

# Impact of Statistical Measures of Quality on Business Projects Performance “A Study in Istanbul - Turkey”

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**Abstract:** *The purpose and aim of this research are to show and evaluate the relationship and the effectiveness between total quality management (TQM) Practices, Statistical Measures, and Financial, Innovation, and Operational performance respectively in business projects at firms. In addition to finding ways to improve the performance through focuses on how to use TQM Practices and Statistical Measures to improve the performance of business projects. Data were collected from 283 respondents in Istanbul, sample of Turkish firms based on the study model data were examined using the Statistical Package for the Social Sciences (SPSS) software by applying frequency distribution tables also bar charts of questionnaire (part A) and further correlation, R-Square, ANOVA and Regression Analysis for questionnaire (part B). Results show that the relationship between TQM Practices, Statistical Measures, and Performance (Financial, Innovation, and Operation) in the firms is positive. This study has analyzed through a descriptive approach that was used to study about the demographic profile of business in Istanbul, and TQM items have been developed to test the hypothesis. Five-point Likert scale questionnaire has been adopted for data collection, the reliability statistics of all items was 0.909 which is excellent, in order to measure the relationship among variables correlation a test was used, regression analysis R-Square interpretation, ANOVA was used to show the impact of TQM Practices on Financial, Operations, and Innovation Performance of the business projects. Statistical analysis also showed results and suggestions for this model.*

**Keywords:** TQM, Statistical Measures, Financial Performance, Innovation Performance, Operation Performance, Business Projects.

## 1. Introduction

In the rapidly evolving world of business, the importance of TQM is very great [1]. Most of the businesspersons get help of it. Indeed, without proper use of TQM practices it is not very easy for the managers to venture and make accurate calculations. Therefore, almost all the managers, business personals and professionals across all corners of the earth adhere to the TQM practices. Firms need to implement some competition strategies and total quality management applications to overcome the fierce competition among others [2]. In this twenty first century of business competition, TQM practices have become a necessity for business projects. TQM practices are widely used to assess the quality of business projects, improve performance and help predict future outcomes, hence introducing TQM practices into the business projects not only improves their quality but also managerial expectations and their realization [3]. TQM has been widely used in the world of business today. Its techniques are of immense importance when it comes to determining the efficiency and effectiveness of the business projects [4]. TQM techniques help us in forecasting the outflow of funds. It also assists us in maintaining the quality of the raw material so that the material can be saved from damage. Different techniques are employed in order to motivate team members. Their retention is the soul of a project to make its way to the completion. Most of the business projects do not get successful due to this issue. TQM practices are frequently used in the short-term projects for enhancing the marketing of the projects. A good market value is engineered through TV commercials and aids along with the social media platform. TQM implementation brings

innovations in the business projects. Managers are subject to regular scrutiny. They had pressure from the top management to retain quality in their projects. Therefore, they take full care of all the assets and commodities. They try to maintain their warehouses so that the stocked material does not get obsolete. The projects that rely on TQM practices get faithfulness of their team members. Because TQM practices promises some new methods of rewarding employees. Through handsome rewarding techniques, the team members show through full support and dedication to make the projects work. As a result, the efficiency or Operational Performance of the business projects is improved to a greater degree. TQM practices also help us in managing the ethnic or group issues that are more common in business projects. The managers are directed to focus on the quality. They start observing minutely. They try to resolve every problem that arises in the group so that the quality of the work should not be compromised. With the dedication and strong will of managers to resolve any issue, these group problems start to fade away [5]. The reason behind is that, most of the unresolved issues are due to lack of interest of managers to solve them and their existence negatively affects the quality of a business project. Therefore, it goes without any doubt that the TQM implementation in business projects is of great significance.

### 1.1. Problem Defined

There is a lot of research work around the world on almost every topic. But the issue of assessing the impact of TQM

practices on business projects goes without much attention. However, the topic is dealt with in some research papers indirectly. Specially, Turkey is the hub of business. New companies are venturing in the country. New investors are coming. The government is offering scholarships to international students. All this makes the business world more competitive. Hence, it becomes indispensable for the stakeholders of the country to lend ears to this issue and assist research scholars in this regard. This technical gap can be overcome by welcoming the research work on it. The outcome would be the best possible way of executing the business projects; to know their efficiency; future predictions and performances, etc. [6]. The newcomers would be facilitated, and the Student community would also be accommodated. Because they carry out a number of business projects as an assignment in their degree programs. But due to lack of availability of statistical data on the performance of business projects, they get locked up in the vicious cycle of problems. This is the main line of problem. We try to reduce this gap by offering a comprehensive research on the use of TQM practices in the business projects.

### 1.2. The Importance of the Study

The significance of TQM has increased many folds [7]. It has become a central tool for business projects in the world of business today. Statistical tools generated as a result of TQM applications pave the way for smooth and productive conclusion of business projects undertaken in different conditions by different business-minds. This is the center of our research to know the impacts of TQM practices in the form of statistical measures on project's performance. Statistical tools help us find out the exact calculations for future planning for business tools. For example, correlation test helps us in identifying the validity of the relationship between two hypotheses that a student claims to be researched. This is one of the statistical tools that assists not only the researchers but also the businessmen in carrying out the business projects [8]. For instance, a manager is expecting a profit for a new venture equal to that of last year. But he has no exact calculations. He is scared to launch a new business project, having the similar ingredients of the last one. In this scenario statistical tools of TQM practices are the only viable option to assess the chances of getting the similar profit this year [9]. Correlation technique would help him by determining the relationship of profit of last year and the probability of getting the same profit this year. Other statistical tools such as regression, beta test, reliability test, etc. are also very indispensable in having the positive impact on the business projects. That is the only purpose that we try to highlight the impact of TQM practices in the shape of statistical tools on the business projects. In Turkey, this question is of immense importance as there is a lack of articulated work on this question [10]. The country is home to an expanding market of business where a number of new companies are shifting their operations. The new investors would be facilitated in determining the potential of the market that whether their business projects would be a success story or not.

### 1.3. Research Objectives

- The first and foremost objective of this research work is to use effectively the statistical tools in order to determine the relationship of variables on the performance of business projects. This would add to the knowledge and expertise of the businessman to make the business project more product oriented.
- The second most objective is to find out, with the help of this research work, problems and hurdles faced by the business organizations in Istanbul by using the total quality management practices.
- Afterwards, the relationship between TQM practices and Statistical measures of quality should be pinned out.
- After that, the relationship between TQM practices and financial performances of business projects needs to be bifurcated.
- The work must be carried out towards finding the relationship between the TQM practices and the Innovation performance of the business projects.
- It is also the goal that the relationship between TQM Practices and operation performance of business projects should be highlighted. Because most of the business practices are devoid of TQM practices now a days.

### 1.4. Hypotheses of the Study

There are many study results showing positive and negative (or non-significant) relationships or correlations between TQM practices and various performance indicators [2]. Below all hypotheses of the study:

- **H1**= TQM practices is significantly related to Financial Performance of business projects controlled by statistical measures of quality.
- **H2**= TQM practices is positively connected to Innovation Performance of business projects controlled by statistical measures of quality.
- **H3**= TQM practices is directly and indirectly related to the Operation Performance of business projects controlled by statistical measures of quality.

## 2. Literature Review

Though there are a lot of definitions on the word quality, yet no single definition is applied worldwide. Every firm defines it on the basis of its own perspective. Yet, there are a few scholars whose given definitions are widely accepted. They include Crosby, Deming, Feigenbaum and others. Quality is what that fulfils all the requirements or criteria of a product or serviceable its essentials are satisfied [11]. The customer is subjected to receive all the features that a manufacturer claims to incorporate in its product or receive services that a service-provider claims to provide to his customers [12]. In order to study TQM practices and their profound impact on the business projects, their operational, innovation and financial performance, it was very important to reflect light on the term "quality". That was the reason that we started our second chapter with defining the word quality from the definitions of prominent scholars. To move ahead, quality means to satisfy customer's needs. And, customer's needs are dynamic. They change from time to time. Owing to this fact, we cannot fix the standards of quality for a particular product or services. We need to keep these standards of

quality on open end to entertain the changes [13]. The TQM practices are the essential tools for doing this. But the irony is that since the standards by which quality is measured are different from country to country, one single literature of TQM is insufficient for all the countries of the world. This was the need that compelled us to study TQM practices in detail for Turkey. Once TQM practices are implemented with full zeal, the positive impacts are recorded on business projects. In practice, most firms that claim to implement TQM in their business projects lack modern techniques. There is also deficiency of relevant literature (country-wise). Lack of training of the staff further deteriorates the situation [13]. This all, in turn, affects the financial, operational and innovation performance of a business project. The prime object of this study is to help Turkish community in this regard. The findings of this study once published will serve the purpose of presenting an outlook of TQM practices that positively affect the overall performance of business projects. Statistical measures of quality positively affect the performance of business projects [14]. Statistical measures of quality are one of the major tools of TQM techniques currently pursued in the field of business. Statistical measures such as Frequency Distribution among the items, Regression tests, Probability, Forecasting, etc. all are the main ingredients by which quality is maintained and retained.

### 2.1. Financial Performance

Financial performance of a business is affected by two main factors. One is old techniques of recording and forecasting the financial data and the other is incompetent management. Firstly, most of the businesses resist changes [15]. They are very slow when it comes towards sticking to the change offered by new trends. The methods on which financial performance is based are not updated. They remain antiquated. As a result, the financial performance of a business project remains drowsy and dull despite spending much on its improvement. When the financial record is maintained manually, audit is not carried out easily. Employees are unable to compare the current financial progress with that of the previous year's [16]. Because the pages on which the financial record is spanned are too many to be analyzed. Usually the practice of audit and comparing previous performance goes missing and the financial performance of that business project gets badly affected. Secondly, the incompetent management adds fuel to fire. When a business is up to date with the modern technology and modern techniques of recording and analyzing the financial data, the management deteriorates its quality. In some businesses or firms, the staff is accustomed to status quo. They don't want to streamline themselves to new techniques. They don't want to transform their way of doing things [17]. This attitude sometimes proves lethal for the business entities. Because in the financial matters, change is inevitable. New rival firms cannot be competed when you rely on old techniques. And to change the ingrained psyche of employees is almost an impossible task. When this attitude is found in the people who are connected with the financial sector, then the performance of a project becomes bleak and cheerless [18]. Hence, if a businessman wants to make his project successful, he has to capitalize on the

available statistical measures to improve quality and efficacy of his project.

### 2.2. Operational Performance

The second variable of this study is operational performance that is triggered by the use of statistical measures. TQM techniques also play their part in this regard. Without TQM implementation, statistical measures cannot achieve positive operational performance [19]. Both the TQM principles and statistical measures go hand in hand when improving the operational performance of business projects.

There are many hurdles in the way of achieving satisfactory operational performance.

Today, most of the businesses are struck with this issue of how to get satisfactory operational performance [20]. But there are four main hurdles in improving operational performance of a firm. After going in depth of these issues, determining their nature, these hurdles would be removed with the help of TQM principles and statistical measures of quality.

### 2.3. Innovation Performance:

Innovation is a thing that makes a firm's business develop by leaps and bounds. It brings new things that help business machinery and business minded people do their task with relative ease. Employees are facilitated by technology. Their skills are enhanced and the way of performing tasks become easy and comfortable [21]. Every business entity works on introducing innovation in its products, the way of doing things, and facilitating its employees. Some of them become successful while others do not. Firms face two main issues when they measure innovation performance: cost of switching and the difficulty in streamlining.

Different business projects are launched by every business firm in order to bring innovation in their products and methodology of working. The aim is to improve quality and increase the chances of earning handsome profit [22]. For that purpose, they change their products features, color and design to attract the customers. To ensure efficiency, they bring modern machinery and techniques for their working. Usually, the less popular or newly born firms switch to innovation. They need something unique to popularize their product that is the case with the old firms having great market value and customer chain.

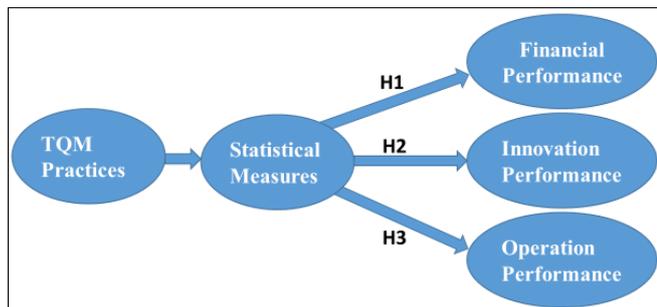
### 2.4. TQM Practices

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quality for a particular product or services. We need to keep these standards of quality on open end to entertain the changes [13].

**2.5. Conceptual Framework**



**Figure 1:** Conceptual Framework

**3. Research Methodology**

**3.1. Introduction**

This chapter is purely dedicated to present a brief sketch of research methods, data collection means, size of sample and their analysis. The research questionnaire, its types and nature. The research plan is stated as: establishing research model, researching for the survey questions in the literature, constructing the best fitting survey from the alternatives, reaching the participants and informing them for the survey, gathering the data and measuring and analyzing the data to test the hypothesizes [2].

**3.2. Target Population**

Since the main focus of our study is upon the use of statistical measures on business projects performance in turkey, we have target population of businesses operating in Turkey that frequently initiate short term and long-term business projects. Each firm is taken into account in order to make the results effective. The 283 middle level managers and executive level managers from firms of Turkey have been asked to complete the survey.

**3.3. Sampling Size**

According to Turkey Union of Chambers and Commodity Exchanges (TOBB), announced in December 2018 and established the last year-liquidated company statistics (URL-1). Accordingly, the number of companies in Turkey is 85,279. And based on (URL-2) the percentage of Istanbul companies 29.5%, that is mean the approximately number of companies in Istanbul is 25,075.

By using the below equation, the sample size required for this study is **268** responds.

$$\text{Sample size, } n = N * \frac{Z^2 * p * (1 - p)}{[N - 1 + \frac{Z^2 * p * (1 - p)}{e^2}]}$$

(1)

Where N (Population Size) =25,075, Z (Confidence level) =1.645, e (Margin of Error) =0.05, and P (Sample Proportion - uncertain) =0.5.

**3.4. Sampling**

The sample will be collected from Business organizations in Istanbul from both European and Anatolian sides. Simple and random sampling will be used for the collection of data. The data will be collected from 284 managers of those organizations.

**3.5. Research Methodology**

On behalf of past study all variables measured by Index of total quality management evolved by [23] these questionnaires measured independent variables TQM Practices, Statistical measures, Strategic Quality Planning and Performance of Business Projects, and dependent variable evolved by [24] which measured Performance of Business Projects. This scale also used by other scholars also in China and other several countries, [25] also used this scale to measure the scales. The whole questionnaires are composed of 30 that measures all independent variables and 22 items measures the performance of business projects.

**3.6. Data Collection**

Data collection is the most important aspect of any research. The results of every research lie on this very important aspect. Most of the researchers do not adhere much importance to this phase which is why they fail in producing desired results through their researches. For that purpose, we have given a special attention to this phase of our journey so as to keep the research’s results intact and effective for future use. In order collect data effectively we have used an all-embracing questionnaire that deals every aspect of our theses and hypotheses. Researcher use primary data collection, that means the whole data is collected by researcher via questionnaire’s Performa having Likert type Scale. This questionnaire is distributed among the respondents to extract information from them.

**4. Results and Discussions**

**4.1 Demographic Discussion**

The respondents who were contacted for this study numbered 283. Below will discuss the most important aspect of demographic questions:

**4.1.1 Number of Employees**

**Table 1:** Number of Employees

	Frequency	Percent	Valid Percent	Cumulative Percent
1-19	33	11.7	11.7	11.7
20-100	137	48.4	48.4	60.1
100+	73	25.8	25.8	85.9
Unknown	40	14.1	14.1	100.0
Total	283	100.0	100.0	

This is the table that shows substantiation that we have collected genuine information and on that we are going to proceed ahead. The frequency of employees between 20-100 around 50 percent which is very impressive percentage. The valid percentage is 50 and ours is crossed fifty. It means in this respective we have reached the accuracy level.

**4.1.2 Position in the Company:**

**Table 2: Positions of the company**

Position	No. of Respondents	Percentage
General Managers	28	9.89%
Relations Managers	23	8.13%
Financial Manager	27	9.54%
Operation Managers	16	5.65%
Marketing Manager	30	10.60%
Support Manager	11	3.89%
IT Managers	8	2.83%
CEO	3	1.06%
Program Managers	12	4.24%
Project Managers	17	6.01%
Investment Manager	8	2.83%
Human recourse Manager	19	6.71%
PMO Manager	34	12.01%
Sales Director	9	3.18%
Quality Manager	17	6.01%
Others	21	7.42%

As per the above table different people belonging to different managerial hierarchy and different project firms were contacted to fetch information. The break-up of the total contacted people is shown above to help the researchers and spectators.

**4.1.3 Quality System**

**Table 3: Quality System**

	Frequency	Percent	Valid Percent	Cumulative Percent
ISO 9000-20000	70	24.7	24.7	24.7
SIX SIGMA	64	22.6	22.6	47.3
TQM	115	40.6	40.6	88.0
Other Tools	34	12.0	12.0	100.0
Total	283	100.0	100.0	

As earlier discussed, different quality system has different objectives and different purpose to be served. In our case, the percentage of respondents' firm using ISO 9000-2000 was 24.7% which is a valid number recognized by the SPSS.

Since beginning, a number of times the doubts and disagreements blanketed the initiation of ISO 9000 in order to satisfy customers internal, external, and changing needs with regard to products and services [26]. The main objective of ISO 9000 is to maintain and retain the quality of a product and services by introducing such qualitative measures [27]. Most of the authors and scholars admit that the ISO 9000 lacks in implementation. It operates as a paper driven work in some cases [28]. In order to maintain its standards of quality, human resource must be given to it.

This was the reason that the second version of it became a necessity. In its new version (ISO 9000:2000) an attempt is made to reinvigorate its document and meet its deficiencies

[29]. In the new version there is nothing negative, but the benefits are seeming less than the previous one [30].

Secondly, the quality system of Six Sigma is also a significant one that is used widely in the world of business now a day. It also works to cater to the different needs of business project in terms of enhancing quality and effectiveness. The valid percentage of Six Sigma recognized by SPSS is 22.6%. The figure near to it is also reliable.

Thirdly, the Quality system of TQM is also an important aspect of quality. In our case around 40% companies being contacted used TQM as a quality tool.

Using TQM improves performance of business projects by leaps and bound. It caters to the needs of customers, employees as well as society [31]. The fruits of using TQM come in the form of customer retention, enhanced productivity, and improved performance of products and services [32]. Implementing TQM leads to productive performance indicators, competitive advantage and increased capacity of labor to work more [33].

**4.2 Reliability Test**

**Table 4: Reliability Test**

Variable	Cronbach's Alpha	N of Items
TQM-Practices	0.748	8
Statistical-Measures	0.806	5
Operation-Performance	0.751	7
Financial-Performance	0.701	6
Innovation-Performance	0.738	4
Overall Items	0.909	30

Reliability test of items has checked through Cronbach's alpha of overall items and it is 90.9% which is excellent it means we can say that items which we have used in this research that are valid and acceptable.

**4.3 Factors Analysis**

Kaiser-Meyer-Olkin (KMO) Test is a measure of how suited your data is for Factor Analysis. The test measures the adequacy of sampling for each parameter in the system and for the entire model. The statistics is a calculation of the ratio of variance between variables that could be typical and common variance [34].

**Table 5 : KMO Result Explanation based on [35]**

Value	Status - Result
Between 0.00 to 0.49	Unacceptable
Between 0.50 to 0.59	Miserable
Between 0.60 to 0.69	Mediocre
Between 0.70 to 0.79	Middling
Between 0.80 to 0.89	Meritorious
Between 0.90 to 1.00	Marvelous

**4.2.1 Factor Analysis (KMO) for independent variables (TQM-Practices and Statistical-Measures)**

**Table 6:** KMO Test result for independent variables

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.858
Bartlett's Test of Sphericity	Approx. Chi-Square	2050.581
	df	78
	Sig.	.000

Based on the above table, the KMO for the independent variables in this study is 0.858. That mean our values of sample is Meritorious and acceptable.

**4.2.2 Factor Analysis (Rotated Component Matrix) for independent variables (TQM-Practices and Statistical-Measures)**

**Table 7:** Rotated Component Matrix Test result for independent variables

Rotated Component Matrix <sup>a</sup>		
	Component	
	1	2
TQM1-The senior executives provide high visible leadership in maintaining an environment that supports quality improvements		.797
TQM2-The industry collects a wide range of data and information about the quality.	.837	
TQM3-Middle managers (e.g., department heads, program directors, and first line supervisors) are playing a key role in setting priorities for quality planning	.659	
TQM4-Continuous improvement tools (brainstorming, check sheet and other statistical process control) are applied on regular basis.		.897
TQM5-Employees' participation in industry's success reduces the turnover and therefore reduces the cost of hiring and training new employees	.691	
TQM6-As well as being fully aware of customers' needs and expectations, each person must respect the needs and expectations of their suppliers		.905
TQM7-The industry emphasizes on assessing current customers' needs and expectations.	.832	
TQM8-Structural changes (less complexity, reduction of through put time and losses) are appreciated in your industry.	.764	
SM1-Industry employees are given education and statistical training in how to identify and act on quality improvement opportunities.		
SM2-Industry employees are given education and training in statistical and other quantitative methods that support quality improvement.	.741	
SM3-Industry employees have the authority to correct problems in their area when quality standards are not being met.	.776	
SM4-Industry employees are supported when they take necessary risks to improve quality.	.822	
SM5-The industry has an effective system for employees to make suggestions to management on how to improve quality	.775	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. <sup>a</sup>		
a. Rotation converged in 3 iterations.		

Based on the above table, the researcher finds the below about independent variables:

- TQM-Practices, its grouped in two groups (factors). That is mean the TQM-Practices will divide for two variables (factors). The new variables (factors) are TQM-Continues-Improvements and TQM-Management-Supports.
- The questions TQM2, TQM3, TQM5, TQM7, and TQM8 are related to TQM-Continues-Improvements.
- The questions TQM1, TQM4, and TQM6 are related to TQM- Management-Supports.
- The first question in Statistical-Measures (SM1), its discarded because of its factor can't be grouped.

**4.2.3 Factor Analysis (KMO) for dependent variables (Financial, Operation and Innovational Performances)**

**Table 8:** KMO Test result for dependent variables

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.747
Bartlett's Test of Sphericity	Approx. Chi-Square	2096.497
	df	136
	Sig.	.000

Based on the above table, the KMO for dependent variables in this study is 0.747. That mean our values of sample is Middling and acceptable.

**4.2.4 Factor Analysis (Rotated Component Matrix) for dependent variables (Financial, Operation and Innovational Performances)**

**Table 9:** Factor Analysis - Rotated Component Matrix Test result for dependent variables

Rotated Component Matrix <sup>a</sup>			
	Component		
	1	2	3
OP1-Industry employees are given adequate time to plan for and test improvements.			.828
OP2-Each department and work group within this industry maintains specific goals to improve quality.			.565
OP3-Middle managers (e.g., department heads, program directors, and first line supervisors) are playing a key role in setting priorities for quality planning.			.715
OP4-External customers are playing a key role in setting priorities for quality planning	.637		
OP5-Non-managerial employees are playing a key role in setting priorities for quality planning.	.589		
OP6-The senior executives have demonstrated an ability to manage the changes (e.g., organizational, technological) needed to improve the quality.			.684
OP7-The senior executives generate confidence that efforts to improve quality will succeed.	.819		
FP1-Liquidity cash on hand.			
FP2-Solvency (as little liabilities as possible).	.874		
FP3-Efficiency (time-efficient processes).	.892		
FP4-Effectiveness (performing economically).	.833		
FP5-Existence (remaining in operation).			
FP6-Profitability (most profit as possible).			
IP1-Competitors are slow to copy our product introductions.		.764	

IP2-New product development projects often don't finish on time.		.708	
IP3-Managers receive lots of support developing new ideas.		.703	
IP4-We don't penetrate all possible channels, customer groups, and regions with new products and services.		.762	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. <sup>a</sup> a. Rotation converged in 5 iterations.			

Based on the above table, the researcher finds the below about dependent variables:

- Operation-Performance, its grouped in two groups (factors). That is mean the Operation-Performance (OP) will divide for two variables (factors). The new variables are OP-Quality-Planning and OP-Quality-Improvements.
- The questions OP4, OP5, and OP7 are related to OP-Quality-Planning.
- The questions OP1, OP2, OP3, and OP6 are related to OP-Quality-Improvements.
- The questions FP1, FP5, and FP6 in Financial-Performance, its discarded because of its factors can't be grouped.

**4.4 Correlation Analysis:**

Abbreviations for the below table:

Pearson Correlation (PC), Sig. (2-tailed) (Sig), TQM-Continues- Improvements (TQM-CI), TQM-Management-Supports (TQM-MS), Statistical Measure (SM), Operation Performance, Quality-Planning (OP-QP), Operation Performance, Quality-Improvements (OP-QI), Innovation Performance (IP), and Financial Performance (FP).

**Table 10: Correlation Analysis**

		TQM-CI	TQM-MS	SM	OP-QP	OP-QI	IP	FP
TQM-CI	PC	1	.043	.787**	.745**	.303**	.209**	.860**
	Sig		.476	.000	.000	.000	.000	.000
	N	283	283	283	283	283	283	283
TQM-MS	PC	.043	1	.243**	.156**	.218**	.233**	-.025
	Sig	.476		.000	.008	.000	.000	.676
	N	283	283	283	283	283	283	283
SM	PC	.787**	.243**	1	.696**	.372**	.375**	.718**
	Sig	.000	.000		.000	.000	.000	.000
	N	283	283	283	283	283	283	283
OP-QP	PC	.745**	.156**	.696**	1	.419**	.239**	.712**
	Sig	.000	.008	.000		.000	.000	.000
	N	283	283	283	283	283	283	283
OP-QI	PC	.303**	.218**	.372**	.419**	1	.123*	.437**
	Sig	.000	.000	.000	.000		.039	.000
	N	283	283	283	283	283	283	283
IP	PC	.209**	.233**	.375**	.239**	.123*	1	.118*
	Sig	.000	.000	.000	.000	.039		.048
	N	283	283	283	283	283	283	283
FP	PC	.860**	-.025	.718**	.712**	.437**	.118*	1
	Sig	.000	.676	.000	.000	.000	.048	
	N	283	283	283	283	283	283	283

\*\* Correlation is significant at the 0.01 level (2-tailed).  
\* Correlation is significant at the 0.05 level (2-tailed).

This study contains three main hypotheses. These hypotheses are newer and are linked with each other to form a new hypothesis which is "Is the use of statistical measures of quality positively affect the performance of business projects?" Now, the researcher has undergone a test of these variables in order to determine their validity. According to [36], researchers conduct correlation tests to determine how these variables are connected with each other and whether their amalgamation is valid or not.

The main variable of this thesis is TQM practices of Quality and depending variables were Innovation Performance, Operational Performance, Financial Performance and Statistical Measures of Quality. The test is that how these variables are linked with one another.

If we look at the above table, we found that all of our values were positive expect FP with TQM-MS. It means almost all of our variables were positively linked to each other and form a consensus to develop a newer hypothesis. Finding a good relationship between variables results in newer and stronger idea that develops into a hypothesis or, in other words, becomes the center of study.

**4.5 Regression Analysis**

**4.5.1R-Square for Operation Performance – Quality Planning**

**Table 11 : R Square – OP-QP**

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.769a	.592	.587	.70713

a. Predictors: (Constant), SM, TQM-CI, TQM-MS

R- square is 0.592 that means using the TQM and Statistical Measures can explained by 59.2% variations of variation in Operation Performance – Quality Planning of Business Projects.

**4.5.2ANOVA for Operation Performance – Quality Planning**

**Table 12: ANOVA - OP-QP**

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	202.314	3	67.438	134.866	.000b
Residual	139.510	279	.500		
Total	341.824	282			

a. Dependent Variable: Operation Performance – Quality Planning  
b. Predictors: (Constant), SM, TQM-CI, TQM-MS

Above table (ANOVA) showing the significance value is 0.000 and it is below that 0.05 it means that Regression analysis also supported hypotheses of this research.

**4.5.3Beta Interpretations for Operation Performance – Quality Planning:**

**Table 13: Co-efficient of Betas - OP-QP**

	Unstandardized	Standardized	t	Sig.
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Model	Coefficients		1) Beta		
	B	Std. Error			
(Constant)	.808	.182		4.437	.000
TQM-Continues-improvements	.528	.062	.547	8.556	.000
TQM-Management-Supports	.061	.034	.073	1.792	.074
Statistical Measures	.225	.060	.248	3.771	.000
a. Dependent Variable: Operation Performance – Quality Planning					

Based on the above table, the researcher finds the below:

- If the company will apply 1 tool of TQM-Continues-improvements, then Operation Performance – Quality Planning will be increase by 52.8%.
- If the company will apply 1 tool of TQM-Management-Supports, then Operation Performance – Quality Planning will be increase by 6%.
- If the company will apply 1 tool of Statistical Measures, then Operation Performance – Quality Planning will be increase by 22.5%.

**4.5.4 R-Square for Operation Performance – Quality Improvements**

**Table 14: R Square – OP-QI**

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.398a	.158	.149	.98232
a. Predictors: (Constant), SM, TQM-CI, TQM-MS				

R- square is 0.158 that means using the TQM and Statistical Measures can explained by 15.8% variations of variation in Operation Performance – Quality Improvements of Business Projects.

**4.5.5 ANOVA for Operation Performance – Quality Improvements**

**Table 15 : ANOVA - OP-QI**

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	50.627	3	16.876	17.489	.000b
Residual	269.223	279	.965		
Total	319.850	282			
a. Dependent Variable: Operation Performance – Quality Improvements					
b. Predictors: (Constant), SM, TQM-CI, TQM-MS					

Above table (ANOVA) showing the significance value is 0.000 and it is below that 0.05 it means that Regression analysis also supported hypotheses of this research.

**4.5.6 Beta Interpretations for Operation Performance – Quality Improvements:**

**Table 16 : Co-efficient of Betas - OP-QI**

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.
(Constant)	.808		4.437	.000
TQM-Continues-improvements	.528	.547	8.556	.000
TQM-Management-Supports	.061	.073	1.792	.074
Statistical Measures	.225	.248	3.771	.000

	B	Std. Error	Beta		
(Constant)	2.269	.253		8.965	.000
TQM-Continues-improvements	.079	.086	.085	.926	.355
TQM-Management-Supports	.121	.047	.149	2.556	.011
Statistical Measures	.236	.083	.269	2.843	.005
a. Dependent Variable: Operation Performance – Quality Improvements					

Based on the above table, the researcher finds the below:

- If the company will apply 1 tool of TQM-Continues-improvements, then Operation Performance – Quality Improvements will be increase by 7.9%.
- If the company will apply 1 tool of TQM-Management-Supports, then Operation Performance – Quality Improvements will be increase by 12.1%.
- If the company will apply 1 tool of Statistical Measures, then Operation Performance – Quality Improvements will be increase by 23.6%.

**4.5.7 R-Square for Innovation Performance**

**Table 17 : R Square – IP**

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.416a	.173	.164	.99780
a. Predictors: (Constant), SM, TQM-CI, TQM-MS				

R- square is 0.173 that means using the TQM and Statistical Measures can explained by 17.3% variations of variation in Innovation Performance of Business Projects.

**4.5.8 ANOVA for Innovation Performance**

**Table 18 : ANOVA - IP**

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	58.098	3	19.366	19.452	.000b
Residual	277.774	279	.996		
Total	335.873	282			
a. Dependent Variable: Innovation Performance					
b. Predictors: (Constant), SM, TQM-CI, TQM-MS					

Above table (ANOVA) showing the significance value is 0.000 and it is below that 0.05 it means that Regression analysis also supported hypotheses of this research.

**4.5.9 Beta Interpretations for Innovation Performance:**

**Table 19 : Co-efficient of Betas - IP**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error			
(Constant)	2.376	.257		9.243	.000
TQM-Continues-Improvements	.169	.087	-.176	-1.939	.054
TQM-Management-Supports	.102	.048	.123	2.119	.035
Statistical	.435	.084	.484	5.163	.000

Measures					
a. Dependent Variable: Innovation Performance					

Based on the above table, the researcher finds the below:

- If the company will apply 1 tool of TQM-Continues-improvements, then Innovation Performance will be decrease by 16.9%.
- If the company will apply 1 tool of TQM-Management-Supports, then Innovation Performance will be increase by 10.2%.
- If the company will apply 1 tool of Statistical Measures, then Innovation Performance will be increase by 43.5%.

4.5.10 R-Square for Financial Performance

Table 20: R Square – FP

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.867a	.752	.749	.67620
a. Predictors: (Constant), SM, TQM-CI, TQM-MS				

R- square is 0.752 that means using the TQM and Statistical Measures can explained by 75.2% variations of variation in Innovation Performance of Business Projects.

4.5.11 ANOVA for Financial Performance

Table 21: ANOVA - FP

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	386.096	3	128.699	281.469	.000b
Residual	127.570	279	.457		
Total	513.666	282			
a. Dependent Variable: Financial Performance					
b. Predictors: (Constant), SM, TQM-CI, TQM-MS					

Above table (ANOVA) showing the significance value is 0.000 and it is below that 0.05 it means that Regression analysis also supported hypotheses of this research.

4.5.12 Beta Interpretations for Financial Performance:

Table 22: Co-efficient of Betas - IP

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.291	.174		1.669	.096
TQM-Continues-improvements	.872	.059	.736	14.766	.000
TQM-Management-Supports	-.098	.033	-.096	-3.010	.003
Statistical Measures	.180	.057	.162	3.153	.002
a. Dependent Variable: Financial Performance					

Based on the above table, the researcher finds the below:

- If the company will apply 1 tool of TQM-Continues-improvements, then Financial Performance will be increase by 87.2%.
- If the company will apply 1 tool of TQM-Management-Supports, then Financial Performance will be decrease by 9.8%.
- If the company will apply 1 tool of Statistical Measures, then Financial Performance will be increase by 18%.

4.6 Updated Conceptual Framework

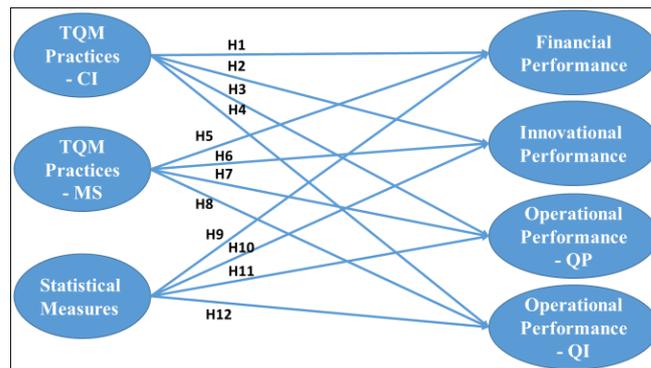


Figure 2: Updated Conceptual Framework

4.7 Updated and Testing Hypotheses:

TQM-Practices - Continues Improvements are directly affects Financial, Innovational, Operational (Quality Planning and Quality Improvements) Performances.

- 1) H1: TQM-Practices - Continues Improvements are directly and positively affects Financial Performance. Based on the table 9, value is (r=0.860) and  $p < 0.05$ . Based on the table 20,  $R^2 = 0.752$ . Based on the table 21,  $p < 0.05$ . Based on the table 22,  $p < 0.05$ . Based on the above results, it means there is strong relationship between TQM Practices - Continues Improvements and Financial Performance, that is supported H1 hypothesis.
- 2) H2: TQM-Practices - Continues Improvements are directly and positively affects Innovational Performance. Based on the table 9, value is (r=0.209) and  $p < 0.05$ . Based on the table 17,  $R^2 = 0.173$ . Based on the table 18,  $p < 0.05$ . Based on the table 19,  $p > 0.05$ . Based on the above results, it means there is no strong significant relationship between TQM Practices - Continues Improvements and Innovational Performance, that is not supported H2 hypothesis.
- 3) H3: TQM-Practices - Continues Improvements are directly and positively affects Operational - Quality Planning Performance. Based on the table 9, value is (r=0.745) and  $p < 0.05$ . Based on the table 11,  $R^2 = 0.592$ . Based on the table 12,  $p < 0.05$ . Based on the table 13,  $p < 0.05$ . Based on the above results, it means there is strong relationship between TQM Practices - Continues Improvements and Operational - Quality Planning Performance, that is supported H3 hypothesis.
- 4) H4: TQM-Practices - Continues Improvements are directly and positively affects Operational – Quality Improvements Performance. Based on the table 9, value is (r=0.303) and  $p < 0.05$ . Based on the table 14,  $R^2 = 0.158$ . Based on the table 15,  $p < 0.05$ .

Based on the table 16,  $p > 0.05$ .

Based on the above results, it means there is no strong significant relationship between TQM Practices - Continues Improvements and Operational - Quality Improvements Performance, that is not supported H4 hypothesis.

TQM-Practices - Management Supports are directly affects Financial, Innovational, Operational (Quality Planning and Quality Improvements) Performances.

- 5) H5: TQM-Practices - Management Supports are directly and positively affects Financial Performance. Based on the table 9, value is ( $r = -0.025$ ) and  $p > 0.05$ . Based on the table 20,  $R^2 = 0.752$ . Based on the table 21,  $p < 0.05$ . Based on the table 22,  $p < 0.05$ . Based on the above results, it means there is no strong significant relationship between TQM Practices - Management Supports and Financial Performance, that is not supported H5 hypothesis.
- 6) H6: TQM-Practices - Management Supports are directly and positively affects Innovational Performance. Based on the table 9, value is ( $r = 0.233$ ) and  $p < 0.05$ . Based on the table 17,  $R^2 = 0.173$ . Based on the table 18,  $p < 0.05$ . Based on the table 19,  $p < 0.05$ . Based on the above results, it means there is strong relationship between TQM Practices - Management Supports and Innovational Performance, that is supported H6 hypothesis and accepted.
- 7) H7: TQM-Practices - Management Supports are directly and positively affects Operational - Quality Planning Performance. Based on the table 9, value is ( $r = 0.156$ ) and  $p < 0.05$ . Based on the table 11,  $R^2 = 0.592$ . Based on the table 12,  $p < 0.05$ . Based on the table 13,  $p > 0.05$ . Based on the above results, it means there is no strong significant relationship between TQM Practices - Management Supports and Operational - Quality Planning Performance, that is not supported H7 hypothesis.
- 8) H8: TQM-Practices - Management Supports are directly and positively affects Operational - Quality Improvements Performance. Based on the table 9, value is ( $r = 0.218$ ) and  $p < 0.05$ . Based on the table 14,  $R^2 = 0.158$ . Based on the table 15,  $p < 0.05$ . Based on the table 16,  $p < 0.05$ . Based on the above results, it means there is strong relationship between TQM Practices - Management Supports and Operational - Quality Improvements Performance, that is supported H8 hypothesis.

Statistical Measures are directly affecting Financial, Innovational, Operational (Quality Planning and Quality Improvements) Performances.

- 9) H9: Statistical Measures are directly and positively affecting Financial Performance. Based on the table 9, value is ( $r = 0.718$ ) and  $p < 0.05$ . Based on the table 20,  $R^2 = 0.752$ . Based on the table 21,  $p < 0.05$ . Based on the table 22,  $p < 0.05$ . Based on the above results, it means there is strong relationship between Statistical Measures and Financial Performance, that is supported H9 hypothesis.
- 10) H10: Statistical Measures are directly and positively affecting Innovational Performance. Based on the table 9, value is ( $r = 0.375$ ) and  $p < 0.05$ . Based on the table 17,  $R^2 = 0.173$ . Based on the table 18,  $p < 0.05$ . Based on the table 19,  $p < 0.05$ . Based on the above results, it means there is strong relationship between Statistical Measures and Innovational Performance, that is supported H10 hypothesis.
- 11) H11: Statistical Measures are directly and positively affecting Operational - Quality Planning Performance. Based on the table 9, value is ( $r = 0.696$ ) and  $p < 0.05$ . Based on the table 11,  $R^2 = 0.592$ . Based on the table 12,  $p < 0.05$ . Based on the table 13,  $p < 0.05$ . Based on the above results, it means there is strong relationship between Statistical Measures and Operational - Quality Planning Performance, that is supported H11 hypothesis.
- 12) H12: Statistical Measures are directly and positively affecting Operational - Quality Improvements Performance. Based on the table 9, value is ( $r = 0.372$ ) and  $p < 0.05$ . Based on the table 14,  $R^2 = 0.158$ . Based on the table 15,  $p < 0.05$ . Based on the table 16,  $p < 0.05$ . Based on the above results, it means there is strong relationship between Statistical Measures and Operational - Quality Improvements Performance, that is supported H12 hypothesis.

**4.8 Hypotheses Test Summary**

**Table 23: Hypotheses Test Summary**

H	Hypothesis	Result
H1	TQM-Practices - Continues Improvements are directly and positively affects Financial Performance.	Supported
H2	TQM-Practices - Continues Improvements are directly and positively affects Innovational Performance	Not Supported
H3	TQM-Practices - Continues Improvements are directly and positively affects Operational - Quality Planning Performance	Supported
H4	TQM-Practices - Continues Improvements are directly and positively affects Operational - Quality Improvements Performance	Not Supported

H5	TQM-Practices - Management Supports are directly and positively affects Financial Performance	Not Supported
H6	TQM-Practices - Management Supports are directly and positively affects Innovational Performance	Supported
H7	TQM-Practices - Management Supports are directly and positively affects Operational - Quality Planning Performance	Not Supported
H8	TQM-Practices - Management Supports are directly and positively affects Operational - Quality Improvements Performance	Supported
H9	Statistical Measures are directly and positively affecting Financial Performance	Supported
H10	Statistical Measures are directly and positively affecting Innovational Performance	Supported
H11	Statistical Measures are directly and positively affecting Operational - Quality Planning Performance	Supported
H12	Statistical Measures are directly and positively affecting Operational - Quality Improvements Performance	Supported

## 5. Conclusion

To conclude is to say that imparting statistical measures of quality is the only viable option to increase the productivity and efficiency of business projects in this modern era of competition. As early discussed, businesses have developed. Technology develops with every passing day [37]. New techniques are employed by rival firms to shore up their interests. Hence, without adhering to TQM tools, businesses cannot improve their performance. That is why; most of Turkish firms use statistical measures of quality to develop their business projects not only in operations but also in financial and innovation aspects.

It was very necessary to initiate a research paper on this question because the significance of TQM has increased many folds [13]. It has become a central tool for business projects in the world of business today. Statistical tools generated as a result of TQM applications pave the way for smooth and productive conclusion of business projects undertaken in different conditions by different business-minds. This is the center of our research to know the impacts of TQM practices in the form of statistical measures on project's performance.

Statistical tools help us find out the exact calculations for future planning for business tools. For example, Correlation test help us in identifying the validity of the relationship between hypotheses that a student claims to be researched. This is one of the statistical tools that assist not only the researchers but also the businessman in carrying out the business projects (Yeung, et al, 2006).

## 6. Recommendations

- This research has studied with limited region only in Istanbul Province of Turkey, it is highly recommended that apply the same model of TQM Practices and Performance of Business Projects in other provinces of

Turkey like in Ankara, Antalya, Izmir and Konya, also carried the research as international level apply in different countries and continents and to formulate the hypothesis.

- Nowadays, market is flooded with the trained employees it does not have the headache of finding trained employees. Because of that the researcher its recommended that take the training variable and check with TQM practices how that affect.
- The research and development (R&D). In order to save the operational cost, many businesses today avoid research. On the other hand, research is the main part of any business that explores new ways and avenues for a business to develop and fill the gap where it is found. Without research innovation cannot be achieved. According to this its recommended that take the research and development variable and check with TQM practices how that affect.
- TQM techniques are the soul of quality. These techniques lead to the use of statistical measures of quality that in turn make the business projects successful. TQM techniques help us in forecasting the outflow of funds. It also assists us in maintaining the quality of the raw material so that the material can be saved from damage. Different techniques are employed in order to motivate team members. Their retention is the soul of a project to make its way to the completion. Being researcher on this point it will be recommended that take inventory management variable and shows relationship with TQM Practices.
- The concluding suggestion of this study is that the use of statistical measures of quality positively affects the performance of business projects. In other words, in order to make the performance of business projects, companies need the help from statistical measures of quality and TQM practices. Quality Assurance system is the major factor to increase the performance of business projects. Along with this, from starting point long time ago there were disagreements were blanketed the takes place of ISO 9000 to satisfy customers internal, external, and changing needs regarding products and services [26]. The researcher its recommended that take the Quality Assurance variable and check with TQM practices how that affect.

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