

Evaluating the Implementation Status of TQM Practices in Industrial Organization of Textile and Apparel

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Abstract

In competitive world of today, every company has to be quality conscious. Textile and apparel industry is considered the back bone of Pakistan industry. It has 67% share of total exports of Pakistan. It has almost 37% employment and 11% share of GDP. So to be competitive in the world, Pakistan has to grow its textile & apparel sector. Purpose of the study was to evaluate that to what extent, industry has adopted Total Quality Management practices. The project was started with literature survey. Then existing management systems within the organization were studied. A TQM inspection tool that was made to evaluate TQM practices in Chinese manufacturing industries was used to evaluate quality management practices in the industry (TQM inspection tool on 5-point likert scale). In order to evaluate implementation status of TQM practices in the organization, Pearson correlation was used. Each element of 11 quality constructs was correlated with elements of "Measurement of product quality". Then negative relation between the two became the deficiency elements. Although organization is ISO and WRAP certified but these certifications are not implemented in their true sense. It has been evaluated that the organization will have to improve education to the employee about Total Quality Management and also room for improvement is still there in Statistical Process Control (SPC), Evaluation system and Employee participation in quality related decisions.

Keywords: TQM, Textile Industry.

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42 1. Introduction

43

44 Total quality management (TQM) has its origins over 60 years ago in the International Journal of Quality concept of
45 organization-wide or total quality control (TQC) proposed by Feigenbaum (1956) wherein each function contributing to
46 the added value of a product shares responsibility for its quality. This concept migrated to Japan in the 1950s together
47 with the practitioner-based teachings of Juran (1964) and Implementing Deming (1982). Total quality is defined as the
48 unrelenting pursuit of continuous improvement which is realized by accessing and utilizing the intensive knowledge and
49 experience of managers and employees at all levels (Kossoff, 1993). There are significant relationships between TQM,
50 competitive advantage and business excellence (Powell, 1995). Global competition and economic liberalization are
51 creating opportunities not only for Pakistani organizations but also for whole developing world. TQM is a management
52 philosophy that encourages customer satisfaction, continuous improvement, teamwork and strong aspirations to
53 self-actualization (Williams, 1994). Total quality management (TQM) is one of the most popular modern
54 management concepts (Bayazit, 2003). It is the discipline dedicated to enhance quality in every aspect of an organization.

55

56 Over the past few decades, TQM seers such as Deming (1986), Crosby (1979), Feigenbaum (1991), Ishikawa (1985), and
57 others have developed certain proposals in the area of quality management. There are several Quality Awards world-
58 wide, such as the Deming Prize (1992) in Japan, the European Quality Award in Europe (1994) and the Malcolm Baldrige
59 National Quality Award (1997) in the USA. Each of these awards is based on a perceived model of TQM. They do not
60 focus only on product, service perfection or traditional quality management methods, but consider a wide range of
61 management activities, behavior and processes that manipulate the quality of the final offerings. These award models
62 provide a useful audit or assessment framework against which organizations can be evaluated. The practice of total
63 quality management (TQM) as an improvement strategy is being embraced by more and more organizations throughout
64 the world as quality has become a competitive mandate. The premise of TQM is quite clear. Quality improvement can be
65 achieved if an organization develops a management philosophy of continuous improvement and provides the necessary
66 supporting organizational practices (Juran, 1993).

67

68 1.1 TQM Implementation Framework

69 Based on the comprehensive review of the TQM literature, the subsequent 11 constructs are considered to be the TQM
70 implementation constructs in present study. Leadership, Supplier quality management, Vision and plan statement,
71 Evaluation, Process control and improvement, Product design, Quality system improvement, Employee participation,
72 Recognition and reward, Education and training and Customer focus (Zhang et al., 2000). The European Quality Award
73 recognizes the crucial role of top management leadership in creating the goals, values and systems that guide the
74 detection of continuous performance improvement. Lack of top management commitment is always considered one of the
75 reasons for the failure of TQM efforts (Brown, 1994). Supplier quality management is an important aspect of TQM since
76 materials and purchased parts are repeatedly a major source of quality problems. The Malcolm Baldrige Quality Award
77 (1997) is also aware of the importance of supplier quality.

78

80 A vision statement describes how a company wants to be seen in its selected business. As such, vision describes
81 standards, values, and beliefs. Evaluating the situation in organizations, quality management practices provide an
82 important base for organizations to improve their quality management practices. A key element of any total quality
83 strategy is the management of processes (Porter and Parker). One important matter in process management is to make
84 sure that process capability can meet production requirements. One aspect of process management is equipment
85 maintenance, which ensures that variation is kept within acceptable limits, keeping the manufacturing process running
86 efficiently and effectively. Good process management should involve exactly documenting various process procedures,
87 with instructions for equipment operation in order to minimize the possibility of operator errors.

88

89 Product design is significant dimension of quality management. For complex products, errors during product
90 development cause about 50% of condition for use problems. Sound product design meets or exceeds the requirements
91 and hope of customers better than the competitors, leading to an improved market share. For improving product design,
92 designing engineers are required to have some shop floor and marketing experiences. Customer requirements and
93 production cost should be thoroughly measured during the method of product designing. All the associated departments
94 in a business should take part in new product improvement. Before preparing, new product plan should be carefully
95 reviewed in order to stay away from troubles occurrence during production. A distinctive quality system as part of a TQM
96 plan can contribute to TQM by running the organization's processes in a regular way. A quality system is definite as the
97 organizational composition, procedures, processes and revenue needed to execute quality management (ISO 8402, 1994).
98 In 1987, ISO published the ISO 9000 standards series on quality administration and quality declaration. When ISO 9000
99 is implemented, a quality instruction manual, quality procedures, and work instructions are recognized. An organization
100 may eventually apply to be registered as having an ISO 9001 (9002 or 9003) quality certificate.

101

102 By participating in quality improvement activities, employees acquire new understanding, see the benefits of the quality
103 disciplines, and gain a sense of achievement by solving value problems. The participation leads to lasting changes in
104 behavior. Participation is decisive in inspiring action on quality improvement (Juran, 1993). Participation may enable the
105 employees to improve their personal capabilities, increase their self respect, commit themselves to the success of their
106 organizations, and/or change certain character. Involvement may also change employees' negative attitudes and instill in
107 the employees a better understanding of the importance of product quality. Involvement may contribute to the concern of
108 a company-wide quality culture. Employees in organizations should be optimistic to report their work problems. Good
109 employees' suggestions should be implemented after being evaluated. Methods such as cross-functional teams, functional
110 teams, QC circles, voluntary teams, and suggestion schemes can be used for encouraging employee participation.

111

112 It almost goes without saying that an important feature of any quality improvement program is performance due
113 recognition for enhanced performance by any individual, section, and department or division within the organization
114 (Dale and Plunkett, 1990). Both teams and individuals can be recognized and rewarded for their superb performance. To
115 effectively support organization's quality efforts, they have to implement reward system that strongly links quality and
116 customer satisfaction with pay (Brown et al., 1994). Recognition and reward activities are supposed to effectively
117 stimulate employee assurance to quality improvement. Otherwise, these activities are subject to fail. Working condition

118 improvements, salary promotions, position promotions, financial awards for excellent suggestions are good methods for
119 recognition and reward. Deming (1986) forces the importance of education and training for continual updating and
120 improvement. Many research results disclose that education and training are one of the most important elements in a
121 successful implementation of TQM (e.g. Mann, 1992). The research confirms what most organizations have already
122 realized, namely, that education and training are a fundamental and necessary part of the TQM initiative. Investment in
123 education and training is fundamentally important for TQM success. Employees should consider as valuable, long-term
124 resources worthy of receiving education and training throughout their career. All management personnel, supervisors, and
125 employees should believe quality education and training such as quality awareness education and quality management
126 methods education.

127

128 To get quality, it is essential to know what customers desire and to provide products or services that meet their
129 requirements (Ishikawa, 1985). Successful organizations distinguish the need to put the customer first in every decision
130 made. The key to quality management is sustaining a close relationship with the customer in order to fully agree on the
131 customer's needs, as well as to get feedback on the extent to which those needs are being met. The customer should be
132 closely concerned in the product design and advance process, with inputs at every stage of the process so that there is
133 less likelihood of quality problems once full production begins (Flynn et al., 1994). The ultimate measure of company
134 performance is customer liking, which may very well predict the future success or failure of an organization (Kanji and
135 Asher, 1993). In order to get better customer satisfaction, customer complaints should therefore be treated with top
136 priority. Warranty on sold products should also be offered. Methods that can be used for customer retention and
137 satisfaction include collections of customer complaint information, market investigations, and customer contentment
138 surveys.

139 *1.2 Study of Organization*

140 *1.2.1 Brief Introduction of Organization*

141 Masood Textile Mills Ltd. is one of the few fully vertical textile mills in Pakistan having in-house Yarn, Knitting,
142 Fabric dyeing, Processing, and Laundry & Apparel Manufacturing facilities. The vertically integrated operations help in
143 achieving shorter lead times and greater flexibility to outfit to the customers' demand.

144 *1.2.2 Company Vision:*

145 Organization defines its vision as; "Our vision is of continual improvement and sustained growth, and of a family of
146 workers, who are given the best compensation benefits and working conditions in the region. In this respect, Masood
147 Textile Mills Ltd. continues to stress the need to invest in and develop its most precious resource - its human capital.
148 Organization continues to provide training courses and self-enhancement opportunities for all our workers".

149 *1.2.3 Targeted Facility*

150 There are quality check points at every stage of manufacturing starting from raw cotton, yarn, fabric, processing,
151 cutting, stitching and packing. Before the fabric is cut, it is checked whether it conforms to the customer standards of
152 shrinkage, weight, etc. After each lot of fabric is cut, 100% cut parts inspection is conducted to ensure that only high-
153 quality quality pieces move to stitching units. During the process of sewing, each and every process is inspected by inline
154 inspectors. The inspectors make sure that only good parts move to the next stage. An individual tracking number is sewn
155 inside each garment. After trimming and pressing of garments, highly experienced final inspectors inspect each garment.

156 The quality assurance team monitors the performance of every individual inspector by picking up the inspected garments
157 and checking the quality of these garments. To ensure that the garments are packed as per necessities of customers, we
158 can even track & check, which case the garment, has been packed in. with the help of this, we plan to attain the zero
159 defect level.

160 Apparel manufacturing division of the ABC organization was targeted for the assessment of the TQM practices. This was
161 selected because organization deals more in Apparel exports than any of the other products like yarn, Greig Fabric,
162 Finished Fabric, etc. All the other processes have their own quality control and quality assurance teams. In attire
163 manufacturing all the defects have to be removed before the final packing either faults belong to the yarn, fabric or
164 stitched garment.

165

166 1.2.4 Infrastructure & Hierarchy

167 Being the leading organization in textile and apparel business the ABC organization has strong infrastructure with
168 respect to machine. In the stitching they have different sites with following machine setups.

169

Stitching Setup Location	Sub unit	Machines	Total Machines
Apparel – I	Main Unit	1082	1350
	Panther	286	
Apparel – II	Falcon	484	587
	Leopard	103	
Apparel – III	Crescent	766	1234
	Peacock	458	
Total Machines			3171

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171 Table: 2.1 Machine setup

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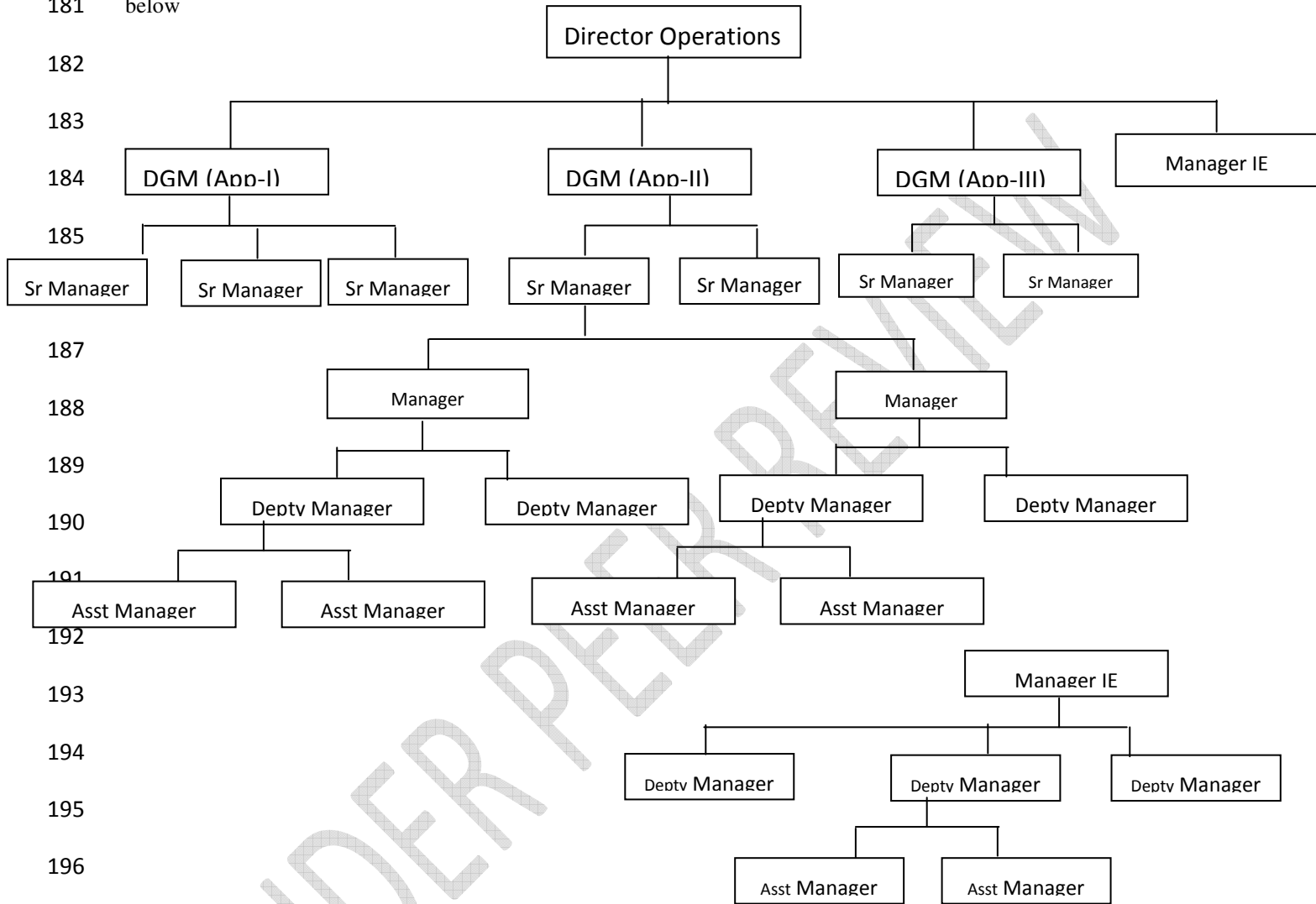
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180 For each subunit there is one Sr. Manager and for each main setup they have DGM. Detailed hierarchy is shown
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199 For each manager (Asst, Depty & Sr manager) there are prescribed number of machines

200 1.2.5 ISO Certification

201 ISO department provides a management system at organization, as per their claim renders the product free of non
202 conformance. The department has training system that creates understanding of Total Quality Management (TQM). A
203 qualified team of employees and certified auditors do their efforts to improve and ensure the consistency in the
204 system.

205

1.2.6 WRAP Certification

The Worldwide Responsible Apparel Production Principles are minimum standards for production facilities participating in the Worldwide Responsible Apparel Production certification Program. The Program's objective is to demonstrate the apparel industry's commitment to socially responsible business practices and to assure that sewn products are produced under lawful, caring and moral conditions. Participating companies voluntarily agree that their production and that of their contractors will be certified by an independent monitor as complying with these standards. Created by a working group of the American Apparel & Footwear Association in 1997, WRAP became a standalone entity in 2000. While it was founded by clothing industry companies, WRAP's charter requires that a majority of its board members come from outside the apparel industry.

Almost 10 years ago, the industry began a process to demonstrate its commitment to responsible business practices and to ensure that apparel is produced under lawful, humane and ethical conditions. The process has reached out to many interested constituencies outside the apparel manufacturing community, including retailers, human rights advocates, public interest organizations, development agencies, and the licensing community. The first result of this process was the development of the Worldwide Responsible Accredited Production Principles - basic standards that address labor practices, factory conditions, and environmental and customs compliance. Global support for WRAP from consumers, manufacturers and governments grows monthly. In addition to the endorsement of the WRAP Principles, the manufacturing associations and member manufacturing companies are actively participating in the WRAP Certification Program. The WRAP Certification Program is the only independent and globally supported factory certification program requiring manufacturers to comply with the 12 universally accepted WRAP Production Principles assuring safe and healthy workplace conditions, and respect for workers' rights. Many manufacturers have commented that WRAP has not only resulted in more reliable social compliance, but has contributed to greater productivity, lower turnover, improved communications between management and employees, safer working conditions and improved morale. Today, WRAP is being recognized by many retailers and manufacturers as the most reliable, yet economically efficient factory compliance system to assure lawful, ethical and humane manufacturing.

1.2.7 Summarizing the TQM practices in Industry

In Masood Textile Mills Ltd. as long as compliance and ISO standards are concerned, Organization lack behind on many standards that will be discussed in the next sections of the work. In apparel manufacturing there are two departments named "Quality Control" and "Quality Assurance" to maintain quality of the process. Although policy statements and quality manuals exist, still there is gigantic gap between the documentation and implementation. This gap is discussed in the later sections.

TQM inspection tool

Quality Management in Operations

Customer oriented quality definitions off course depend on successful results of product supplies and services by the organizations. Three types of quality is done in textile industry

244 Product quality

245 Factory and social audits

246 Laboratory testing

247 Departments in selected organization's apparel division; especially responsible for quality are "Quality Control" and
248 "Quality Assurance". These two different departments are purely looking after for quality of product. Production
249 department is also looking after for quality but questions are not asked about poor quality to this department directly.
250 This practice denies the TQM execution in textile industry. As we know that TQM defines that everyone is
251 responsible for quality. Any how the quality procedure that is adopted by these departments is assessed below.

252

253 **Assessment of TQM practices**

254 To evaluate the implementation status of total quality management in textile industry, TQM implementation
255 instrument is prepared in the light of instrument used to evaluate TQM execution for Chinese manufacturing
256 companies (IJQRM 17, 7 PP 730-755) and circulate among the key persons in the industry. According to this paper
257 the instrument presented is reliable and valid and may be used to target improvement areas.

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259 **2. Methodology**

260 In this study, validity was a measure of how well scales representing the various quality management practices are
261 related to measures of product quality performance (the criteria) (Flynn et al., 1994). Product quality performance was
262 measured by asking respondents to rate (on a five-point scale, 1 = worst in the industry; 2 = below average; 3 =
263 average; 4 = above average; 5 = best in the industry) seven indices. These indices included, for example, performance,
264 conformity rates, reliability, durability, defect rates of their primary products, internal failure costs, and warranty
265 claims costs as a percentage of their annual sales. Accordingly, bi-variate correlation (Pearson) was conducted to
266 study the interrelationships between the independent and dependent variable sets: the TQM implementation (predictor
267 set) and the product quality performance measures (the criterion set). Fortunately, the correlation within the 11 scales
268 (predictor set), within the seven measures (criterion set), between the predictor set and criterion set was significant at
269 the 0.01 level. It can therefore be concluded that this set of scales had good criterion-related validity.

270 **Correlation analysis**

271 Use the Correlation transformer to determine the extent to which changes in the value of an attribute (such as
272 Leadership, statistical process control, etc) are associated with changes in another attribute (such as Product Quality
273 Measures). The data for a correlation analysis consists of two input columns. Each column contains values for one of
274 the attributes of interest. The Correlation transformer can calculate various measures of association between the two
275 input columns.

276 The Correlation transformer calculates any of the following correlation-related statistics on one or more pairs of
277 columns:

278 **Correlation coefficient r**

279 The correlation coefficient r is a measure of the linear relationship between two attributes or columns of data. The
280 correlation coefficient is also known as the Pearson product-moment correlation coefficient. The value of r can range

from -1 to +1 and is independent of the units of measurement. A value of r near 0 indicates little correlation between attributes; a value near +1 or -1 indicates a high level of correlation.

When two attributes have a positive correlation coefficient, an increase in the value of one attribute indicates a likely increase in the value of the second attribute. A correlation coefficient of less than 0 indicates a negative correlation. That is, when one attribute shows an increase in value, the other attribute tends to show a decrease.

Also note that

Strength: As you move farther away from zero (closer to -1.00 or 1.00) the relationship is stronger. The strongest relationship would be either 1.00 or -1.00 meaning that as one variable changes by one unit, the other variable changes by one unit. As you get closer to zero, the relationship is weaker. A zero correlation means that there is no relationship between the factors and a change in one variable does not mean a change in the other variable

Direction: The sign of the correlation coefficient tells the direction of the relationship. A positive sign means that the factors move together. This can mean as one variable increases the other variable increases. A negative sign means that the relation is inversely significantly correlated. Note that correlations of -.89 and .89 are equally strong but opposite in sign.

Causality: Correlation is *never* causality. Just because the variable move together does not mean that one causes the change in the other. A third variable could be causing the movement of both.

Results and Discussion

Data Collection

For the study in the trade to access the TQM status of accomplishment the decision making personnel from different departments are chosen. The TQM execution assessment tool was distributed among the key persons by emails and by visiting the industry on their location. The departments and designators from whom the data was composed is as follow

Departments

Production, Quality Control, Quality Assurance, Industrial Engineering, Marketing, Production Planning & Control.

Designations

Managers, Asst Managers, Deputy Managers, Officers.

Sample Size

Total sample size consists of 79 people. Detail about the sample size effects and number of persons in one designation in sample size is as follows. Total questionnaires distributed in industry were 116. But total respondents were 79.

312 Department

Department	Quantity	Percent
Human Resource	5	6.3
Industrial Engineering	4	2.5
Marketing	13	15.2
PPC	5	8.9
Procurement	5	8.9
Product Development	3	3.8
Production	23	24.1
Quality Assurance	7	13.9
Quality Control	14	16.5
Total	79	100.0

Designation

Designation	Quantity	Percent
Asst Manager	43	54.4
Dypty Manager	18	22.8
Manager	13	16.5
Officer	5	6.3
Total	79	100.0

Table: 5.2 Designation in sample size

321 Table: 5.1 List of Department

322 Performance of the organization

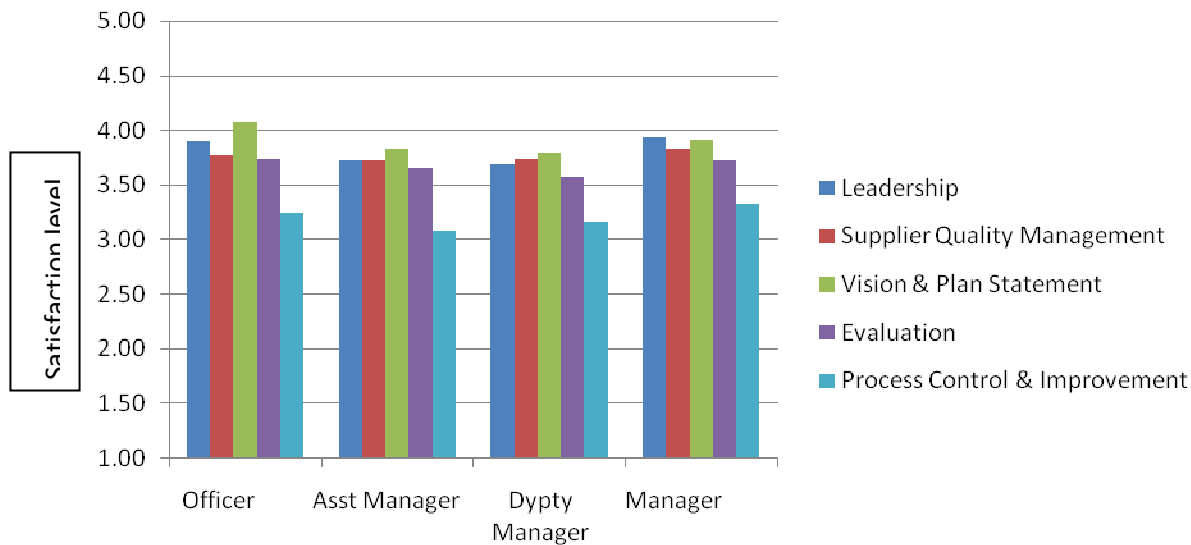
323 Designee Vs Quality Construct

324 As long as understanding of different quality construct by different designees is concerned, result of their satisfaction
325 level towards implementation of the described construct is as follows;

326 Satisfaction level about implementation of quality construct by various levels in hierarchy is different. Mean values of
327 satisfaction level are illustrated in graph 5.1(a) and 5.1(b).

328 Managers' satisfaction level score is higher as compared to others on leadership and supplier quality management. In
329 case of vision & plan statement and evaluation each level in hierarchy is satisfied. Satisfaction level of managers
330 about Process Control and Improvement is higher among the hierarchy

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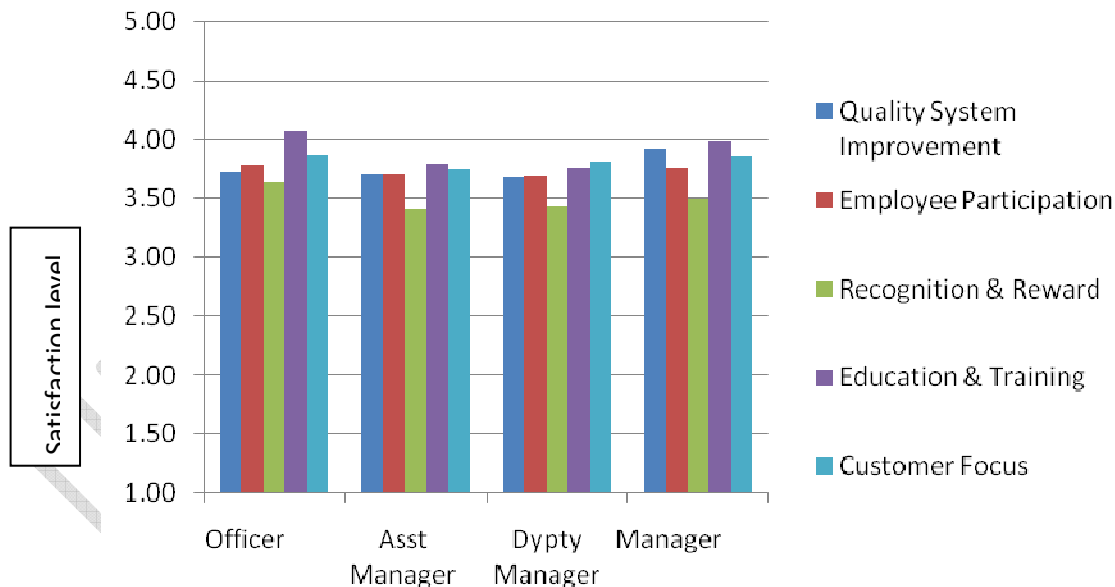


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333 Graph: 5.1(a) Satisfaction level by Different Designees

334 Mangers are more convinced in quality system improvement than others. Because they actually have bird's eye view
 335 on the quality policy and they can notice even a small improvement in the process. Each level in hierarchy believes
 336 that everyone is get involved in the problem solving issues.

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339 Graph: 5.1(b) Satisfaction level by Different Designees

340 Officers are more convinced about Recognition and Reward system in the organization than other levels in the
 341 hierarchy. Same is the case in Education & Training.

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343 An organization's success depends on how much customer is happy with services/product offered by the company.

344 Out of the eleven construct of the TQM mention in the literature survey, construct of the product quality has

345 importance in correlating with others. Therefore one should acknowledge that all the constructs of total quality

346 management has direct or indirect relation with one of the "Product Quality".

347 Now all the construct of TQM will be correlated with product quality in order to better analyze the implementation

348 status of quality management practices in the organization.

349 Before starting evaluation, it is important to describe the key features of the Pearson correlation table. Such as

350 The correlation coefficient r is a measure of the linear relationship between two attributes or columns of data. The

351 correlation coefficient is also known as the Pearson product-moment correlation coefficient. The value of r can range

352 from -1 to +1 and is independent of the units of measurement. A value of r near 0 indicates little correlation between

353 attributes; a value near +1 or -1 indicates a high level of correlation.

354 When two attributes have a positive correlation coefficient, an increase in the value of one attribute indicates a likely

355 increase in the value of the second attribute. A correlation coefficient of less than 0 indicates a negative correlation.

356 That is, when one attribute shows an increase in value, the other attribute tends to show a decrease.

357 Consider two factors x and y :

358 • If $r = 1$, then x and y are perfectly positively correlated. The possible values of x and y all lie on a straight line
359 with a positive slope in the (x,y) plane. All positive values shows both factors (elements) are moving in the
360 same direction i.e if one factor increasing other factor will also increase

361 • If $r = 0$, then x and y are not correlated. They do not have an apparent linear relationship. However, this does
362 not mean that x and y are statistically independent.

363 • If $r = -1$, then x and y are perfectly negatively correlated. The possible values of x and y all lie on a straight
364 line with a negative slope in the (x,y) plane

365 First of all elements of product quality will be correlated with itself as. Elements of product quality are numbered as

366 P1 to P7, as mention in the chapter 3.

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Indicators		Product Quality						
		Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)
Product Quality		P1	P2	P3	P4	P5	P6	P7
	P1	1	-.015 (.898)	.077 (.501)	-.349(**) (.002)	-.025 (.827)	.182 (.109)	.061 (.594)
	P2	-.015 (.898)	1	.492(**) (.000)	.036 (.756)	-.093 (.415)	-.045 (.696)	.128 (.259)
	P3	.077 (.501)	.492(**) (.000)	1	.147 (.196)	-.241(*) (.032)	.183 (.107)	.180 (.113)
	P4	-.349(**) (.002)	.036 (.756)	.147 (.196)	1	-.064 (.577)	-.051 (.655)	-.067 (.557)
	P5	-.025 (.827)	-.093 (.415)	-.241(*) (.032)	-.064 (.577)	1	.262(*) (.020)	.203 (.073)
	P6	.182 (.109)	-.045 (.696)	.183 (.107)	-.051 (.655)	.262(*) (.020)	1	.116 (.310)
	P7	.061 (.594)	.128 (.259)	.180 (.113)	-.067 (.557)	.203 (.073)	.116 (.310)	1

Table: 5.3 Measurement of Product Quality (Correlation)

P2 and P3 are significantly correlated with each other. As conformity of the product increases, reliability of the primary product also increases in the same trend. Element of Defects rate (P5) is negatively correlated with reliability of the product, which is a good sign for the organization. As the defects rate reduces reliability increases, but it should be stronger than existing results. Performance of the primary product is negatively correlated with the durability of the product. which shows that they are focusing on the technical features of the material than its performance as in this case performance mean that how material/product behaves against sunlight, washes, rubbing, etc. so one should care for the performance of the product as well.

Now all the constructs of quality will be analyzed with the product quality one by one.

1. Leadership

Quality Construct	Indicators	Product Quality						
		Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)
		P1	P2	P3	P4	P5	P6	P7
Leadership	A	.167 (.141)	-.021 (.855)	-.003 (.980)	.249(*) (.027)	.179 (.114)	-.109 (.340)	.157 (.168)
	B	.126 (.270)	.034 (.769)	-.017 (.885)	.020 (.863)	-.060 (.599)	.084 (.461)	.078 (.492)
	C	-.142 (.213)	-.155 (.172)	-.003 (.982)	.192 (.090)	.332(**) (.003)	.193 (.088)	.113 (.321)
	D	.134 (.240)	.130 (.252)	.221 (.050)	.016 (.891)	-.184 (.105)	-.071 (.535)	-.015 (.896)
	E	.302(**) (.007)	-.281(*) (.012)	.014 (.902)	.150 (.187)	-.107 (.349)	-.001 (.990)	-.123 (.281)
	F	.309(**) (.006)	-.195 (.085)	.106 (.354)	.187 (.099)	-.133 (.244)	.083 (.468)	-.159 (.161)
	G	-.088 (.443)	.285(*) (.011)	.185 (.102)	-.017 (.881)	-.050 (.664)	.278(*) (.013)	.061 (.592)
	H	.116 (.308)	-.045 (.692)	.134 (.240)	.146 (.200)	-.345(**) (.002)	-.305(**) (.006)	-.131 (.249)
Supplier Quality Management	SQ1	-.128 (.262)	.224(*) (.048)	.271(*) (.016)	.413(**) (.000)	.022 (.851)	.124 (.276)	-.054 (.638)
	SQ2	.028 (.806)	.071 (.535)	.050 (.664)	.127 (.265)	-.148 (.192)	.102 (.370)	-.123 (.279)
	SQ3	.302(**) (.007)	-.063 (.580)	.037 (.749)	-.105 (.355)	-.174 (.124)	.055 (.631)	-.067 (.559)
	SQ4	-.154 (.177)	.453(**) (.000)	.160 (.158)	.157 (.168)	-.256(*) (.023)	-.297(**) (.008)	-.093 (.417)
	SQ5	.312(**) (.005)	-.017 (.881)	.033 (.776)	-.150 (.186)	-.137 (.228)	.207 (.067)	.103 (.365)
	SQ6	-.225(*) (.046)	.338(**) (.002)	.309(**) (.006)	.260(*) (.021)	-.072 (.528)	-.066 (.562)	-.165 (.147)
Vision and Plan Statement	VP1	.053 (.643)	.165 (.147)	.233(*) (.038)	.112 (.324)	.113 (.321)	.217 (.055)	.157 (.167)
	VP2	.172 (.129)	.278(*) (.013)	.296(**) (.008)	.090 (.430)	.149 (.191)	.016 (.888)	.199 (.079)
	VP3	.190 (.094)	.441(**) (.000)	.254(*) (.024)	.215 (.057)	.179 (.115)	.117 (.304)	.013 (.912)
	VP4	.220 (.052)	.237(*) (.035)	.154 (.174)	.263(*) (.019)	.442(**) (.000)	.289(**) (.010)	-.185 (.102)
	VP5	.261(*) (.020)	-.077 (.502)	.219 (.052)	.122 (.282)	-.105 (.358)	.040 (.725)	.120 (.292)
	VP6	-.030 (.790)	-.077 (.501)	.158 (.165)	.327(**) (.003)	-.026 (.817)	.092 (.422)	-.170 (.133)
	VP7	.351(**) (.001)	-.208 (.066)	-.062 (.585)	.123 (.282)	.157 (.168)	-.041 (.718)	.197 (.082)
	VP8	.249(*) (.027)	-.102 (.371)	.146 (.199)	-.243(*) (.031)	-.076 (.506)	.027 (.811)	-.252(*) (.025)

Table: 5.4 “Quality Constructs(1-3) – Product Quality” Correlation

Most of the elements of product quality have very good relation with the Leadership points. But at some points are significantly correlated with each other as

Elements of Leadership A & C are significantly correlated with P4 and P5 respectively. i.e, Participation of in quality management and improvement process (A) have the positive effects on the durability of the product (P4). Arranging Employee trainings (E) and discussing quality related issues in meeting (F) are very highly significant with the

performance of the product (P1). Whereas with the increase in the education and trainings, decrease in the conformity is shown in the relationship table, which is not natural so it needs to be improved.

Top management pursue for long term business success (H) is significantly negative correlated with defect rate of the product (P5).

2. Supplier Quality management

Providing feedback to the vendors (SQ4) is negatively significant correlated with the defects rate (P5) and internal failure cost of the product (P6) as shown in the relationship.

Conducting quality audits regularly (SQ6) lowers the performance of the primary product (P1) which is a weak relation but it exists there. One should focus on the auditing procedure, in order to have efficient performance of the product.

3. Vision and Plan Statement

A clear long term vision statement (VP1) is significantly correlated with reliability of the product (P3). VP2 and VP3 are significantly correlated with both P2 & P3, which indicates that encouraging employee's commitment to quality improvement (VP2) and short term business plans (VP3) are moving the product's reliability (P3) and conformity (P2) in right direction. Having clear quality policy (VP4) is significantly correlated with P2, P4, P5 and P6 element of product quality. An inverse relation exists between the involvement of employees in making policies (VP8) and durability (P4), warranty claim cost as percentage of annual sales.

4. Evaluation

Evaluating policies and strategies regularly (E1) is highly significant with the performance of product (P1). As this relation is with positive sign therefore it shows that a direct relation exists between these two. Also E1 is significantly correlated in reverse direction with the durability of the product.

Conducting quality audits regularly (E2) improves the conformity (P2) and reliability (P3) of the product. These quality audits also minimize the warranty claim costs as percentage of annual sales (P7).

0.375 value of correlation coefficient between Benchmarking (E3) and performance of the product (P1) shows that as organization adopt benchmarking practice, performance of product moves towards positive direction.

Quality Construct	Indicators	Product Quality						
		Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)
		P1	P2	P3	P4	P5	P6	P7
Evaluation	E1	.323(**) (.004)	-.029 (.802)	.059 (.608)	-.355(**) (.001)	.103 (.366)	.117 (.304)	.202 (.074)
	E2	.117 (.305)	.261(*) (.020)	.373(**) (.001)	-.010 (.930)	-.013 (.909)	-.039 (.735)	-.292(**) (.009)
	E3	.375(**) (.001)	-.117 (.305)	-.004 (.971)	.005 (.966)	-.146 (.199)	-.060 (.598)	-.141 (.216)
	E4	.117 (.304)	.272(*) (.015)	.102 (.369)	-.034 (.764)	-.396(**) (.000)	-.070 (.537)	.326(**) (.003)
	E5	.147 (.195)	-.066 (.562)	.202 (.074)	.302(**) (.007)	.067 (.559)	.007 (.955)	.032 (.779)
	E6	.128 (.260)	-.327(**) (.003)	.022 (.844)	.084 (.459)	.014 (.899)	.221 (.050)	-.092 (.421)
	E7	.016 (.886)	.017 (.880)	.075 (.510)	-.104 (.360)	-.144 (.206)	-.139 (.223)	-.011 (.926)
	E8	-.257(*) (.022)	.220 (.052)	.009 (.937)	.303(**) (.007)	-.140 (.217)	-.067 (.558)	-.054 (.638)
	E9	-.150 (.188)	.122 (.283)	.156 (.170)	.150 (.188)	.090 (.429)	.189 (.096)	-.139 (.221)
	E10	-.263(*) (.019)	.111 (.330)	-.014 (.903)	-.008 (.947)	-.065 (.567)	-.101 (.374)	-.241(*) (.032)
Process Control and Improvement	PC1	.189 (.095)	-.111 (.330)	-.129 (.259)	.199 (.078)	-.223(*) (.048)	-.113 (.322)	-.052 (.652)
	PC2	-.058 (.611)	.117 (.303)	.083 (.467)	-.028 (.806)	-.173 (.127)	-.075 (.513)	.022 (.847)
	PC3	.168 (.140)	.502(**) (.000)	.323(**) (.004)	.087 (.447)	-.036 (.751)	.053 (.641)	.022 (.847)
	PC4	.094 (.411)	.143 (.208)	.083 (.467)	.167 (.141)	-.263(*) (.019)	-.252(*) (.025)	-.031 (.788)
	PC5	.133 (.241)	-.165 (.145)	-.024 (.834)	.223(*) (.048)	.004 (.975)	.036 (.751)	.127 (.264)
	PC6	.016 (.889)	-.103 (.366)	-.010 (.927)	.049 (.667)	.029 (.802)	.232(*) (.040)	-.085 (.459)
	PC7	.019 (.867)	.195 (.085)	.269(*) (.016)	.223(*) (.048)	-.122 (.283)	.003 (.976)	-.024 (.831)
	PC8	.005 (.966)	.100 (.380)	.047 (.681)	-.148 (.192)	.062 (.589)	.045 (.693)	.136 (.233)
Product Design	PD1	-.194 (.086)	.263(*) (.019)	.118 (.300)	.249(*) (.027)	-.082 (.471)	.202 (.074)	-.042 (.714)
	PD2	.416(**) (.000)	.098 (.388)	.273(*) (.015)	-.102 (.370)	.109 (.340)	.269(*) (.016)	.299(**) (.007)
	PD3	-.011 (.924)	.291(**) (.009)	.128 (.262)	.061 (.596)	-.168 (.139)	-.183 (.106)	-.033 (.770)
	PD4	.126 (.269)	.194 (.087)	.363(**) (.001)	-.032 (.780)	-.294(**) (.009)	-.151 (.184)	.016 (.888)
	PD5	.225(*) (.046)	.267(*) (.018)	.009 (.934)	-.048 (.676)	-.124 (.277)	.014 (.901)	-.195 (.085)
	PD6	-.214 (.058)	-.225(*) (.046)	-.112 (.325)	.212 (.061)	.268(*) (.017)	.159 (.162)	-.356(**) (.001)
	PD7	-.174 (.125)	.136 (.232)	-.030 (.791)	.193 (.088)	-.125 (.273)	-.156 (.170)	-.084 (.462)
	PD8	-.085 (.456)	.460(**) (.000)	.038 (.738)	.105 (.356)	.209 (.065)	.122 (.283)	.068 (.554)

Table: 5.5 “Quality Constructs (4-6) – Product Quality” Correlation

434

435 Use of quality related costs extensively (E4) improve conformity rates (P2) and warranty claim cost (P7) as E4 is

436 significantly correlated with P2 & P7. Also use of quality related cost (extensively) is significantly negative correlated

437 with the defect rates (P5).

Keeping detailed quality data such as defect rates and scraps (E5) is significantly correlated with durability of the product (P4).

E6 is significantly correlated with P2 (conformity of product) but this relation is in opposite direction. i.e, use of quality related data to evaluate the management of the organization is lowering the conformity of the product.

Use of quality related data to evaluate employee performance (E8) lowers the performance of the product (P1). Also E8 is significantly correlated with durability of the product (P4).

Purpose of evaluation is improvement (not criticism) is inversely correlated with performance of the product (P1). This may lead us to a result that evaluation purpose is criticism not improvement.

5. Process Control and Improvement

Cleanliness situation of the work floor is inversely and significantly correlated with defects rate of the product (P5). There is room for improvement in the massive situation of shop floor.

Well maintenance of production equipment/machines (PC3) is significantly correlated with conformity (P2) and reliability (P3) of the product.

Use of statistical process control tools (PC7) significantly correlated with reliability (P3) and durability (P4) of the product. Inverse relation exists between incoming, processes, final product inspection (PC4) and defects rates of the product (P5). It is clear from this inverse relation that as organization increases inspection at various levels, defects rate unchanged or increases. Same is case with internal failure costs as a percentage of annual sales.

6. Product Design

Design Engineers with more experience in organization (PD1) is correlated with the conformity of the product quality (P2) and with parameter of durability of product (P4). Personnel of product design with marketing experience (PD2) are more significantly correlated with the performance of product (P1) and also with lesser internal failure cost as percentage of annual sales (P7).

Considering the customer requirement in new product design (PD3) is significantly correlated with conformity of product (P2).

Various departments' participation in developing new product (PD4) is significantly negative correlated with defects rate of the product (P5). Correlation coefficient 0.460 between PD8 and P2 shows that there is significant correlation between the usage of quality function deployment and conformity of the product quality.

7. Quality System Improvement

Continuous Quality System Improvement (QS1) is significantly correlated with reliability (P3) and durability of the product (P4). Usage of ISO 9000 as guideline for establishing Quality System (QS2), documented quality manuals

468 and procedures (QS3, QS4) are inversely correlated with defects rate (P5). A significant correlation exists between
 469 having clear quality manual (QS3), clear working instruction (QS4) and durability of the product (P4).

Quality Construct	Indicators	Product Quality						
		Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)	Corre. Coefficient (p-value)
Quality System Improvement		P1	P2	P3	P4	P5	P6	P7
	QS1	.089 (.433)	.120 (.294)	.255(*) (.023)	.352(**) (.001)	.023 (.841)	.108 (.344)	.000 (.998)
	QS2	.224(*) (.047)	-.205 (.071)	.090 (.431)	.097 (.396)	-.234(*) (.038)	.048 (.674)	-.107 (.347)
	QS3	-.099 (.384)	.307(**) (.006)	.180 (.113)	.346(**) (.002)	-.413(**) (.000)	-.078 (.493)	-.108 (.343)
	QS4	-.210 (.063)	.100 (.381)	.020 (.862)	-.189 (.095)	-.237(*) (.035)	-.243(*) (.031)	-.016 (.886)
	QS5	.105 (.358)	.030 (.792)	.128 (.260)	.423(**) (.000)	.046 (.686)	.251(*) (.026)	-.265(*) (.018)
Employee Participation	EP1	.566(**) (.000)	.036 (.750)	.091 (.424)	-.501(**) (.000)	.185 (.103)	.192 (.091)	.164 (.148)
	EP2	.209 (.064)	.114 (.319)	.301(**) (.007)	.058 (.615)	-.168 (.140)	-.127 (.263)	.272(*) (.015)
	EP3	-.346(**) (.002)	.037 (.745)	.112 (.326)	.571(**) (.000)	.260(*) (.021)	.134 (.239)	-.036 (.751)
	EP4	-.345(**) (.002)	.075 (.512)	-.154 (.176)	.204 (.072)	.353(**) (.001)	.061 (.591)	.100 (.380)
	EP5	.368(**) (.001)	-.160 (.160)	-.055 (.627)	-.014 (.903)	.361(**) (.001)	.256(*) (.023)	.049 (.666)
	EP6	.172 (.130)	.488(**) (.000)	.636(**) (.000)	.232(*) (.040)	-.016 (.891)	.230(*) (.041)	.133 (.241)
	EP7	.017 (.885)	.622(**) (.000)	.441(**) (.000)	.052 (.652)	-.326(**) (.003)	-.023 (.838)	.345(**) (.002)
	EP8	-.158 (.164)	-.249(*) (.027)	-.041 (.721)	.164 (.148)	.370(**) (.001)	.433(**) (.000)	-.016 (.892)
Recognition and Reward	RR1	-.394(**) (.000)	.043 (.707)	.137 (.227)	.331(**) (.003)	.168 (.140)	.176 (.122)	.172 (.129)
	RR2	-.046 (.690)	-.037 (.748)	.100 (.382)	.140 (.218)	.071 (.533)	.150 (.187)	.139 (.223)
	RR3	-.168 (.139)	.162 (.153)	.060 (.599)	.033 (.774)	-.017 (.884)	.044 (.698)	.198 (.081)
	RR4	.165 (.145)	.144 (.206)	-.001 (.990)	-.018 (.876)	-.098 (.391)	-.239(*) (.034)	.357(**) (.001)
	RR5	.208 (.066)	.118 (.302)	.170 (.135)	.261(*) (.020)	-.178 (.116)	-.121 (.290)	-.097 (.395)
	RR6	.157 (.167)	-.286(*) (.011)	-.083 (.465)	.103 (.368)	.290(**) (.009)	.054 (.635)	.055 (.630)
Education and Training	ET1	.161 (.156)	-.117 (.303)	-.148 (.193)	-.121 (.290)	-.010 (.928)	-.097 (.397)	.108 (.341)
	ET2	.142 (.211)	-.135 (.234)	-.009 (.934)	-.390(**) (.000)	-.078 (.497)	-.014 (.901)	.146 (.198)
	ET3	.124 (.276)	.196 (.083)	.314(**) (.005)	.143 (.208)	-.324(**) (.004)	-.073 (.521)	.225(*) (.046)
	ET4	.095 (.407)	.155 (.172)	.337(**) (.002)	.363(**) (.001)	-.256(*) (.023)	-.001 (.994)	-.039 (.731)
	ET5	-.146 (.198)	-.369(**) (.001)	-.102 (.372)	.177 (.120)	.057 (.617)	.016 (.892)	-.080 (.482)
	ET6	-.258(*) (.022)	.180 (.113)	.268(*) (.017)	.404(**) (.000)	-.090 (.433)	.094 (.409)	-.011 (.924)
Customer Focus	CF1	-.104 (.361)	.461(**) (.000)	.150 (.186)	-.266(*) (.018)	.283(*) (.011)	.035 (.757)	.205 (.070)
	CF2	-.041 (.718)	.379(**) (.001)	.369(**) (.001)	.037 (.746)	-.213 (.060)	.041 (.722)	-.219 (.052)
	CF3	.113 (.323)	.262(*) (.020)	.221 (.050)	.208 (.066)	-.037 (.746)	.095 (.407)	-.002 (.986)
	CF4	.028 (.804)	-.341(**) (.002)	-.132 (.245)	-.010 (.931)	-.015 (.896)	.031 (.789)	.105 (.358)
	CF5	.106 (.353)	.035 (.758)	.076 (.507)	.226(*) (.045)	.060 (.599)	.047 (.680)	-.175 (.122)
	CF6	-.015 (.895)	.078 (.494)	-.058 (.614)	.046 (.687)	-.210 (.064)	-.053 (.643)	-.042 (.715)

471 8. Employee Participation

472 As cross functional teams exist in the organization (EP1), therefore performance of product is fine (P1) but durability
473 of product (P4) very low as there is inverse relation between EP1 & P4. This inverse relation with P4 needs to be
474 reversed.

475 Quality Control Circles (QS2) are significantly correlated with the reliability (P3) of product quality in the
476 organization. Involvement of employees in quality related activities (EP3) and performance of the product (P1) are
477 inversely and significantly correlated. Implementation of suggestion activities in the industry (EP4) is directly and
478 significantly correlated with performance of the products (P1) and also with the defect rate of the product (P5). After
479 evaluation implementation of the suggestion (EP5) is also directly and significantly correlated with the performance
480 and defects rate of the product.

481 Employee’s commitment towards the success of the organization (EP6) has direct relation with almost all the factors
482 of product quality construct.

483 Encouraging employees to fix problems they find (EP7) is significantly negative correlated with defect rate of the
484 product (P5).

485 9. Recognition and Reward

486
487 Inverse relation between RR1 and P1 shows that working conditions are not improved in order to recognize employee
488 quality improvement efforts. But RR1 is significantly correlated with durability of product. As excellence suggestions
489 are rewarded (RR4) therefore internal failure cost is less as in column P6.

490 10. Education and Training

491 There is inverse relation between the availability of resources for training (ET2) and durability of product. This
492 indicates that the resources are not adequate for the employees.

493 ET3 is significantly correlated with P3 and P7 but inverse with P5. As most employees are trained on quality
494 management tools (ET3) therefore product is more reliable (P3) and warranty claim cost is less.

495 Quality awareness education to employees (ET4) is significantly correlated with reliability (P3) and durability (P4) of
496 product but inversely correlated with defects rates of product (P5).

497 Specific work skill training to employees (ET5) is significantly negative correlated with conformity of product, which
498 shows that specific work skills need to be focused.

11. Customer Focus

Receiving complaints from customer (CF1) is significantly correlated with conformity (P2) and defect rate of the product (P5) but has inverse relation with durability of the product.

As quality related customer complaints are entertained with top priority (CF2) therefore it is very much significantly correlated with conformity (P2) and reliability of product (P3).

Conducting customer survey each year is significantly correlated with conformity rate of the primary product (P2).

Summary

In the entire organization TQM status is measured using 5-point likert scale on the described constructs of TQM. Each construct of TQM is evaluated by correlating product quality measuring elements. As it has been described earlier that values (between TQM constructs & Product Quality) in correlation are understandable as:

Strength: As you move farther away from zero (closer to -1.00 or 1.00) the relationship is stronger. The strongest relationship would be either 1.00 or -1.00 meaning that as one variable changes by one unit, the other variable changes by one unit. As you get closer to zero, the relationship is weaker. A zero correlation means that there is no relationship between the factors and a change in one variable does not mean a change in the other variable

Direction: The sign of the correlation coefficient tells the direction of the relationship. A positive sign means that the factors move together. This can mean as one variable increases the other variable increases. A negative sign means that the relation is inversely significantly correlated. Note that correlations of -.89 and .89 are equally strong but opposite in sign.

Causality: Correlation is *never* causality. Just because the variable move together does not mean that one causes the change in the other. A third variable could be causing the movement of both.

Following results found considering above three points.

Top management is not pursuing long term business success as this element is inversely correlated with internal failure cost as percentage of annual sales.

Feedback to the vendors by the organization is significantly negative correlated with internal failure cost.

Construct of TQM "Evaluation" is deteriorating product quality badly because almost each element of Evaluation is negatively and significantly correlated with one or two elements of Product Quality measures.

Implementation of inspections at various stages of process is inversely correlated with defect rates and internal failure costs.

Various departments are not participating effectively in new product development, so that's why defect rate increases as they are not positively correlated.

Cost is not emphasized in new product design because warranty claim cost as percentage of annual sales is not best in industry.

Clear quality manual in the organization is not positively correlated with the defect rate. It has to be revised accordingly.

Employee participation in quality related decisions for the organization is significantly negative correlated with product quality elements like performance, durability and defects rates.

Working conditions are not improved in order to recognize employee quality improvement efforts as this element is inversely and significantly correlated with performance of the product.

Education resources, quality management tool and specific work skill training facility is not improved as they are negatively significantly correlated with durability, defect rates and conformity rate of the product quality.

Market research for improving product performance is negatively and significantly correlated with conformity of the product.

Conclusion

Certifications that the organization has are not synchronized with the actual practices within the organization. Out of all negative correlations studied, it is commonly observed that “defect rate of the product” and “internal failure cost as percentage of annual sales” remain one of the factor among negative correlations.

First of all, one should emphasize on above two factors for the betterment of product quality. Then organization has to review following elements of different quality construct for the effective implementation of Total Quality Management practices.

- Long-term business strategy
- Evaluation procedure to examine the performance of Employees / Departments
- Inspection at various stages of the operations
- Involvement of all departments in new product development
- Employee participation in quality relevant decisions
- Working conditions in order to recognize employee quality improvement efforts.
- Market research for improving product performance

Need of the hour is to strictly obey Statistical Process Control (SPC) tools to indicate root cause for the problems and then to take necessary action in the light of quality management systems.

565 **References**

- 566 Bayazit, O. (2003), "Total quality management (TQM) practices in Turkish manufacturing organizations", *The TQM*
567 *Magazine*, Vol. 15 No. 5, pp. 345-50.
- 568 Brown, M.G., Hitchcock, D.E. and Willard, M.L. (1994), *Why TQM Fails and What to Do about It*, Irwin, Burr
569 Ridge, IL.
- 570 Crosby, Philip B. *Quality is Free: The Art of Making Quality Certain*. New York: New American Library, 1979.
- 571 Dale, B.G. and Plunkett, J.J. (1990), *Managing Quality*, Philip Allan, New York, NY.
- 572 Deming, W. (1982), *Quality, Productivity and Competitive Position*, MIT, Center for Advanced Engineering Study,
573 Cambridge, MA.
- 574 Deming, W.E. (1986), *Out of the Crisis*, MIT Centre for Advanced Engineering Study, Cambridge, MA.
- 575 Feigenbaum, A. (1956), *Total Quality Control*, McGraw-Hill, New York.
- 576 Flynn, B.B., Schroeder, R.C. and Sakakibara, S. (1994), "A framework for quality management research and an
577 associated measurement instrument", *Journal of Operations Management*, Vol. 11, pp. 339-66.
- 578 Ishikawa, K. (1985), *What Is Total Quality Control? The Japanese Way*, Prentice-Hall, London.
- 579 Juran, J. (1964), *Managerial Breakthrough*, McGraw-Hill, New York.
- 580 Juran, J., (1993) "*Made in USA: a Renaissance in quality*", *Harvard Business Review*, July-August 1993, pp. 42-50.
- 581 Kanji, G.K. and Asher, M. (1993), *Total Quality Management Process: A Systematic Approach*, *Advances in Total*
582 *Quality Management Series*, Carfax, Abingdon.
- 583 Kossoff, L. (1993), "Total quality or total chaos?", *HR Magazine*, Vol. 38 No. 4, pp. 131-4.
- 584 Mann, R.S. (1992), *The Development of a Framework to Assist in the Implementation of TQM*, PhD thesis,
585 Department of Industrial Studies, University of Liverpool, UK.
- 586 Powell, T.C. (1995), "Total quality management as competitive advantage: a review and empirical study", *Strategic*
587 *Management Journal*, Vol. 16 No. 1, pp. 15-37.
- 588 Williams, R.I. (1994), *Essentials of Total Quality Management*, A Worksmart Series, New York, NY.
- 589 Zhihai Zhang, Ab Waszink and Jacob Wijngaard (2000), "An instrument for measuring TQM implementation for
590 Chinese manufacturing companies", *International Journal of Quality &*
591 *Reliability Management*, Vol. 17 No. 7, pp. 730-755.