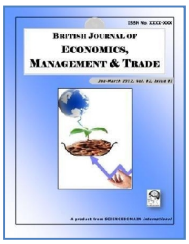

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# Implementation Status of TQM Practices in Textile and Apparel Industrial Organization: A Case Study from Faisalabad, Pakistan

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***Authors' contributions***

*This work was carried out in collaboration between all authors. Author IUH designed the study, wrote the protocol, and wrote the first draft of the manuscript. Author MMS managed the analyses of the study. Author JLP managed the literature searches. Author KA performed the statistical analysis. All authors read and approved the final manuscript.*

***Case Report***

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## ABSTRACT

**Aims:** Purpose of the study was to check the provision of Total Quality Management practices in textile industry of Pakistan. For this purpose we have evaluated Total Quality Management practices in textile industry. The focal intention behind this study was to get first hand information about this problem for further detailed research.
**Place and Duration of Study:** Study was conducted in Masood Textile Mills Faisalabad. Duration of study was from February 2012 to October 2012.
**Methodology:** 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.
**Results:** 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.

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**Conclusion:** 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; Pakistan.*

## 1. INTRODUCTION

Total quality management (TQM) has its origins over 60 years ago in the International Journal of Quality concept of organization-wide or total quality control (TQC) proposed by [1] wherein each function contributing to the added value of a product shares responsibility for its quality. This concept migrated to Japan in the 1950s together with the practitioner-based teachings of Juran [2] and Implementing Deming [3]. Total quality is defined as the unrelenting pursuit of continuous improvement which is realized by accessing and utilizing the intensive knowledge and experience of managers and employees at all levels [4]. There are significant relationships between TQM, competitive advantage and business excellence [5]. Global competition and economic liberalization are creating opportunities not only for Pakistani organizations but also for whole developing world. TQM is a management philosophy that encourages customer satisfaction, continuous improvement, teamwork and strong aspirations to self-actualization [6]. Total quality management (TQM) is one of the most popular modern management concepts [7]. It is the discipline dedicated to enhance quality in every aspect of an organization.

Over the past few decades, TQM seers such as Deming [8], Crosby [9], Ishikawa [10], and others have developed certain proposals in the area of quality management. There are several Quality Awards world-wide, such as the Deming Prize (1992) in Japan, the European Quality Award in Europe (1994) and the Malcolm Baldrige National Quality Award (1997) in the USA. Each of these awards is based on a perceived model of TQM. They do not focus only on product, service perfection or traditional quality management methods, but consider a wide range of management activities, behavior and processes that manipulate the quality of the final offerings. These award models provide a useful audit or assessment framework against which organizations can be evaluated. The practice of total quality management (TQM) as an improvement strategy is being embraced by more and more organizations throughout the world as quality has become a competitive mandate. The premise of TQM is quite clear. Quality improvement can be achieved if an organization develops a management philosophy of continuous improvement and provides the necessary supporting organizational practices [11].

### 1.1 TQM Implementation Framework

Based on the comprehensive review of the TQM literature, the subsequent 11 constructs are considered to be the TQM implementation constructs in present study. Leadership, Supplier quality management, Vision and plan statement, Evaluation, Process control and improvement, Product design, Quality system improvement, Employee participation, Recognition and reward, Education and training and Customer focus [12]. The European Quality Award recognizes the crucial role of top management leadership in creating the goals, values and systems that guide the detection of continuous performance improvement. Lack of top management commitment is always considered one of the reasons for the failure

of TQM efforts [13]. Supplier quality management is an important aspect of TQM since materials and purchased parts are repeatedly a major source of quality problems. The Malcolm Baldrige Quality Award (1997) is also aware of the importance of supplier quality.

A vision statement describes how a company wants to be seen in its selected business. As such, vision describes standards, values, and beliefs. Evaluating the situation in organizations, quality management practices provide an important base for organizations to improve their quality management practices. A key element of any total quality strategy is the management of processes [14]. One important matter in process management is to make sure that process capability can meet production requirements. One aspect of process management is equipment maintenance, which ensures that variation is kept within acceptable limits, keeping the manufacturing process running efficiently and effectively. Good process management should involve exactly documenting various process procedures, with instructions for equipment operation in order to minimize the possibility of operator errors.

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

By participating in quality improvement activities, employees acquire new understanding, see the benefits of the quality disciplines, and gain a sense of achievement by solving value problems. The participation leads to lasting changes in behavior. Participation is decisive in inspiring action on quality improvement [15]. Participation may enable the employees to improve their personal capabilities, increase their self respect, commit themselves to the success of their organizations, and/or change certain character. Involvement may also change employees' negative attitudes and instill in the employees a better understanding of the importance of product quality. Involvement may contribute to the concern of a company-wide quality culture. Employees in organizations should be optimistic to report their work problems. Good employees' suggestions should be implemented after being evaluated. Methods such as cross-functional teams, functional teams, QC circles, voluntary teams, and suggestion schemes can be used for encouraging employee participation.

It almost goes without saying that an important feature of any quality improvement program is performance due recognition for enhanced performance by any individual, section, and department or division within the organization [16]. Both teams and individuals can be recognized and rewarded for their superb performance. To effectively support organization's quality efforts, they have to implement reward system that strongly links quality and

customer satisfaction with pay [17]. Recognition and reward activities are supposed to effectively stimulate employee assurance to quality improvement. Otherwise, these activities are subject to fail. Working condition improvements, salary promotions, position promotions, financial awards for excellent suggestions are good methods for recognition and reward. Deming forces the importance of education and training for continual updating and improvement. Many research results disclose that education and training are one of the most important elements in a successful implementation of TQM e.g. Mann [18]. The research confirms what most organizations have already realized, namely, that education and training are a fundamental and necessary part of the TQM initiative. Investment in education and training is fundamentally important for TQM success. Employees should consider as valuable, long-term resources worthy of receiving education and training throughout their career. All management personnel, supervisors, and employees should believe quality education and training such as quality awareness education and quality management methods education.

To get quality, it is essential to know what customers desire and to provide products or services that meet their requirements [19]. Successful organizations distinguish the need to put the customer first in every decision made. The key to quality management is sustaining a close relationship with the customer in order to fully agree on the customer's needs, as well as to get feedback on the extent to which those needs are being met. The customer should be closely concerned in the product design and advance process, with inputs at every stage of the process so that there is less likelihood of quality problems once full production begins [20]. The ultimate measure of company performance is customer liking, which may very well predict the future success or failure of an organization [21]. In order to get better customer satisfaction, customer complaints should therefore be treated with top priority. Warranty on sold products should also be offered. Methods that can be used for customer retention and satisfaction include collections of customer complaint information, market investigations, and customer contentment surveys.

## 1.2 Study of Organization

### 1.2.1 Brief introduction of organization

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

### 1.2.2 Company vision

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

### 1.2.3 Targeted facility

There are quality check points at every stage of manufacturing starting from raw cotton, yarn, fabric, processing, cutting, stitching and packing. Before the fabric is cut, it is checked

whether it conforms to the customer standards of shrinkage, weight, etc. After each lot of fabric is cut, 100% cut parts inspection is conducted to ensure that only high-quality pieces move to stitching units. During the process of sewing, each and every process is inspected by inline inspectors. The inspectors make sure that only good parts move to the next stage. An individual tracking number is sewn inside each garment. After trimming and pressing of garments, highly experienced final inspectors inspect each garment. The quality assurance team monitors the performance of every individual inspector by picking up the inspected garments and checking the quality of these garments. To ensure that the garments are packed as per necessities of customers, we can even track & check, which case the garment, has been packed in. with the help of this, we plan to attain the zero defect level.

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

### 1.2.4 Infrastructure & hierarchy

Being the leading organization in textile and apparel business the Masood Textile Mills has strong infrastructure with respect to machine. In the stitching they have different sites with machine setups given in Table 2.1.

**Table 2.1 Machine setup**

| 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 |

For each subunit there is one Sr. Manager and for each main setup they have DGM.

For each manager (Asst, Depty & Sr manager) there are prescribed number of machines

### 1.2.5 ISO certification

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

### 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.

### 1.2.8 Assessment of TQM practices

To evaluate the implementation status of total quality management in textile industry, TQM implementation instrument is prepared in the light of instrument used to evaluate TQM execution for Chinese manufacturing companies and circulate among the key persons in the industry. According to this paper the instrument presented is reliable and valid and may be used to target improvement areas.

## 2. MATERIALS AND METHODS

In this study, validity was a measure of how well scales representing the various quality management practices are related to measures of product quality performance (the criteria) [22]. Product quality performance was measured by asking respondents to rate (on a five-point scale, 1 = worst in the industry; 2 = below average; 3 = average; 4 = above average; 5 = best in the industry) seven indices. These indices included, for example, performance, conformity rates, reliability, durability, defect rates of their primary products, internal failure costs, and warranty claims costs as a percentage of their annual sales. Accordingly, bi-variate correlation (Pearson) was conducted to study the interrelationships between the independent and dependent variable sets: the TQM implementation (predictor set) and the product quality performance measures (the criterion set). Fortunately, the correlation within the 11 scales (predictor set), within the seven measures (criterion set), between the predictor set and criterion set was significant at the 0.01 level. It can therefore be concluded that this set of scales had good criterion-related validity.

### 2.1 Correlation Analysis

The correlation coefficient is a measure of association between two attributes or variables that estimates direction and strength of the linear relationship, after the statistician Karl Pearson as discussed by David, George & Akisa [23].

### 2.2 Analysis of Variance (ANOVA)

A statistical technique to test the difference of two or more means is the Analysis of Variance (ANOVA) as described by David K [ibid].

### 2.3 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.

### 2.4 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.

## 3. RESULTS

### Table 3.1 Analysis of Variance (ANOVA) Table of All Tools of TQM

| Tools of TQM | S.O.V | SS | df | MS | F | *P*-value |
|---|---|---|---|---|---|---|
| **Leadership** | Between Elements | 25.038 | 7 | 3.577 | 7.383 | .000** |
| | Within Elements | 302.304 | 624 | 0.484 | -- | -- |
| | Total | 327.342 | 631 | -- | -- | -- |
| **Supplier quality management** | Between Elements | 7.859 | 5 | 1.572 | 3.681 | .003* |
| | Within Elements | 199.823 | 468 | 0.427 | -- | -- |
| | Total | 207.681 | 473 | -- | -- | -- |
| **Vision & Plan statement** | Between Elements | 20.771 | 7 | 2.967 | 6.908 | .000** |
| | Within Elements | 268.025 | 624 | 0.430 | -- | -- |
| | Total | 288.796 | 631 | -- | -- | -- |
| **Evaluation** | Between Elements | 61.505 | 9 | 6.834 | 13.183 | .000** |
| | Within Elements | 404.329 | 780 | 0.518 | -- | -- |
| | Total | 465.834 | 789 | -- | -- | -- |
| **Process Control and Improvement** | Between Elements | 190.070 | 7 | 27.153 | 53.515 | .000** |
| | Within Elements | 316.608 | 624 | 0.507 | -- | -- |
| | Total | 506.677 | 631 | -- | -- | -- |
| **Product Design** | Between Elements | 16.087 | 7 | 2.298 | 5.196 | .000** |
| | Within Elements | 275.975 | 624 | 0.442 | -- | -- |
| | Total | 292.062 | 631 | -- | -- | -- |
| **Quality System Improvement** | Between Elements | 6.927 | 4 | 1.732 | 4.703 | .001** |
| | Within Elements | 143.595 | 390 | 0.368 | -- | -- |
| | Total | 150.522 | 394 | -- | -- | -- |
| **Employee participation** | Between Elements | 25.266 | 7 | 3.609 | 8.558 | .000** |
| | Within Elements | 263.165 | 624 | 0.422 | -- | -- |
| | Total | 288.430 | 631 | -- | -- | -- |
| **Recognition and reward** | Between Elements | 34.568 | 5 | 6.914 | 12.870 | .000** |
| | Within Elements | 251.392 | 468 | 0.537 | -- | -- |
| | Total | 285.960 | 473 | -- | -- | -- |
| **Education and training** | Between Elements | 39.200 | 5 | 7.840 | 14.603 | .000** |
| | Within Elements | 251.266 | 468 | 0.537 | -- | -- |
| | Total | 290.466 | 473 | -- | -- | -- |
| **Customer focus** | Between Elements | 28.466 | 5 | 5.693 | 11.817 | .000** |
| | Within Elements | 225.468 | 468 | 0.482 | -- | -- |
| | Total | 253.935 | 473 | -- | -- | -- |
| **Product Quality** | Between Elements | 31.986 | 6 | 5.331 | 12.003 | .000** |
| | Within Elements | 242.506 | 546 | 0.444 | -- | -- |
| | Total | 274.492 | 552 | -- | -- | -- |

*** Highly significant at 5% level of significance.*

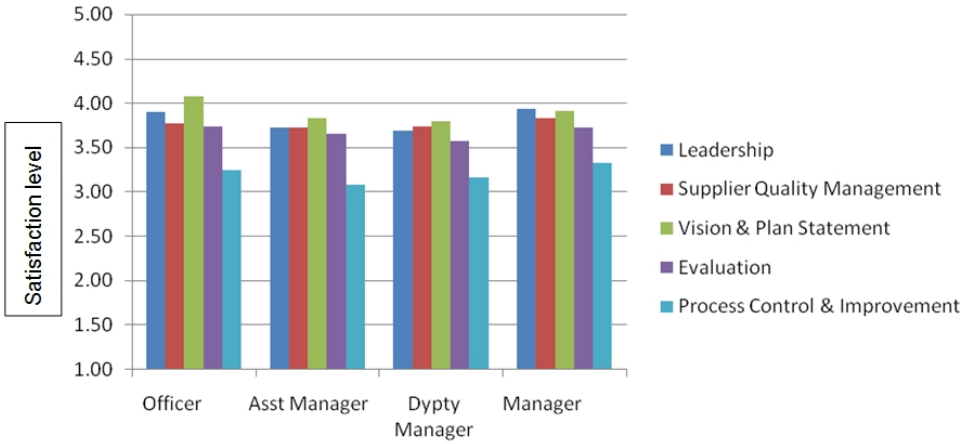
The Analysis of variance (ANOVA) table indicates that the score of different elements in all TQM tools are highly significant at 5% level of significance.

## 3.2 Performance of the Organization

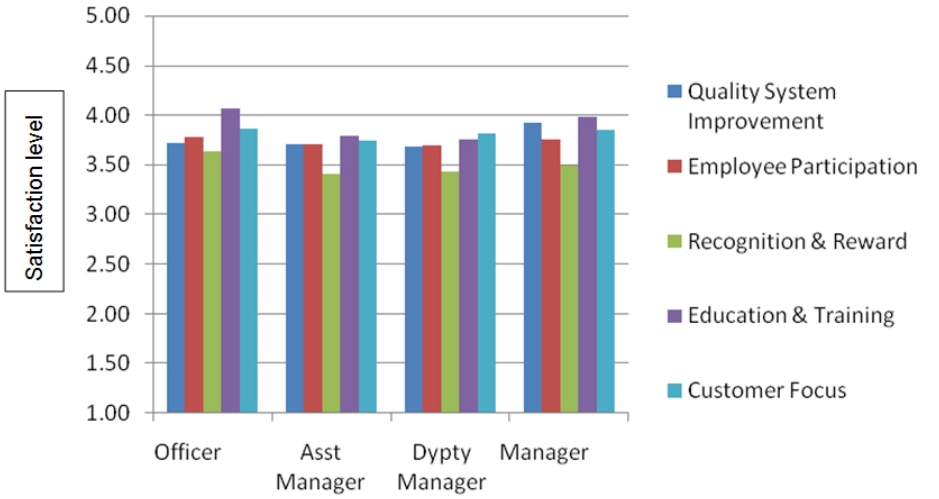
### 3.2.1 Designee Vs quality construct

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

Satisfaction level about implementation of quality construct by various levels in hierarchy is different. Mean values of satisfaction level are illustrated in Graph 3.1(a) and 3.1(b).




**Graph 3.1(a) Satisfaction level by Different Designees**




**Graph 3.1(b) Satisfaction level by Different Designees**

Managers' satisfaction level score is higher as compared to others on leadership and supplier quality management. In case of vision & plan statement and evaluation each level in

hierarchy is satisfied. Satisfaction level of managers about Process Control and Improvement is higher among the hierarchy.

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

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

An organization's success depends on how much customer is happy with services/product offered by the company. Out of the eleven construct of the TQM mention in the literature survey, construct of the product quality has importance in correlating with others. Therefore one should acknowledge that all the constructs of total quality management has direct or indirect relation with one of the "Product Quality".

Now all the construct of TQM will be correlated with product quality in order to better analyze the implementation status of quality management practices in the organization.

First of all elements of product quality will be correlated with itself as. Elements of product quality are numbered as P1 to P7.

Pearson Correlation (Product Quality P1-P6)

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.

*3.2.1.1 Leadership*

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).

*3.2.1.2 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.

*3.2.1.3 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.

*3.2.1.4 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.

Use of quality related costs extensively (E4) improve conformity rates (P2) and warranty claim cost (P7) as E4 is significantly correlated with P2 & P7. Also use of quality related cost (extensively) is significantly negative correlated 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.

*3.2.1.5 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.

*3.2.1.6 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.

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

*3.2.1.8 Employee participation*

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

Quality Control Circles (QS2) are significantly correlated with the reliability (P3) of product quality in the organization. Involvement of employees in quality related activities (EP3) and

performance of the product (P1) are inversely and significantly correlated. Implementation of suggestion activities in the industry (EP4) is directly and significantly correlated with performance of the products (P1) and also with the defect rate of the product (P5). After evaluation implementation of the suggestion (EP5) is also directly and significantly correlated with the performance and defects rate of the product.

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

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

*3.2.1.9 Recognition and reward*

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

*3.2.1.10 Education and training*

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

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

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

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

*3.2.1.11 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).

**Table 3.2 Measurement of product quality (correlation)**

| 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 3.3. "Quality Constructs (1-3) – Product Quality" Correlation**

| Quality Construct | Indic-ators | 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 | -.021 | -.003 | .249(*) | .179 | -.109 | .157 |
| | | (.141) | (.855) | (.980) | (.027) | (.114) | (.340) | (.168) |
| | B | .126 | .034 | -.017 | .020 | -.060 | .084 | .078 |
| | | (.270) | (.769) | (.885) | (.863) | (.599) | (.461) | (.492) |
| | C | -.142 | -.155 | -.003 | .192 | .332(**) | .193 | .113 |
| | | (.213) | (.172) | (.982) | (.090) | (.003) | (.088) | (.321) |
| | D | .134 | .130 | .221 | .016 | -.184 | -.071 | -.015 |
| | | (.240) | (.252) | (.050) | (.891) | (.105) | (.535) | (.896) |
| | E | .302(**) | -.281(*) | .014 | .150 | -.107 | -.001 | -.123 |
| | | (.007) | (.012) | (.902) | (.187) | (.349) | (.990) | (.281) |
| | F | .309(**) | -.195 | .106 | .187 | -.133 | .083 | -.159 |
| | | (.006) | (.085) | (.354) | (.099) | (.244) | (.468) | (.161) |
| | G | -.088 | .285(*) | .185 | -.017 | -.050 | .278(*) | .061 |
| | | (.443) | (.011) | (.102) | (.881) | (.664) | (.013) | (.592) |
| | H | .116 | -.045 | .134 | .146 | -.345(**) | -.305(**) | -.131 |
| | | (.308) | (.692) | (.240) | (.200) | (.002) | (.006) | (.249) |
| Supplier Quality Management | SQ1 | -.128 | .224(*) | .271(*) | .413(**) | .022 | .124 | -.054 |
| | | (.262) | (.048) | (.016) | (.000) | (.851) | (.276) | (.638) |
| | SQ2 | .028 | .071 | .050 | .127 | -.148 | .102 | -.123 |
| | | (.806) | (.535) | (.664) | (.265) | (.192) | (.370) | (.279) |
| | SQ3 | .302(**) | -.063 | .037 | -.105 | -.174 | .055 | -.067 |
| | | (.007) | (.580) | (.749) | (.355) | (.124) | (.631) | (.559) |
| | SQ4 | -.154 | .453(**) | .160 | .157 | -.256(*) | -.297(**) | -.093 |
| | | (.177) | (.000) | (.158) | (.168) | (.023) | (.008) | (.417) |
| | SQ5 | .312(**) | -.017 | .033 | -.150 | -.137 | .207 | .103 |
| | | (.005) | (.881) | (.776) | (.186) | (.228) | (.067) | (.365) |
| | SQ6 | -.225(*) | .338(**) | .309(**) | .260(*) | -.072 | -.066 | -.165 |
| | | (.046) | (.002) | (.006) | (.021) | (.528) | (.562) | (.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 3.4. "Quality Constructs (4-6) – Product Quality" Correlation**

| Quality Construct | Indic-ators | 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 | -.165 | -.024 | .223(*) | .004 | .036 | .127 |
| | | (.241) | (.145) | (.834) | (.048) | (.975) | (.751) | (.264) |
| | **PC6** | .016 | -.103 | -.010 | .049 | .029 | .232(*) | -.085 |
| | | (.889) | (.366) | (.927) | (.667) | (.802) | (.040) | (.459) |
| | **PC7** | .019 | .195 | .269(*) | .223(*) | -.122 | .003 | -.024 |
| | | (.867) | (.085) | (.016) | (.048) | (.283) | (.976) | (.831) |
| | **PC8** | .005 | .100 | .047 | -.148 | .062 | .045 | .136 |
| | | (.966) | (.380) | (.681) | (.192) | (.589) | (.693) | (.233) |
| **Product Design** | **PD1** | -.194 | .263(*) | .118 | .249(*) | -.082 | .202 | -.042 |
| | | (.086) | (.019) | (.300) | (.027) | (.471) | (.074) | (.714) |
| | **PD2** | .416(**) | .098 | .273(*) | -.102 | .109 | .269(*) | .299(**) |
| | | (.000) | (.388) | (.015) | (.370) | (.340) | (.016) | (.007) |
| | **PD3** | -.011 | .291(**) | .128 | .061 | -.168 | -.183 | -.033 |
| | | (.924) | (.009) | (.262) | (.596) | (.139) | (.106) | (.770) |
| | **PD4** | .126 | .194 | .363(**) | -.032 | -.294(**) | -.151 | .016 |
| | | (.269) | (.087) | (.001) | (.780) | (.009) | (.184) | (.888) |
| | **PD5** | .225(*) | .267(*) | .009 | -.048 | -.124 | .014 | -.195 |
| | | (.046) | (.018) | (.934) | (.676) | (.277) | (.901) | (.085) |
| | **PD6** | -.214 | -.225(*) | -.112 | .212 | .268(*) | .159 | -.356(**) |
| | | (.058) | (.046) | (.325) | (.061) | (.017) | (.162) | (.001) |
| | **PD7** | -.174 | .136 | -.030 | .193 | -.125 | -.156 | -.084 |
| | | (.125) | (.232) | (.791) | (.088) | (.273) | (.170) | (.462) |
| | **PD8** | -.085 | .460(**) | .038 | .105 | .209 | .122 | .068 |
| | | (.456) | (.000) | (.738) | (.356) | (.065) | (.283) | (.554) |

**Table 3.5. "Quality Constructs (7-11) – Product Quality" Correlation**

| 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 |
| Quality System Improvement | QS1 | .089 | .120 | .255(*) | .352(**) | .023 | .108 | .000 |
| | | (.433) | (.294) | (.023) | (.001) | (.841) | (.344) | (.998) |
| | QS2 | .224(*) | -.205 | .090 | .097 | -.234(*) | .048 | -.107 |
| | | (.047) | (.071) | (.431) | (.396) | (.038) | (.674) | (.347) |
| | QS3 | -.099 | .307(**) | .180 | .346(**) | -.413(**) | -.078 | -.108 |
| | | (.384) | (.006) | (.113) | (.002) | (.000) | (.493) | (.343) |
| | QS4 | -.210 | .100 | .020 | -.189 | -.237(*) | -.243(*) | -.016 |
| | | (.063) | (.381) | (.862) | (.095) | (.035) | (.031) | (.886) |
| | QS5 | .105 | .030 | .128 | .423(**) | .046 | .251(*) | -.265(*) |
| | | (.358) | (.792) | (.260) | (.000) | (.686) | (.026) | (.018) |
| Employee Participation | EP1 | .566(**) | .036 | .091 | -.501(**) | .185 | .192 | .164 |
| | | (.000) | (.750) | (.424) | (.000) | (.103) | (.091) | (.148) |
| | EP2 | .209 | .114 | .301(**) | .058 | -.168 | -.127 | .272(*) |
| | | (.064) | (.319) | (.007) | (.615) | (.140) | (.263) | (.015) |
| | EP3 | -.346(**) | .037 | .112 | .571(**) | .260(*) | .134 | -.036 |
| | | (.002) | (.745) | (.326) | (.000) | (.021) | (.239) | (.751) |
| | EP4 | -.345(**) | .075 | -.154 | .204 | .353(**) | .061 | .100 |
| | | (.002) | (.512) | (.176) | (.072) | (.001) | (.591) | (.380) |
| | EP5 | .368(**) | -.160 | -.055 | -.014 | .361(**) | .256(*) | .049 |
| | | (.001) | (.160) | (.627) | (.903) | (.001) | (.023) | (.666) |
| | EP6 | .172 | .488(**) | .636(**) | .232(*) | -.016 | .230(*) | .133 |
| | | (.130) | (.000) | (.000) | (.040) | (.891) | (.041) | (.241) |
| | EP7 | .017 | .622(**) | .441(**) | .052 | -.326(**) | -.023 | .345(**) |
| | | (.885) | (.000) | (.000) | (.652) | (.003) | (.838) | (.002) |
| | EP8 | -.158 | -.249(*) | -.041 | .164 | .370(**) | .433(**) | -.016 |
| | | (.164) | (.027) | (.721) | (.148) | (.001) | (.000) | (.892) |
| Recognition and Reward | RR1 | -.394(**) | .043 | .137 | .331(**) | .168 | .176 | .172 |
| | | (.000) | (.707) | (.227) | (.003) | (.140) | (.122) | (.129) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **RR2** | -.046 | -.037 | .100 | .140 | .071 | .150 | .139 |
| | | (.690) | (.748) | (.382) | (.218) | (.533) | (.187) | (.223) |
| | **RR3** | -.168 | .162 | .060 | .033 | -.017 | .044 | .198 |
| | | (.139) | (.153) | (.599) | (.774) | (.884) | (.698) | (.081) |
| | **RR4** | .165 | .144 | -.001 | -.018 | -.098 | -.239(*) | .357(**) |
| | | (.145) | (.206) | (.990) | (.876) | (.391) | (.034) | (.001) |
| | **RR5** | .208 | .118 | .170 | .261(*) | -.178 | -.121 | -.097 |
| | | (.066) | (.302) | (.135) | (.020) | (.116) | (.290) | (.395) |
| | **RR6** | .157 | -.286(*) | -.083 | .103 | .290(**) | .054 | .055 |
| | | (.167) | (.011) | (.465) | (.368) | (.009) | (.635) | (.630) |
| **Education and Training** | **ET1** | .161 | -.117 | -.148 | -.121 | -.010 | -.097 | .108 |
| | | (.156) | (.303) | (.193) | (.290) | (.928) | (.397) | (.341) |
| | **ET2** | .142 | -.135 | -.009 | -.390(**) | -.078 | -.014 | .146 |
| | | (.211) | (.234) | (.934) | (.000) | (.497) | (.901) | (.198) |
| | **ET3** | .124 | .196 | .314(**) | .143 | -.324(**) | -.073 | .225(*) |
| | | (.276) | (.083) | (.005) | (.208) | (.004) | (.521) | (.046) |
| | **ET4** | .095 | .155 | .337(**) | .363(**) | -.256(*) | -.001 | -.039 |
| | | (.407) | (.172) | (.002) | (.001) | (.023) | (.994) | (.731) |
| | **ET5** | -.146 | -.369(**) | -.102 | .177 | .057 | .016 | -.080 |
| | | (.198) | (.001) | (.372) | (.120) | (.617) | (.892) | (.482) |
| | **ET6** | -.258(*) | .180 | .268(*) | .404(**) | -.090 | .094 | -.011 |
| | | (.022) | (.113) | (.017) | (.000) | (.433) | (.409) | (.924) |
| **Customer Focus** | **CF1** | -.104 | .461(**) | .150 | -.266(*) | .283(*) | .035 | .205 |
| | | (.361) | (.000) | (.186) | (.018) | (.011) | (.757) | (.070) |
| | **CF2** | -.041 | .379(**) | .369(**) | .037 | -.213 | .041 | -.219 |
| | | (.718) | (.001) | (.001) | (.746) | (.060) | (.722) | (.052) |
| | **CF3** | .113 | .262(*) | .221 | .208 | -.037 | .095 | -.002 |
| | | (.323) | (.020) | (.050) | (.066) | (.746) | (.407) | (.986) |
| | **CF4** | .028 | -.341(**) | -.132 | -.010 | -.015 | .031 | .105 |
| | | (.804) | (.002) | (.245) | (.931) | (.896) | (.789) | (.358) |
| | **CF5** | .106 | .035 | .076 | .226(*) | .060 | .047 | -.175 |
| | | (.353) | (.758) | (.507) | (.045) | (.599) | (.680) | (.122) |
| | **CF6** | -.015 | .078 | -.058 | .046 | -.210 | -.053 | -.042 |
| | | (.895) | (.494) | (.614) | (.687) | (.064) | (.643) | (.715) |

## 4. DISCUSSIONS

Compared to the other quality management instruments developed by Saraph et al. [24], Flynn et al. [25], and Ahire et al. [26], the instrument presented in this paper has the highest external validity for manufacturing industries in general and for Chinese manufacturing companies in particular [27].

In this study, data used for testing and validating this instrument only came from 1 textile industry. Firmly speaking, the generalization is limited, although this study was the first one to aim at evaluating the TQM implementation for Textile industries of Faisalabad.

Although this instrument was empirically tested and validated using data from Chinese manufacturing companies, researchers and practitioners from other countries will be able to use it. The reason is that this instrument was developed on the basis of an extensive literature review. However, it should be eminent that findings from this instrument are more valid for Pakistani textile manufacturing industries than for textile industries in other countries.

In summary, The Analysis of variance (ANOVA) table indicates that the score of different elements in all TQM tools are highly significant at 5% level of significance.

## 5. CONCLUSION

Certifications that the organization holds, 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.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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