

Assessment of TQM Practices as a Part of Supply Chain Management in Healthcare Institutions

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Abstract— Total Quality Management (TQM) has a vital role for an effective management of healthcare supply chain through continuous improvement which is supported by various quality techniques. This study aims to determine the critical factors of TQM in healthcare institutions and to measure the effect of those factors on their business performance. A structural equation model is developed to depict the relationships between those factors and the Partial Least Squares (PLS) method is utilized to estimate those relationships for the healthcare institutions in Turkey. Analysis of the data from 50 hospitals revealed that TQM practices in the healthcare supply chain influence financial performance indirectly by influencing non-financial performance. Then, the main contributions of this study can be summarized as follows: 1) the assessment of TQM factors and their effects on both financial and non-financial business performance measures, and 2) the use of Partial Least Squares (PLS) method in estimation of structural equation model.

Keywords: Hospital Management, Healthcare SCM, Total Quality Management, Business Performance, Partial Least Squares

1. Introduction

Affect of globalization supported by improvement in new technology has changed the way of doing business in today's competitive world. It seems compulsory for firms to make their strategies fit to this emerging concept. The way of being successful and surviving in this environment is to apprehend the important changes in the business area, and get ready to appropriate competition and capitalize on opportunities related with the new dynamic business area [1].

Service sector has become dominant in the developed

countries and accounted for 60 to 70 percent of the total worldwide GNP due to its importance in modern society [2]. The basic concept of service management has changed in a variety of ways. Two of the main changes include: (a) a shift from an interest in the internal consequences of performance (e.g., internal efficiency – productivity of labor and profits) to the external consequences (e.g., consumer behavior- customer satisfaction, loyalty), and (b) a shift from a focus on structure to a focus on process as a part of supply chain management. Thus, company managers now focus more on the supply chain processes of service production and consumption as they govern consumer behavior in the service industry [3].

In recent years, one of the fastest growing industries in the service sector has been the healthcare industry. Hence, the healthcare and hospital industry take significant and growing research context that can be specialized by a concentration on providing individualized benefits and an identified need for making collaboration with considerable decentralized supply chain actors [4], [5].

Although most hospitals with the exception of a few highly specialized ones provide similar types of services, service quality levels vary significantly among hospitals. To achieve service excellence, hospitals must strive for zero defects and retain every customer that the company can profitably serve. Zero defects require continuous efforts to improve the quality of the service delivery system [6]. Customer retention in the healthcare sector refers to customers' preference for the same hospital if and when the need arises for themselves or for their family members [7]. Also, hospitals need to pay enough attention to critical approach which is healthcare supply chain management to be more competitive and successful in a health sector.

Performance enhancement of the healthcare supply chain with minimum costs and maximum responsiveness is an important issue of the hospitals. Healthcare supply chain management is a design of process to relate medicines,

equipment, laundry, food, suppliers, vendors, hospital and transport for efficient and effective utilization of resources to be successful with a Total Quality Management approach.

The healthcare sector denotes a significant industry in a service sector, but, there has not been enough attention paid to operation management and supply chain

management together [8]. The healthcare supply chain generally includes four main elements which are producers, purchasers, providers, and patients [9]. Produced products can be listed as pharmaceuticals, medical devices, and implants, and medical/ surgical supplies that are significant in the delivery of healthcare. Purchasers involve group purchasing organizations (GPOs) and distributors who chase the payment for and

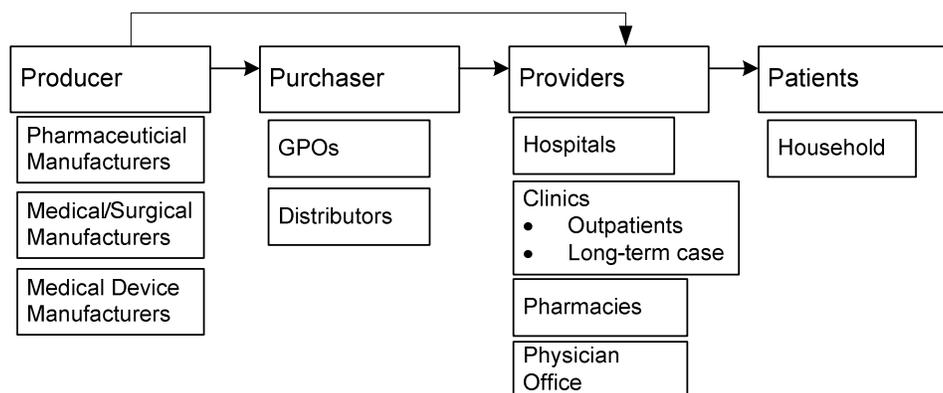


Figure 1. Structure of Healthcare Supply Chain [10]

shipment of goods from the producers to the providers. Providers utilize the goods to arrange healthcare services to patients. A structure of the healthcare supply chain is illustrated in Figure 1.

In a previous research, the definitions of service supply chains are reviewed and categorized it into service only supply chains and product service supply chains. Also, it is classified to three major areas which are service supply management, service demand management, and the coordination of service supply chains and examined the evolution of the service supply chain management research over the past decade. Lastly, some research obstacles were examined and vision of research area on service supply chain management was defined [10], [11]. Ref. [5] refers different units of analysis in healthcare service supply chain. Relying on literature review and case studies, this research figured out that process management is an effective tool when there is structured flow and a sufficient volume of similar repetitions. On the other hand, when a considerable level of exceptions occurs, a process can be decomposed into service units that managed as part of a supply chain.

This study differs from earlier studies in two aspects. First, this study evaluates the effects of critical factors of Total Quality Management (TQM) as a part of supply chain management practices in healthcare institutions on non-financial and financial performance in small and medium sized hospitals in Turkey. Second, Partial Least Squares (PLS) method, an approach for estimation of

structural equation models, is used to estimate these effects.

2. Theoretical Background and Hypotheses

Total quality management can be defined as an organizational culture that commits resources to customer satisfaction through continuous improvement in products/services provided. This culture varies among countries and industries. In addition, it has essential principles which can be implemented to secure greater market share, increased profits, reduced costs and finally increased supply chain performance. Moreover, management awareness of the total quality management's role in firm performance is stimulated by benchmarking which seeks, studies, implements and improves on best practices [12], [13].

Various studies have been carried out to determine critical factors of total quality management in the literature. As a result, different measurement instruments were developed such as Malcolm Baldrige National Award, EFQM (European Foundation for Quality Management), and the Deming Prize Criteria. Based on these studies, a wide range of management techniques, approaches, and systematic empirical investigation have been developed [1], [4], [14], [15].

Performance measurement is very important for the optimum management of an organization and measurement of performance is a prerequisite for

improvement [12]. Hence, to improve organizational performance, one needs to determine the total quality management criteria and measure their effect on business performance [16], [17]. A research on performance measurement was conducted to figure out efficiency points of Small and Medium sized Enterprises in Turkey using both financial and nonfinancial elements [1]. Traditionally, financial metrics were used to indicate business performance such as profit, market share, earnings, and revenue growth. However, ref. [18] refers that financial indicators are measures of past performance only, and they may not be relied upon exclusively to determine future business performance.

Inclusion of non-financial indicators in the traditional performance measurement system can overcome this shortcoming. TQM has become an important tool for improving the organizational performance in the healthcare sector as indicated by a multitude of studies [19], [20]-[24].

The present study aims to contribute to this proliferating body of information. In this study, a structural equation model is developed to measure the impact of critical factors of quality practices on financial performance by considering both direct and indirect effects, via the impact on non-financial performance. The partial least squares method is utilized to evaluate four research hypotheses for the healthcare sector in Turkey.

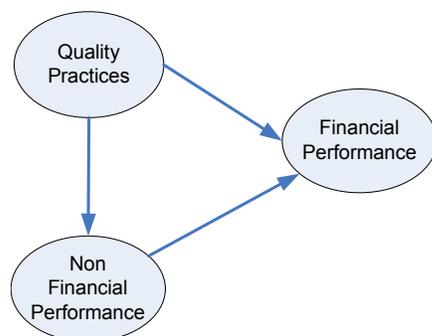


Figure 2. Relationships between Quality Practices and Business Performance

Each hypothesis represents a relationship between the constructs in the model as represented in Figure 2. These hypotheses are:

- H1: Total quality management criteria have a strong influence on non-financial performance in hospitals.
- H2: Total quality management criteria have a weak and direct influence on financial performance in hospitals.
- H3: Non-financial performance criteria have a strong and direct influence on financial performance in hospitals.
- H4: Total quality management has indirect effects on hospital's financial performance through its effect on non-

financial performance. This hypothesis will hold if hypotheses 1 and 3 hold.

In some researches, theoretical support was provided for the above hypotheses. It is indicated that total quality models, such as Malcolm Baldrige Award Models, need enormously expensive use of financial and other resources with no concomitant return on investment. Hence, their critics conclude that investment in quality practices might lead to a decrease in financial performance in the short run. Therefore, total quality management is a strong predictor of long-term survival through their influence on non-financial performance metrics and a leading indicator of future profitability [16], [24].

3. Methodology

Private hospitals in Istanbul/Turkey were selected to evaluate the impact of TQM variables on financial performance. A questionnaire was distributed to the Chief Administrative Officers of a universe of 98 moderate and large sized general hospitals to collect the data and 50 hospitals were found satisfactory to analyze for the proposed model. Data from 50 hospitals, comprising a response rate of 51%, were used in the subsequent analysis.

The instrument was developed and adapted with the purpose of identifying critical factors of total quality management in a business unit environment [25]. For this study, minor modifications were made in this instrument, in its final form; the questionnaire consisted of 43 items for 7 critical factors. Considering the well-established, empirical and conceptually strong nature of the framework from which the survey instrument was derived, its content validity is satisfactory.

The original version of the questionnaire was in English. This questionnaire was translated into the local language (Turkish). Each item was rated on a five-point Likert scale, ranging from "very low" to "very high". The questionnaire was pre-tested several times to ensure that the wording, format, and sequencing of questions were appropriate. Total quality management, non-financial performance, and financial performance were evaluated using judgmental measures based on managers' perceptions of how the organization was performing on multiple indicators of each construct. There are two main reasons for using judgmental measures for financial performance: Lack of past data related to financial measures and hospitals do not want to share their private financial data with others. Occasional few missing data on variables were handled by replacing them with the mean value. The structural equation model is given in Figure 3, and Appendix shows the details of model questions.

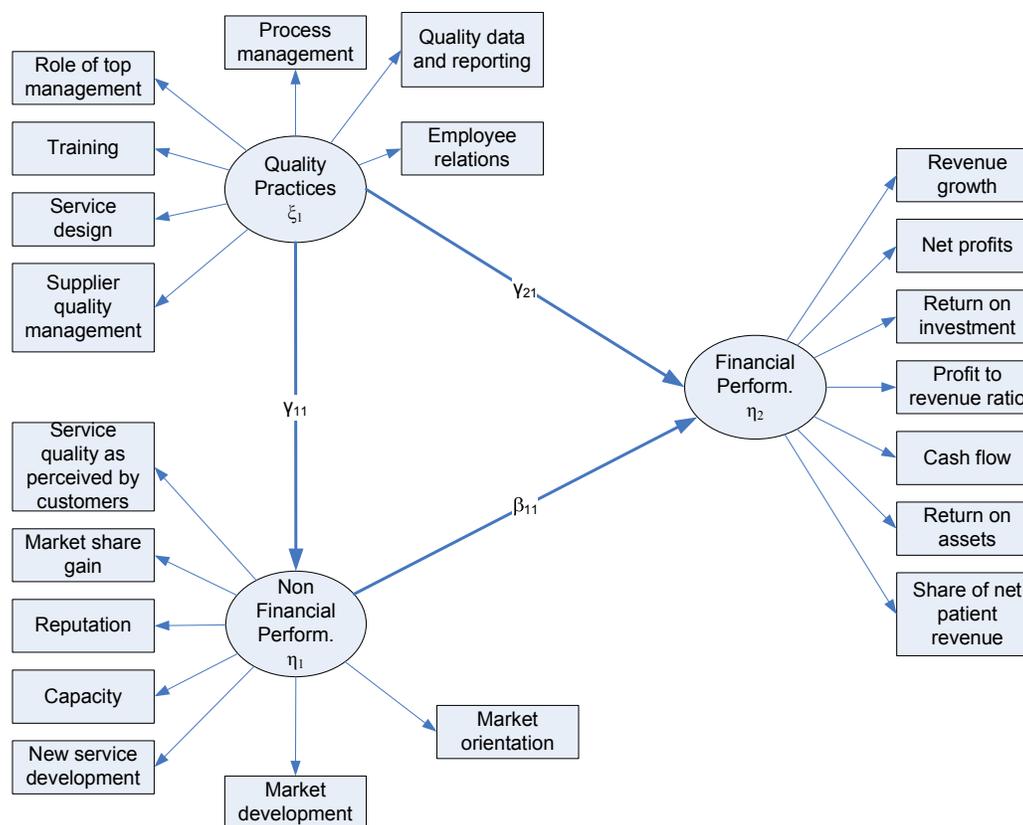


Figure 3. The Structural Model

4. Data Analysis and Results

For the analysis of data, a two-step approach is followed:

1. Determination of the critical factors of the total quality management using summated factor loading.
2. Estimation of the structural equation model using PLS.

4.1 Determining critical factors of TQM using Summated Factor Analysis

Seven factors for quality practices were used by combining related variables into a single composite measure. The reason why a composite model for the TQM block was used in this study is to conserve the degrees of freedom for the analysis (a sample size of 50), the indicators for each construct related to total quality management were represented by a single composite indicator as opposed to using all the individual indicators in the analysis. Thus each factor is derived by taking a weighted average of the items by using an equal weighting scheme. For example, the first factor, role of top management, was derived by taking the average score

of the first nine variables. Next six factors are derived in a similar fashion. These factors are: training, product or service design, supplier quality management, process management, quality data and reporting, and employee relations.

For unidimensionality and convergent validity analysis, confirmatory factor analysis (CFA) was used in place of exploratory factor analysis (EFA). Ref. [26] refers that a strong argument in favor of performing confirmatory factor analysis by suggesting that the major disadvantage of pure EFA lies in the difficulty involved in interpreting the factors. Implementing CFA method within Lisrel framework “allows the specification of measurement errors within a broader context of assessing measurement properties and describes a causal indicator model where the operational indicators are reflective of the unobserved theoretical construct”.

Table 1 provides the following model statistics for the assessment of goodness-of-fit: The χ^2 statistics, its associated degrees of freedom, p-value of significance, GFI, AGFI CFI, and Tucker-Lewis index. One can conclude that each of the seven dimensions achieves unidimensionality and convergent validity.

Table 1. Initial Confirmatory Factor Analysis Results

Dimension	Number of indicators	Chi-Square	df	P-Value	GFI	AGFI	CFI	TLI
Role of Top Management	9	21.096	17	0.222	0.92	0.79	0.98	0.97
Training	4	2.525	1	0.112	0.975	0.755	0.99	0.93
Service Design	5	5.886	4	0.208	0.957	0.84	0.98	0.97
Supplier Quality Management	4	4.075	2	0.130	0.964	0.822	0.98	0.943
Process Management	6	6.752	6	0.344	0.96	0.859	0.996	0.99
Quality Data and Reporting	8	11.630	10	0.311	0.946	0.806	0.995	0.987
Employee Relations	7	5.224	6	0.515	0.971	0.863	1	1

The results of unidimensionality do not provide a direct assessment of construct reliability, thus Cronbach alpha coefficient as a measure of reliability was employed. The Cronbach's alpha measures of reliability for the seven factors are 0.92, 0.91, 0.89, 0.88, 0.87, 0.79, and 0.90 for factor 1-7 respectively. Cronbach's alpha values for all factors are above the traditional acceptable value of 0.70 as suggested by [27].

4.2 Structural Equation Modeling

As mentioned earlier, partial least squares (PLS) approach was utilized to test the hypothesized relationships among the blocks. PLS procedure, developed by [28] uses two stage estimation algorithms to obtain weights, loadings, and path estimates. In the first stage an iterative scheme of simple and/or multiple regressions contingent on the particular model is performed until a solution converges on a set of weights used for estimating the latent variables scores. The second stage involves the non-iterative application of PLS regression for obtaining loadings, path coefficients, mean scores and location parameters for the latent and manifest variables [29]-[31]. For calculating PLS procedure Spad Decisia V56 statistical data analysis software was employed.

4.2.1 Unidimensionality tests of blocks in the path model

A causal modeling approach represented the constructs and tested the hypotheses. The key promises of the testable hypotheses in this study depend on the validity of the measurement properties of the three blocks.

In the model, since all manifest variables reflect their related latent variables, a reflective representation is more appropriate than a formative one. The validity and reliability of three reflective constructs were assessed by checking unidimensionality of each block using three tools: principal component analysis, Cronbach's alpha and Dillon-Goldstein's ρ [30], [31]. As shown in Table 2, all of the Cronbach's alpha values met the minimum criterion alpha value of 0.70. According to the principal component analysis, since the first eigenvalue score of the correlation matrix of the manifest variables of each construct is larger than one, and the second one is smaller than one each construct was considered as unidimensional. Similarly, Dillon-Goldstein's ρ analysis provides ρ values above 0.70 for each construct supporting unidimensionality.

4.2.2 Outer model estimation

Outer model, also known as a measurement model, links the manifest variables to their latent variables. The outer model estimation results are provided in Table 3. The correlations between the manifest variables and their related latent variables are very satisfactory. A communality measure is the squared correlation between the manifest variable and its own related latent variable. It measures the capacity of the manifest variables to describe the related latent variable.

Communality measure is expected to be higher than 0.60 for each manifest variables. In this application communality scores show that the manifest variables are very capable for estimating the change in related latent variable.

Table 2. Unidimensionality check of the blocks

Block	Number of Indicators	Cronbach Alpha	Dillon-Goldstein's ρ	First Eigenvalue	Second Eigenvalue
TQM	7	0.936	0.949	4.862	0.525
NONFIN	7	0.927	0.945	4.377	0.557
FIN	6	0.906	0.932	4.147	0.745

Table 3. Outer model estimation results (* $p \leq 0.001$)

Latent variable	Manifest variable	Outer weight	Correlation	Communality
TQM	TQM1	0.194	0.804	0.647*
	TQM2	0.195	0.913	0.834*
	TQM3	0.175	0.895	0.801*
	TQM4	0.134	0.832	0.693*
	TQM5	0.087	0.796	0.634*
	TQM6	0.200	0.850	0.724*
	TQM7	0.205	0.855	0.732*
NF	NF1	0.179	0.767	0.588*
	NF2	0.216	0.903	0.815*
	NF3	0.125	0.824	0.680*
	NF4	0.140	0.799	0.639*
	NF5	0.212	0.929	0.864*
	NF6	0.196	0.891	0.794*
	NF7	0.182	0.722	0.522*
FP	F1	0.224	0.823	0.677*
	F2	0.245	0.949	0.902*
	F3	0.196	0.782	0.612*
	F4	0.194	0.878	0.771*
	F5	0.172	0.822	0.675*
	F6	0.161	0.686	0.470*

4.2.3 Inner model estimation

As shown in Figure 2, four main hypotheses were tested for this model. Estimation results for the inner model are provided in Table 4.

The first model examines the relationship between non-financial performance and TQM. TQM explains about 29 percent of the variation in non-financial performance. TQM has a significant influence on non-financial performance with a coefficient value of 0.539. The second model covers the second and third hypotheses. This model evaluates the impact of TQM and non-financial performance on financial performance. According to the overall model, TQM and non-financial performance

explain approximately 63 percent of the variation in financial performance. Since the t value is 0.483, the second hypothesis (H2) is rejected. This indicates that TQM does not have a direct influence on financial performance. For the third hypothesis (H3), t value (7.258) is significant at the 0.01 levels, indicating that non-financial performance has a strong influence on financial performance. Similarly, TQM has a significant indirect impact on financial performance (H4). Figure 4 provides the graphical representation of the structural model estimation results.

Table 4. Inner Model Results with Bootstrap Estimation

Model	R ²	P-Value	Bootstrap Estimated Coefficients
$\eta_1 = 2.535 + 0.539 \xi_1 + \zeta_1$	0.2915	0.0001	0.533
$\eta_2 = 0.588 + 0.050 \xi_1 + 0.765 \eta_1 + \zeta_1$	0.6300	0.6312 (for ξ_1) 0.0000 (for η_1)	0.048 (for ξ_1) 0.760 (for η_1)
$\eta_2 = 2.528 + 0.050 \xi_1 + 0.413 \xi_1 + \zeta_1$	0.6300	0.0000 (for indirect effect of ξ_1)	

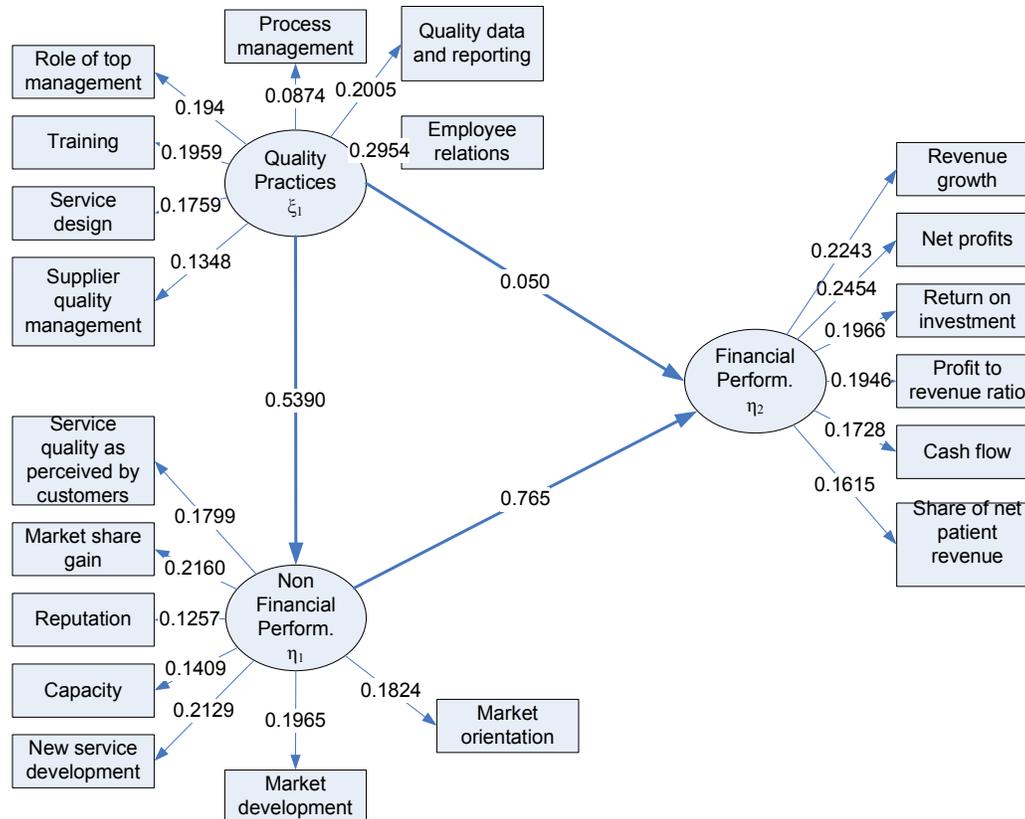


Figure 4. Path Model

After the parameter estimation, bootstrapping was applied to confirm the robustness of our findings. 1000 bootstrap samples are built by re-sampling with replacement from the original sample. In the last column of Table 3 summary results for bootstrapping are provided. The bootstrap estimated coefficients of inner model are very close to the ones estimated using PLS.

5. Conclusions

In this study, it is shown that TQM practices do not have direct influence on financial performance in the healthcare sector. However, by considering the indirect route through non-financial performance, it is also shown that TQM practices have a positive influence on financial performance. Lack of observable direct relationship between financial performance and TQM practices may lead to a sub-optimal resource allocation toward quality practices. However, the interviews/data showed that hospital management recognize the importance of quality management by investing substantial resources in adapting and implementing TQM programs to improve performance.

On the other hand, none of the hospitals in the sample have a quality department indicating that they may not be

fully recognizant of the impact of TQM practices on financial performance. The index scores for TQM practices, non-financial performance and financial performance are calculated as the weighted average of their manifest variables. Then, the index scores for TQM practices, non-financial performance and financial performance were found as 39.94, 58.65 and 57.22, respectively. The lowest index value for TQM practices can be attributed to “awakening” stage in the hospital sector as described by [13].

Based on the results, the most important quality practices are employee relations, training, role of top management, and data and reporting. Hence, companies should focus on developing formal reward and recognition systems to encourage employee involvement, support teamwork, and provide feedback to the employees. At the same time, they should invest in developing their managers to fully reap the benefits from quality implementation. In addition, in healthcare industry, successes of TQM applications depend on a strong leadership that must be initiated by the top management. Quality improvement plans proposed by several experts emphasize primarily the commitment of top management. The top management determines an appropriate organization culture, vision, and quality policy. Managers of healthcare organizations

should determine objectives, and set specific measurable goals to satisfy customer expectations and improve their organizations' performance. In order to increase net profit and revenue, and to reduce cost of quality, hospital managers must convey their priorities and expectations to their employees. Managers will require information to create business intelligence which necessitates data collection and analysis of current processes and customer needs. Moreover, data provides inspection, various test results and verification records. Data can also be used to analyze the process using various types of statistical process control tools such as control charts, Pareto charts, cause and effect diagrams, check sheet, histograms, scatter diagram, and so on. These traditional quality tools are very useful in monitoring and measuring progress and performance.

If TQM plan is implemented properly, it produces a variety of benefits such as understanding customers' needs, improved customer satisfaction, improved internal communication, better problem solving, fewer errors, and so on. The success of TQM increases when it is extended to the entire company. This enables the reformation of the corporate culture and the permeation of the new business philosophy into every facet of organization. The philosophy of doing things right must be implemented with enthusiasm and commitment throughout the organization- from top to bottom and the little steps forward (called "Kaizen" by the Japanese) must be viewed as "a race without a finish". Consequently, effective use of TQM is a valuable asset in a company's resource portfolio. It can produce important competitive capabilities and be a source of competitive advantage.

In this study some several limitations and hence opportunities for further research exist. First, sample size is barely sufficient and needs to be increased. The sample size of 50 posed some estimation problems with regard to degrees of freedom in the operationalization process of total quality management block and testing the path model. Therefore, summated scales were used for each component of TQM. The sample size should be increased in the future by extending the data collection effort to several largest cities in Turkey. Second, only subjective evaluations of the hospitals' top managers were employed in the study, and objective performance indicators should also be employed. Finally, other estimation methods, such as nonlinear neural networks, can provide additional insights in the future.

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Appendix

1. Quality Practices in Hospital Supply Chain

1. Role of Top Management and Quality Policy.
2. Training of employees.
3. Product / Service Design.
4. Supplier Quality Management.
5. Process Management/Operating Procedures.
6. Quality Data and Reporting.
7. Employee Relations.

2. Non-Financial Performance.

1. Service quality as perceived by customers.
2. Market share gain over the last three years.
3. Reputation among major customer segments.
4. Capacity to develop a unique competitive profile.
5. New product/service development.
6. Market development.
7. Market Orientation.

3. Financial Performance.

1. Revenue growth over the last three years.
2. Net profits.
3. Return on investment.
4. Profit to revenue ratio.
5. Cash flow from operations.
6. Share of net patient revenue.