for the comparison analysis of ISO 9000 and non-ISO 9000 certified companies. The results are shown in the table VI.

Table VI: T-test summary

Factors	ISO	N	Mean	Std. Deviation	Sig.
Leadership and Top Management commitment	YES	85	6.23	.731	0.055
	NO	136	6.40	.468	
Customer Focus	YES	85	6.16	.626	0.736
	NO	136	6.13	.686	
Supplier Quality Management	YES	85	5.83	.820	**0.015***
	NO	136	5.54	.918	
Continuous Improvement	YES	85	5.76	.912	0.975
	NO	136	5.76	.790	
Employee Involvement	YES	85	5.77	1.307	0.228
	NO	136	5.55	1.365	
Employee Empowerment	YES	85	5.36	.951	0.128
	NO	136	5.16	.935	
Education and Training	YES	85	5.83	.766	**0.019***
	NO	136	5.56	.884	
Strategic Management	YES	85	5.79	.864	0.856
	NO	136	5.81	.674	
Quality Information Analysis	YES	85	6.09	.886	0.053
	NO	136	5.84	.990	
Quality Assurance	YES	85	6.16	.942	**0.046***
	NO	136	5.88	1.073	
Quality Citizenship	YES	85	5.77	1.210	0.187
	NO	136	5.53	1.427	
Quality Culture	YES	85	5.71	1.163	**0.029***
	NO	136	5.37	1.002	
Bench Marking	YES	85	4.85	1.480	**0.032***
	NO	136	5.27	1.260	
Process and Product Design	YES	85	5.61	1.057	0.321
	NO	136	5.46	1.092	
Process Management	YES	85	5.84	.956	0.52
	NO	136	5.75	.936	
Product Innovation	YES	85	5.80	1.055	0.134
	NO	136	5.57	1.164	
Knowledge Management	YES	85	4.68	1.609	0.354
	NO	136	4.88	1.462	

Quality Performance	YES	85	6.05	.695	0.916
	NO	136	6.06	.664	
Customer Satisfaction Level	YES	85	6.22	.611	0.866
	NO	136	6.21	.568	

Note: $^{*}p<0.05$

IV. CONCLUSION

This research paper has accomplished the stated objectives of the study successfully and analyzed the influence of ISO 9000 certification with the TQM practices and quality performance indicators in Indian manufacturing companies. This study provides seventeen critical factors of TQM and two performance indicators allowing managers to have a better understanding of quality management practices .The results yield a reliable, valid scale and provide empirical support so that the managers know what to do in order to advance towards quality organization performance.

ISO 9000 have some significant effect on both TQM practices and performance indicators. The study shows that five factors that are having a significant difference between ISO 9000 and non-ISO 9000 companies ($p<0.05$) are supplier quality management, education and training, quality assurance, quality culture and bench marking. In this analysis mean values for all factors are more for ISO 9000 companies only except for benchmarking. In the case of benchmarking non-ISO 9000 companies have more mean value than ISO 9000 companies.

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