

# Analysis of Performance Measures for Total Quality Management (TQM) in Manufacturing Industries



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*TQM stresses on 'management by facts' for which the relevant data – facts and figures need to be identified, collected and analysed. Continuous Improvement is one of the pillars of TQM. To enable this, performance needs to be measured, compared / analysed. Thus 'performance management' is essential. The first step of this is identifying the suitable performance measures. This paper presents the analysis of performance measures in the TQM environment over the time for any changes. Another aspect is comparison of PMs in India and other countries.*

## 1. Introduction

Since 1990, TQM has become one of the competitive initiative by the manufacturing organizations across the world. Generally making the beginning with ISO 9000 certification, and gradually moving towards the total quality management. Mixed results have been reported about the benefits of TQM. Empirical studies have not been conclusive about the the better performance of TQM firms as compared to non-TQM firms (Kurkovic et al 2000; Powell, 1995). Many definitions of TQM have been put forth by experts in the field of quality. TQM is an integration of all functions within an organization in order to achieve continuous improvement of the quality of goods and services. (Beheshti, Lollar 2003).

Organizational Performance may be considered as the value that an organization creates using its productive assets, relative to the value that the owners or other stakeholders expect. Measure is the quantification of an attribute or a parameter, to facilitate objectivity in assessment. Neely et al (2002) in their book discuss the 'performance measurement' as the process of quantifying the efficiency and effectiveness of the past action. The 'Performance Measure (PM)' can be defined as 'the parameter used to quantify the efficiency and / or the effectiveness. A performance metric is the definition of the scope, content, and component parts of a broadly based performance measure.

Quality performance is rather difficult to define (Flynn, 1995). Effective performance measurement system to be developed in the TQM context / environment is not easy. (Kumar et al, 2008). Performance being multidimensional, there are many approaches to it. Most obvious are the Financial and Cost Measures, but with the limitations attached. Another is the Balanced ScoreCard approach with the four perspectives: Learning and growth, internal business and production process, customer, and financial. The measures need to be internal and external, lead and lag, financial and non-financial.

## 2. Review of Literature

Quality started gaining importance after the Japanese industry's dominating position in the late 1970s. Thereafter many other countries stated giving focus on quality. TQM gradually became one of the ways to remain competitive. There have been many research articles on TQM and also on performance measurement. Forty-two research papers have been studied and used for this paper. The papers are spanning a time frame of about two decades from 1995 till 2014. These are covering many countries: the U.S., the U.K., Spain, Portugal, Canada, Ghana, Greece, Slovenia, Iran, Turkey, Australia, China, Malaysia, Taiwan, Indonesia, and of course India.

A brief review of these papers is presented here. Both Powell (1995) and Flynn et al (1995) considers TQM as a sustainable competitive advantage, and conduct empirical study of performance, making use of descriptive statistics and path analysis. The relationship between the TQM dimensions and firm performance in the automotive sector was tested by Curkovic et al (2000). The benefits of competitiveness and profitability in the study of U.S. companies have been noted. (Beheshti, Lollar 2003). Zhang, 2000 discuss many quality management methods in association with the performance. It also mentions that TQM gives better performance as compared to ISO 9000 in the study in the Netherlands. In an empirical study of Malaysian manufacturing companies Agus A. et al (2001) indicate the important role of competitive advantage as an intervening variable to ensure increased financial performance. Agua A. (2001) – in another study in Malaysian companies examines the relationships between TQM and performance using structural equation modelling. Chang and Sinclair (2002) validate a model based on over 100 TQM and non-TQM organizations in the U.K. In a study of 106 certified firms in Spain, Claver et al (2003) create an empirically tested scale. Through an empirical study of TQM practices in Japanese-owned manufacturers in China, Miyagawa and Yoshida (2005) indicate that TQM is an effective method to improve business performance. Sousa et al (2007) studied SMEs in Portugal, giving the widely used performance measures, and also found the obstacles to TQM. An in-depth study of performance measurement techniques was done by Chang (2005), resulting in a large list of performance measures, and also areas for continuous improvement. By examining the relationship between strategy and TQM

implementation, and their impact on performance, Fuentes et al (2006) conclude that more the alignment between the strategy and TQM, more is the benefit. Demirbag et al (2006) through study of Turkish SMEs, using structural equation modelling, found strong relationship between TQM practices and financial performance. Exploring TQM's impact on the linkage between manufacturing objective and TQM, Lin C. and Chang S (2006), state that stronger the linkage, better is the performance. Barkar and Emory (2006) from a study of more than 250 manufacturing firms, opine that TQM certainly leads to customer satisfaction. In a comparative study between Australian and Singaporean companies, Feng et al (2006) show which TQM dimensions connect better with certain measures of performance.. In ascertaining the relationships between ISO 9000, TQM, competitiveness, customer satisfaction, and performance, Han et al (2007) reveals that neither ISO 9000 nor TQM alone have large impact, but they together enhance competitiveness which in turn improves the performance. Using the basis of EFQM Excellence Model, Santso-Vijande et al (2007) in a study of Spanish firms, mention that firms using EFQM are able to perform better than their competitors. By studying the data from finalists in the Canada Awards for Business Excellence, Kumar et al (2008) suggest a performance measurement system which will fruitfully support the TQM implementation. Feng et al (2008), in a survey in Australia and New Zealand, depict a positive and significant relationship between ISO certification and business performance. Based on the responses of managers from 446 Spanish firms, Bou-Llusar et al (2008), conclude that EFQM Excellence Model does capture the main assumptions in the TQM concept. Aydin et al (2008) study the effect of multiple performance criteria usage on TQM and JIT implementation, in Turkish firms, found that the four perspectives similar to the Balanced ScoreCard, were significant in influencing the TQM level. Sadikoglu (2008) attempts to test the various complex relationships – direct and indirect, between many variables through a complex model. In examining the SMEs in Ghana, for relationship between quality management practices and performance, Fening et al (2008), mention that quality management practices do improve the performance. By separating 'hard' and 'soft' elements of TQM, Fotopoulos and Psomas (2009), state that the 'soft' factors are more predominant in impact on performance, thus underlining the importance of proper 'culture' for TQM success. Ali Uyar (2009) study of Turkish companies reveals that the managers there believe more in using non-financial measures, rather than financial measures. Hubbard (2009) discusses many performance measures for the 'triple bottom line' (i.e. profits, people, and planet) and emphasize that this will lead to sustainability, and proposes Sustainable balanced ScoreCard. Zakuan et al (2010) using SEM, developed a model for TQM constructs and organizational performance constructs, primarily to be tested in the Malayasian automotive sector. Arumuagm (2011) also developed a model for the automotive industry in Iran, to study the influence of TQM factors on performance. To analyse the impact of quality management practices and concurrent engineering on improvement of business performance, Belay (2011) mentions that there is sdirect relationship between these two and performance. Bahri et al (2012) through a study of a variety of Indonesian manufacturing companies, presents that TQM significantly impacts the performance – but through the mediating variable of organization culture. In a study of Portuguese companies, Barros et al (2014) proposes a conceptual model for relationship between quality management practices and performance.

In the context of Indian organizations - Strong and weak relationships have been found in the empirical study in Indian organisations by Shrivastava et al (2006). Kakkar and Narang (2007), in the Indian context discuss their TQM EF model with an aim to maximize the beneficial impact of TQM. In a web-based measurement of the implementation of TQM, Karuppusami and Gandhinathan (2007) analyzing responses of over a hundred organizations, identified ten critical success factors (CSFs) and the related operational performance measures. Examining various national and international quality awards, models etc. Sharma and Kodali (2008) suggest the framework of TQM elements for sustaining manufacturing excellence. In a study of Rice mills in India, Burli (2012) conclude that only specific TQM practices influence the performance. Kalra and Pant (2013) covering the Indian automotive industry in the NCR region, attempt to find the determinants of TQM for this sector through a model. Investigating the performance measurement factors relevant to the Steel Casting industry in Vidarbha region, Kashedikar et al (2013) reveal that factors can be grouped into four categories or dimensions viz. process performance, productivity improvement, employee development, and business results.

### 3. Analysis of the Performance Measures (PMs)

The PMs suggested by the various researchers were analysed for their occurrences. They were grouped on the time dimension – but for the sake of brevity, rather than on each paper basis, they were clubbed on year slots as shown in the table. To have some comparison, the earlier time slot was kept more. Another aspect of consideration was the country specific nature of PMs. Hence, the PMs discussed all over the countries, versus those mentioned in the studies related to the Indian context were depicted separately. Thus, both: time-wise and country-wise PMs are seen.

A total of 484 counts PMs were observed in the forty-two research papers. The corresponding figure for India is 96 PMs. 41 Performance Measures (PMs) are separately shown. The basis of selection is that at least 10% of the papers (all countries) should have it in them. Thus a minimum of 4 count of frequency is taken. For India, even if one paper out of seven mentions it, the PM is considered. By this basis, 41 PMs are meeting the criteria. These 41 PMs account for 398 occurrences i.e. 82 %. For India, it is 89 occurrences, i.e. 93 %. Thus, it may be considered to satisfy the Pareto Principle. The remaining PMs, more than 50 in number – have only 86 occurrences. The corresponding figure for India is 7.

### 4. Findings / Conclusions

From the table it is evident that the PMs of Market Share, Sales per Employee, Profits/ Net Profits, Cost of Quality, Customer Satisfaction, Employee Wellbeing, Product Quality, Scrap / Rework/ Wastage / Warranty Costs, Customer Complaints,

Productivity /Throughput / Capacity appear to be the prominent ones.

Since the numbers of papers in each of the three time-periods are different, a direct comparison is quite difficult.

But one can obviously make out that since the 'triple bottom line' concept has gained grounds over the last decade, yet the due emphasis on the PM related to Societal Impact is quite low at the all countries level, but in Indian context it is a somewhat better percentage.

With regards to the Pollution / Environmental Protection, both, the all countries, as well as India, lack the necessary emphasis / commitment, both being less than 15 % values.

In the Indian context, the Sales or revenue per Employee does not figure at all. By contrast, Customer Satisfaction gets all the attention, which is good. Likewise Product Quality; Scrap / Rework / Wastage / Warranty Costs; Customer Complaints; Productivity / Throughput / Capacity gets the deserved importance. Safety and Accidents, and After Sales Service aspects have a higher percentage, probably arising out of the fact that these two aspects are already being suitably practiced in other countries. It is nice to observe that the Competitiveness Development, has a higher percentage in India, which signals that the competition is getting fierce.

**Limitations** This study covered forty-two research papers. Coverage of more number of papers, so that each time period will have sufficient papers, may give better insights.

**Table 1** Occurrences of Various Performance Measures in the Different Research Papers

Perf.	Year	1995-2004	2005-2009	2010-2014	1995- 2014	Percent	2006- 2013	Percent
Measure	Country	Mixed	Mixed	Mixed	All		India	
	<b>No. of Papers</b>	<b>9</b>	<b>25</b>	<b>8</b>	<b>42</b>		<b>7</b>	
1	Market Share	3	18	4	25	59	4	57
2	Sales per Employee/ Revenue	4	15	1	20	48	0	0
3	New Customers/ Repeat Orders	1	8	3	12	29	2	29
4	Profits / Net Profits	6	21	5	32	76	6	86
5	Defect Rates	1	6	4	11	26	2	29
6	Inventory Turnover	2	3	1	6	14	2	29
7	Process Capability	2	1	1	4	10	1	14
8	Cost of Quality	1	11	2	14	33	3	43
9	Supplier Relations	1	4	0	5	12	1	14
10	Supplier Performance	1	6	0	7	17	1	14
11	Customer Focus	1	4	0	5	12	2	29
12	Customer Satisfaction	3	20	6	29	69	7	100
13	Employee Satisfaction/ Well Being	1	13	2	16	38	2	29
14	Employee Participation / Involvement	2	3	0	5	12	1	14
15	Employee Skills, Multi- Skills	1	3	0	4	10	2	29
<b>(Table contd.)</b>	<b>Year</b>	<b>1995-2004</b>	<b>2005-2009</b>	<b>2010-2014</b>	<b>1995- 2014</b>	<b>Percent</b>	<b>2006- 2013</b>	<b>Percent</b>
	<b>Country</b>	<b>Mixed</b>	<b>Mixed</b>	<b>Mixed</b>	<b>All</b>		<b>India</b>	
16	Improving Communication	1	0	0	1		1	14
17	Return on Assets, Investments	2	7	2	9	21	2	29
18	Product Quality	2	10	4	16	38	5	71
19	Product Features	1	1	0	2		1	14
20	Delivery On-time	2	10	1	13	31	2	29
21	Societal Impact	1	3	1	5	12	2	29
22	Scrap, Rework, Wastage, Warranty Costs	0	15	4	19	45	5	71
23	Customer Complaints	0	13	3	16	38	3	43
24	Productivity / Throughput / Capacity	0	16	4	20	48	4	57
25	Pollution / Environmental Protection	1	3	1	5	12	1	14
26	Safety, Accidents	1	5	0	6	14	2	29
27	Employee Education, Training	1	5	0	6	14	0	
28	After Sales Service	1	6	1	8	19	3	43

29	Employee Absenteeism	0	5	1	6	14	1	14
30	R & D Inv., New Product Development	1	7	1	9	21	0	
31	Competitiveness development	2	8	0	10	24	3	43
<b>(Table contd.)</b>	<b>Year</b>	<b>1995-2004</b>	<b>2005-2009</b>	<b>2010-2014</b>	<b>1995- 2014</b>	<b>Percent</b>	<b>2006- 2013</b>	<b>Percent</b>
	<b>Country</b>	<b>Mixed</b>	<b>Mixed</b>	<b>Mixed</b>	<b>All</b>		<b>India</b>	
32	Operating Expenses	0	5	3	8	19	1	14
33	Company's Image, Goodwill	1	3	1	5	12	0	
34	Employee Turnover	0	5	0	5	12	0	
35	Understanding Customer's Needs	0	3	1	4	10	1	14
36	Aesthetic Design, Ergonomics	0	1	0	1		1	14
37	Product Reliability, Maintainability	1	2	3	6	14	2	29
38	Employee Morale, Initiative	0	4	1	5	12	1	14
39	Cycle Time /Lead Time	1	7	1	9	21	2	29
40	Improvement in Internal Process	0	4	1	5	12	0	
41	Materials Efficiency	0	3	1	4	10	0	
	<b>Major PMs as above</b>				<b>398</b>	<b>82</b>	<b>89</b>	<b>93</b>
	Other PMs (more than 50)				86	18	7	7
	<b>Total</b>				<b>484</b>	<b>100</b>	<b>96</b>	<b>100</b>

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