*Sindh Univ. Res. Jour. (Sci. Ser.) Vol.46 (4):479-482 (2014)*

**SINDH UNIVERSITY RESEARCH JOURNAL (SCIENCE SERIES)**

# Using Structural Equation Modelling to Analyze the Impact of Quality Management System on Operational Performance

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Received 5th June 2014 and Revised 7nd September 2014

**Abstract:** Business process and operations are affected by quality management. Organizations that have mature quality standards gained competitive edge on those who lack in this area. A wide range of benefits are associated with implementation of quality standards. There are different methods that could be incorporated to implement quality in an organization, out of those several tools, one is quality management system i.e. QMS ISO 9001:2008. Quality management system not only brings financial benefits to organization but also helps in process maturity (stability). Productivity is enhanced by its implementation as it reduces rework effort and production losses. The present research study was carried to establish the documentary evidence regarding the effectiveness of quality management system via survey questionnaire. Research showed positive result i.e. Quality management system implementation effects operational performance of company.

**Keywords:** Quality Management System, ISO 9001: 2008, Operational Performance, Performance Measurement, Process Approach.

## 1. INTRODUCTION

In modern era the industrialization and technological advancements are at their peak, which were incepted in twentieth century. Researchers and statisticians like Dr. Joseph Juran, Armand V Feigenbaum, Edward Deming, Shigeo Shingo, Dr. Kaoru Ishikawa, Dr. Taguchi, and Philip B Crosby give quality a new dimension worked on quantitative aspect of quality. International organization for standardization develops quality management system. Quality management system creates a mutual understanding for the requirements that are integral for implementing quality. There is an increase in the accreditation of quality management system, indicating its healthy impact on organization's performance. It guides the organization to create its procedures to ensure quality. It also ensures the delivery of quality products to the customers. Many companies face a serious downfall as they neglect quality practices. The operations that were once quality oriented, start deteriorating. This indicates that quality management programs have a deep impact on the long run performance of the companies. A well dressed and properly implemented quality management system is a key to provide long run support and protection to the operations of the company, which can be achieved by implementing and evaluating quality management system. The certification of quality management system revolves on series of steps. Once the initial requirements are finalized against a particular certification, the certifying body i.e. an institution conducts a proper review of the processes, against the clauses of standard, thus minimum requirements of a standard are met. There are more than nine hundred thousand to one million ISO 9000 certified companies in more than 170 countries of the world as proposed by Parkash in his study (Parkash, 2011). Padma dinata discussed the constructs of process improvement and customer retention by expanding the canvas of study (Padmadinata, 2007). Quality management system also helps to increase market share and revenue. Process improvement results in well engineered and proactive operations that increase organizational learning and serves as a source to articulate best practices. The ISO certification may help a firm retain or increase market share, and hence improve performance by increasing sales or revenue. It is to be noted that both hard and soft the techniques of quality has their own advantages and both are effective in their respective domains (Corbett, 2005).

## 2. MATERIALS AND METHODS

The present research work aims to identify the effect of quality management system on operational performance of a company. Quality management system implementation is taken as an independent variable and operational performance is taken as dependent variable. Our independent variable i.e. quality management system implementation, has five sub-variables and they are QMS Documentation, Management Responsibility, Product realization, Resource management and Measurement Analysis and improvement. The dependent variable i.e. operational performance, it is measured by two variables and they are rework, time management and process improvement. Based on the

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above discussion our proposed research model is shown in the **(Fig. 1).** below:

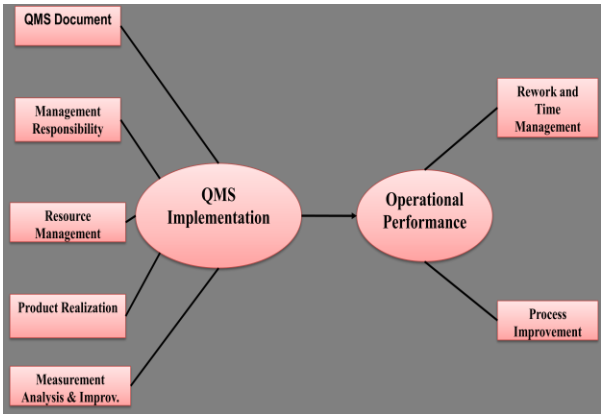


**Fig.1 Proposed Research Model**

## Hypothesis

**$H_1$=** Quality management system implementation affects operational performance.

**Instrument:** The (**Table-1)** research was carried out by using primary data. Quality management system questionnaire was distributed in 20 companies. The questionnaire was adapted from ISO 9001 Audit checklist. Total 44 items were present in the questionnaire on a five point likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree), the division is as follows:

**Table-1. Variables**

| Variables | Dimensions | Number of items |
|---|---|---|
| QMS Implementation | QMS Documentation | 7 |
| | Management Responsibility | 6 |
| | Resource Management | 6 |
| | Product Realization | 8 |
| | Measurement Analysis and Improvement | 5 |
| Operational Performance | Rework and Time Management | 3 |
| | Process Improvement | 9 |

**Participants:** Simple random sampling technique is used for data collection Responses were gathered manually (personal visits) and electronically in order to minimize biasness. The responses were gathered in span of 60 days. Total 320 questionnaires were distributed and 202 complete responses were taken for analysis. Incomplete questionnaires were discarded from the sample.

**Analysis:** Structured Equation Modeling through statistical software (AMOS 18.0) was used to check the effect of quality management system implementation on operational performance. QMS Implementation was our independent variable and operational performance was our dependent variable. Afterwards the data was loaded into Amos. The results were reported along with the recommended values by (Kline, 2011). Moreover, scale reliability was also checked in order to validate our questionnaire. In order to perform scale reliability SPSS 18.0 was used.

## 3. RESULTS AND DISCUSSION

Once the data was finalized and arranged it was computed in SPSS 18 for the calculation of scale reliability test. The test is beneficial in proving the reliability of our overall questionnaire. **(Table-2).**

**Scale Reliability**

**Table – 2**

| Reliability Statistics | Cronbach's Alpha | Number of items | Result |
|---|---|---|---|
| Over All Model | .896* | 44 | Accepted |
| * Significant | | | |

The above result proved the reliability of our model and according to the table the value of Cronbach's Alpha is .896 which is significant as per Fornell 1981 (Fornell, 1981). The total number of items that were used in finding the reliability was 44 and the results were accepted.

In order to validate the model some test were performed for model fits. This task was carried out by using Amos 18.0. Model fit like NFI, CFI, CMIN and RMSEA were computed and the results were shown in **(Table – 3).**

**Table-3. Model Fit**

**Table – 3**

| Fit Metric | Standard | Model value | Result |
|---|---|---|---|
| NFI | $\geq .9^{*}$ | 0.956 | Accepted |
| CMIN | $2-3^{*}$ good fit | 2.172 | Accepted |
| CFI | $\geq .9^{*}$ | 0.957 | Accepted |
| RMESA | $\leq .08^{*}$ | 0.076 | Accepted |

The first value of model is NFI (Normed fit index) which is an incremental measure of fit. In case of our data the value falls in acceptable range. Next was CMIN value which is actually Chi-square. Its standard value is given in the table (2-3); our results showed that the value falls in the required range 2.172, hence it is acceptable. Next was CFI which was a comparative fitness index, good for all small and large sample size, with the standard value of 0.9. The results showed that our data was acceptable. The last fitness test was

RMESA, used for checking the fairness of data explaining the covariance (difference between the observed and implied values of data) with the standard value of ≤0.08; our data was giving the value as 0.076 that was also a perfect Fit. It is evident from the above table that other model fits were within the limits as proposed by Hooper and Mullen (Hooper, 2008).

After proving the reliability of our questionnaire and model fit, it was easy to perform structural equation modeling. In order to compute structural modeling equation (SEM) the data was computed in Amos 18.0 and our main hypothesis $H_1$ was hypothesized. **(Table-4).**

**Table-4. SEM Result**

| Table – 4 | | | | |
|---|---|---|---|---|
| **Sr. No.** | **Hypothesis** | **Direct Effect** | **Estimate** | **Result** |
| 1 | $H_1$ | QMS Imp effects Operational Performance | .783*** | Accepted |
| ***Significant | | | | |

Main hypothesis was tested in this process and the results showed that implementation of quality management system affects operational performance. The triple asterisk showed that results were significant. Thus the output generated by SEM validates out hypothesis i.e. QMS implementation effects operational performance.

The results that were generated from the data validate main hypothesis. The value of Cronbach's Alpha was validating the reliability of out questionnaire. The instruments used for the research was relevant and there was no multi-colinearity in the data. Structural equation modeling was validating our main hypothesis that there was a relationship between quality management system implementation and operational performance. Operational performance was positively affected by the implementation of quality management system. The main reason of this significant relationship is the diversity of quality management system and its process areas. The information provided in questionnaire responses validates the effectiveness of quality management system. Organizations that have implemented quality management system in its true sense have stable processes. The measurement and analysis process area of the standard provides guidelines to evaluate the processes objectively. The evaluation was performed internally and its validation occurs when an independent external audit was performed. The review mechanism helps to study the weakness of the system and suggest the remedial measures as well.

Management responsibility was an important process area of the overall quality management system. It represents the vision of management in embedding quality in their products. An efficient, conscious and visionary management always invests in process stabilization, which can be achieved through implementing quality management system. All the five process areas of quality management system contribute towards the proper implementation of the standard. The research was conducted by keeping in view wide implications of quality management system. It was evident from the previous studies that operations of company are the function of its processes. As quality management system aims to improve processes so it has an effect on operational performance as well, this was tested in this research, and resulted successful in establishing a positive relationship.

Moreover, the tools and techniques like PDCA (Plan Do Check Act) cycle, Six Sigma approach, quality principles, and quality matrices were introduced to promote quality in industry. (Burrill, 1999). The beauty of quality management system is that also creates a mutual understanding for the requirements that are integral for implementing quality (Singles, 2001). It not only creates strong and stable operating procedures but also ensures the delivery of quality products to the customers' every time (Finch, 2003). Muhammad and Azaranga (Mohammad R. and Azaranga, 1998) supported that quality management programs and training session have a strong impact on the overall performance of an organization. In another research conducted by Benson, Schroeder and Saraph (Benson, 1991) it was reported that the operations of a company are more stable and proactive if it has strong quality checks. Study conducted by Denzler also validates the importance of quality management system. Denzler, 1996) Managers sometimes feel certification a burden, as there is an element of cost in process documentation and audit fee (Corbett, 2005). According to Pagell (Pagell, 1999) and Van den Heuval different approaches are used to define quality; it includes basics of quality management along with indicators of organizational performance that are helpful in accelerating operations of company (Van den Henuvel, 2006). Quality matrix consists of different set of process areas that are drafted in quality management system (Gingele, 2002). As mentioned earlier that this family of standards was initiated in 1987, so researchers have taken some steps to study its operational layout and analysis (Taylor, 2005).

The research could be used as a documentary evidence to support the effectiveness of quality management system on operational performance. Results also validate the existing literature about the

effectiveness of quality management system. It creates strong, stable and proactive standard operating procedures that were helpful in organizational learning. The study could also be used to identify and highlight the short comings in current practices and will be more beneficial in identification of loopholes. The research will have more generalize results if the sample size in increased. The research is beneficial in pin pointing the key process areas that are usually ignored by the managers while implementing quality management system. The research could be used to judge the understanding of quality principles among employees. The research could also be used in cross industry comparison pertaining to quality management system and its implementation. Owing to numerous benefits the adoption of quality management must be encouraged.

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