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Total productive maintenance, total quality management and operational performance: An empirical study on Pakistan's manufacturing industry

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Abstract

The aim of this research is to study factors affecting the operational performance in manufacturing industry of Pakistan. The research examined the relationship among total quality management, total productive maintenance and operational performance, the study further determined the influence of these practices of management and maintenance on operational performance in manufacturing industry of Pakistan. Quantitative research approach was adopted for this research and questionnaire was adopted from existing literature. To collect primary data a survey was conducted using convenient sampling and data was collected electronically from supply chain professionals and the research modal was tested empirically. The results indicated that total quality management and total productive have moderate correlation with operational performance. Further, management of total quality and total productive maintenance have statistically significant impact on operational performance in manufacturing industry. The findings of research will help policy makers in implementation of total quality management and total productive maintenance and deepen their knowledge regarding them, which will further help in developing supply chain strategies in manufacturing sector.

Keywords: *TQM, TPM, operations, manufacturing performance.*

1. Introduction

1.1 Background of the Study

Globally, market place competition is increasing with time. In increasing result of competition product quality is becoming the valuable factor and lately, management of total quality is become consider as the new important management problem. As time passes term qualities became reformed because of the evolving environment. As well as, so many authors defined words quality in different perspective. Quality is conformance to specifications said by Phil Crosby. Other author Joseph shared that quality is fitness for use. In order to reach the implied vision, foundation words are the main focused of the products as far as product and service importance is completely characterized and defined by the ISO 8402. Entire functions and business process are optimized and integrated by the management of total quality (TQM). In order to construct the satisfied customer and achieving all the targeted goal organizations should start continuous improvement in their process and at last it will help the organization to lead and provide best quality services and products. Behavioral changes with the time, measuring system capacity. Prevent products form any defects and improve process all these are included under the main objectives of Total Quality Management (TQM) (Ahlam Mohammed Alamri, 2014). In today's economic environment all aspects of speedy changes in business demands are working to make the organization performance highly effective and efficient. Manufacturing industry is evolving very fast and this evolution is inevitable in the global industrialization, it will reduce the stages of production cycle, increase expectation of customer towards service and product and increasing manufacturing cost. To achieve the organizational targeted goals organizations should be optimizing, new approaches in manufacturing, equipment utilization and availability of product's equipment (Sharma, 2016). Specifically, in Japan maintenance of total production serves the instant evaluation and has been recognize as a new standard. Also, manufacturing production driven improvement methodology. TPM

helps everyone to engage in their own tasks in the organization (Campbell, 2006).

TPM proceed optimizes effectiveness of equipment by involving total workforce which eliminates breakage and promotes maintenance. Maintenance system is known as TPM in today's world and it covers prevention of sustainability. Manufacturing organization accepted TPM because this phenomenon familiarizes productive policies of preservation which help to enhance concert of sustainability. Past researches concluded that TPM has the direct link in enhancing the complete company performance and improving the process of manufacture (Ahuja I. a., 2008). In the world ranking, Pakistan ranked as the 30th major industrial country. The sector of manufacturing, cooperatively generates around the twenty percent of the output from the manufacturing sector in the national economy of Pakistan. The manufacturing sector has typical yearly growth rate of approx. four percent over last five years and it is divided into two constituents such as, manufacturing under big scale of production and the other is manufacturing under small scale of production. According to related study of the (Ahuja I. a., 2008) execution of management with total quality production in industry of Pakistan and ranging over the association connecting the active application and performance of an organization. Continuous improvement, guarantee and the control of the quality are the categorized implemented methods of TQM which is implemented in Pakistan. According to the findings it is indicate that TQM has shown up two organizational performances. Similarly, additional research absorbed on computing the influence of management of total quality. By the help of Likert scale data were examined. Data collected through the questionnaire. The outcomes manifest strong correlation between reliant factor, and an independent variable, which is TQM practices. In the last years, many researchers chose TQM as their topic of research. In those researches, authors evaluated and concluded the diagnosed ways of implementing TQM with the association of TPM and its impact on performance of an organization in the industries of Pakistan, few writers have conducted a research on the performance of the organization in the aspects of total quality management and production maintenance.

1.2 Problem Statement

In last four decades, the manufacturing industry has experienced significant changes. (Ahuja I. K., 2006) he concluded that approaching the top management, expectation of loyal customer, capabilities of supplier and effectiveness of technology are counted as the changing factors. In evolving era, internationally competition and working culture are putting lots of constraint on manufacturing companies to sustain in the market and reach the top higher standard of performance (Miyake, 1990). With respect of achieving the top rank in world ranking, organizations are working very hard. Similarly, lots of manufacturing firms are struggling to attain the excellency in operations over the globe. TPM is the most vital aspects for the efficacious of the business and also, they should be helpful in the practices and presentation of the manufacturing process (Ahuja I. a., 2008). Japanese companies understood the TPM approach from 1970 to 1990, then share with European countries. Now, adoption of TQM activity in the organizations of European world is very mainstream. In the era of global environment, race of achieving world class performance every organization feel threatened and pressurize (Miyake, 1990). Most of the organization are working hard for their production side, they are concern about the quality and turning their business towards the cost cutting scenario. Moreover, in want to achieve top position in worlds good performing organization, many organizations are working to maintain their functions efficiently. The business target the refining process for the existence machines on the production side and retain their products in good condition (Swanson, 2001). According to the research of (Kutucuoglu, 2001) the machinery and equipment's are the biggest asset of any organization especially in pharma. With the rapid growth in technology the importance of equipment is increasing (Maggard, 1992). In addition, (Ahmed, 2005) stated that, this the reason which make the maintenance, a vital function in an engineering location. On the other hand, stated by (Kumar, 2004) that became very main purpose in productivity and quality. To achieve the world's top manufacturing, sustainability became the main issue for some businesses. If marketers want to achieve and gain the competitive edge in market, firms should maintain their own sustainability and manufacturing approach. If organizations want to save their time, money and other useful

important resources so they should maintain functions and quality practice through effective integration (Brah, 2004). Enhancement of the market situation of an association strategic investment function is decisive, that suggest to performance enhancement (Coetzee, 1990), and its key to perform the successful operations is effective maintenance. Symptoms of poor maintenance are; delayed in scheduled production, utilization of equipment poorly and failure of numerous equipment. Also, misalignment of equipment is directly affecting the shop floor operations. This machine breakdown may consequence into scrap or defective products.

A study led by researcher in Malaysia indicated that there is a positive correlation amongst practices of the management of the total quality on the operation of organizational performance**.** However, it is noted that this research observed the variables of the study in isolation and focused on ISO certified firms. In Ghana noted employment of management of quality practices in the organization was dependent on strategic leadership. However, the study was confined to different variables such as product development and customer focus. Further, despite extensive studies conducted in Kenya, it is revealed that on the influence of little attention gob is shown by the previous researcher. For instance, study by (Anyango, 2012) was limited in order to assess the practices of quality administration and enactment of industrial organization in Nairobi. A survey conduction by (Kagumba, 2013) Kenyatta University they conduct a quality performance survey. However, findings of the previous studies, it is noted that conceptual, contextual and mythological gaps are evident. First, some studies were examining variables of this study in isolation or in pairs and failed to examine the integrated approach of the variables of this study on operational performance. Second, some studies were happened in many other countries such as US, Ghana and Malaysia but failed to focus on the developing countries. Further, some studies were limited to different sectors such as manufacturing and higher education sectors and finally, some studies were restricted to non-probability sampling techniques and data analysis methods which did not assess the variables of the study. In contrast, it is on this premise this study sought to investigate the influence of TQM practices and operational performance. Hence as per the discussion above the research is going

to examine the impact of total quality management and total productive maintenance on operational performance in manufacturing industry of Pakistan.

1.3 Research Questions

How total quality management and total productive maintenance influence the operational performance in manufacturing industry of Pakistan?

2. Literature Review

Research conducted in pharmaceutical organization in India which explored the impact of TPM and TQM practices. TPM constructs under four dimensions i.e. disciplined maintenance, information tracking, operator involvement and housekeeping and all these are helpful for literature. Similarly, TQM also have four constructs dimension and they are; reporting of quality data, innovation of products, (R&D) management and management of technology is being included. Approximately 254 reaction has been included for this survey from 410 for the analysis of this study. For the analysis of the proposed framework three structure were used i.e. factor analysis, path model and structural operation. Afterwards, the results of an alternative models have also been studied. In last, in order to proving or disproving the hypothesis effects of TPM and TQM has been analyzed. Research findings shown that practices of TPM in organization have a huge effect on effectiveness and efficiency of ground level manufacturing operations. Similarly, achieving the performance operative, practices of TPM and TQM combine together then TPM shows its effects on performance operative. Simply TPM smash TQM and TQM in return to gain operative organizational performance. TQM contributes such as quality data and reporting whereas, significant impact of TPM is on R&D, innovative products and technology. If organization wants to gain high standard in operative presentation, then they need to focus the huddles in the plantation and processing the TQM and TPM (Sharma, 2016).

Another research conducted on the Turkish manufacturing sector, among the 100 large companies of the Turkey. In this research practices of TQM in manufacturing industry of Turkey were analyzed. Quality is the main factor in the manufacturing industry, that's why

the practices which include quality prominence should be encompass on the entire organization till supplier to buyer. The research findings indicated the competitive advantage among all companies who are willing to implement management of quality. It has been originating that for the success of the full implementation of TQM numerous factors are included such as; the support of higher management, involvement of employee (Decentralization), customer focus, education quality, commitment, training and teamwork are the important. according to his study, effectiveness of ISO 9001directly contributes to quality of service and products and organizational performance. Although. Along with the moderator of the operational performance, ISO having indirect connection and have no such direct effect on manufacturing firm's business performance (Gotzamani, 2015).

Production and performance of an organization is revolving around three dimensions and they are; Product quality, operational performance and business. The basic purpose behind this research paper is to furnish and evaluate additional evidence which proof the impact of ISO 9001 effectiveness. initial exploratory factor analysis (EFA) is included in the analysis which have been conducted to explore relation between proposed constructed model and this is followed by the CFA and SEM. A sample which is certified by the 287 ISO 9001 by the manufacturing firm of the Greek and this sample is used for this purpose. In this evaluation small to medium size firm were participated. Additionally, some other factor which effect the environment of business internally and externally is also being explored in particular study. In this study is clearly offered all the require the implications for managers wo are focusing on some factors which help to enhance the effectiveness of the ISO 9001 and also focus on the firm strategies for their goal achieving and this concept is introduced to meet the objectives of the firm (Bayazit, 2003).

According to this research of (Thomas Friedli, 2010), in turkey management of total quality-based production has significant positive relationship among innovative performance and supercilious quality. This study investigated activities of TQM who are affecting the quality and performances as well as define the effective component on these performance types. The study supervised in the region of Marmara from different size and the research held on every level of managers especially upper and higher of organizations in Marmara.

In order to evaluate data SPSS software 18.0 were used for the evolution. Furthermore, to estimate the reliability of the scales Cronbach alpha were used and factor analysis is used for the validity. The study regression and correlation analysis were used. The research supported both the dimensions in terms effects on quality management i.e. management leadership and process management dimensions. Moreover, other approaches such as managing supplier and managing system are founded very effective. Somehow, several studies founded and accepted all dimensions admissible. Respectively, this study contributes to the discussion about the most important dimensions. However, in the cause of limiting factors significant variables should be tested in future studies by keeping new organizational traits and factors.

Products and services performance with respect to quality and satisfying customer can be intensifying by introducing the new and effective initiatives of quality improvement in the organization summarized by this research. TQM strategies that are focusing on amplifying the satisfaction level of customers might be automatically boost the production of an organization. Assorted factors directly affect the production of an organization such as, size of an organization, innovation level in culture of an organization (Ahuja I. a., 2008). In reference to finding the management of good quality products and practices of advanced operations, a survey was conducted in Kenya on commercial banking sector. For this study, commercial banks almost forty-three censuses. The objectives of this study are achieving the quality production and the data collected of this study collected through a structured answer sheet which have questions. The question sheet designed with focusing question on the basis of management of quality-based production in the bank of Kenya the questions were designed with both open and close ended questions. After this research, it has been identified that implementation of quality management system has potential to increase profit in banking sector. Also, this implementation boosted sales, amplified bank competitiveness which result in acquisition of greater share in market. Moreover, it will increase service delivery in banks and ensured effective waste reduction in operations (Bayazit, 2003).

In Saudi Arabia, a research conducted in greatest telecommunication Saudi company and this study is about presenting the relation in 6 practices of Quality Management and operating performance. This research give proposal to the organizations that in which aspect organization can improve its performance by implying the quality management process. Collected data from the largest Saudi telecommunication company in which 421 employees of the organization were participated. Using Microsoft Office Excel for data analysis and data analyzed to calculate the correlation in two stages. Leadership, focus on customer, customer retention, employee retention, strategic development, quality management of supplier and process management quality; these variables are combining together to construct the management of good quality. Other side, improvement in production performance, employee morale and satisfied consumers all are the operational performance. furthermore, it is having strong correlation with customer focus and employee relations, but correlated have negative impact on supplier quality management. The study result that constructed are connected with previous researches (Ahlam Mohammed Alamri, 2014).

According to the study of (Kiprotich A. M., 2018), total quality management practices were analyzed to see the impact on operational performance. The study notified that, though TQM positively impact on operational performance but in public organizations there is a deviation as Total quality management is not properly implemented in these organizations which in result do not positively impact on operational performance. To analyze TQM practices, they emphasized on Employee training, system automation and continuous improvement an it's impact production of operations. To study the impact, both qualitative and quantitate data were taken for comparison purpose. The target population of the study was Kenya Revenue Authority and the data was collected from 557 employee of the organization which include, the higher management and the lower management both. Those employees who are having knowledge of implementing quality management are selected for survey. Collection of data had been through administered questionnaires with both exposed and nearby completed questions. The selection method for collecting the data was purposive sampling. other than that, secondary data was also collected from quality assurance report,

customer satisfactory report, academic research papers, articles and government economic reports. allowing to the study, founded positive relation amongst continuous improvement, employee training and automation of system. To get best results from TQM and to increase operational performance of the organization, they must implement employee training, automotive systems and continuous improvement, otherwise they will not get operational excellence they are expecting. These above practices will make the implementation of TQM easier and will help in completing the goalmouths of the group on time. The study also suggested that, the organization must involve their senior management in improvisation of technology to get desire results. They should also understand that the culture of an organization is very important. It can help in developing business more. The organization culture should me customer centric so that they can work according to the need of their customer and bring out the best results. (Alfred Maritim Kiprotich, 2018) a research on maintenance of total production. As far as TPM is an all-encompassing way to deal with gear support that endeavors to accomplish close flawless generation forms. Self-sufficient upkeep is the procedure where administrators are associated with keeping up their own gear while underlining proactive and protection support. Improved procedures and persistent improvement are key essentials of TPM. The TPM procedure guarantees less breakdowns, stops, and imperfections while likewise bringing down expenses and locks in workers from C-level on down. Viable correspondence procedures and top the board bolsters help the usefulness of TPM. TPM improves hardware working conditions, empowers the accomplishment of Tact time at the most noteworthy conceivable machine viability, and supports gear at an optima dimension of execution and unwavering quality. TPM likewise extends the future of gear, lessens or disposes of breakdowns, dispenses with moderate running or little stoppages, and goes for zero imperfections and zero mishaps while drawing in administrators to be 100% included and submitted. This article gives a diagram, presentation, and usage manual for TPM. There are five distinctive focuses to (TPM). Initially, TPM is an inventive way to deal with upkeep strategies that streamline gear viability through constant improvement including both item and administration forms. Next, TPM builds up a world-class dependability-based support framework

using proactive Upkeep, prescient support, and deterrent support. The focal point of the TPM practices draws in the whole gear life cycle. Top administration support is a key distinguisher for TPM. There should be purchase in at each dimension of the association.

A research paper has given a diagram of the advantages of TPM and a way to deal with executing TPM in an association. Initiative should likewise structure their TPM usage with an attention on all out representative inclusion. This is empowered by authority pushing decision making furthermore, framework improvement down to the most reduced dimensions. It is additionally critical to share data, oversee desires, and distinguish and enable bosses, especially tasks supervisors. Another key angle is to make an environment of experimentation by enduring slip-ups and being persistent. Initiative ought to introduce edified and reasonable implementation measures, valuation, and prize bases and get rid of unbending execution objectives amid usage. The sample study has to be executed preceding from the group of people live together as an association is fundamental. Some portion of a fruitful TPM implementation depends on the hierarchical structure. Recognize champions from top administration who will effectively bolster the TPM usage (Campbell, 2006). Research paper has given a diagram of the advantages of TPM and a way to deal with executing TPM in an association. Initiative should likewise structure their TPM usage with an attention on all out representative inclusion. This is empowered by authority pushing decision making furthermore, framework improvement down to the most reduced dimensions. It is additionally critical to share data, oversee desires, and distinguish and enable bosses, especially tasks supervisors. Another key angle is to make an environment of experimentation by enduring slip-ups and being persistent. The need to execute pilot ventures preceding moving society out over the association is fundamental. Some portion of a fruitful TPM implementation depends on the hierarchical structure. Recognize champions from top administration who will effectively bolster the TPM usage (Campbell, 2006).

Jordan country searched the impact of Hard (TQM) application on the dimension of the operational performance in manufacturing organization under the study on operational performance of manufacturing companies. The main concern of the

hard practices is using the improvement tool, structure and management system of quality. Practices of hard TQM are more technical, system and tool oriented then the practices of soft TQM. The practices of hard TQM comprise innovation and continuous enhancement, production measures, management of process and strategic planning. In research, there are total five hard TQM practices in which only three practices were embraced. Also, these practices are inspecting in empirical studies of quality management. Questionnaire was the medium for conducting the data and it has been made structurally. Personally, administered and via mailed cross sectional questionnaire survey testing data were collected and also show the relation amongst hard TQM practices and production operation were hypothesized. 40 organization were participated in this survey. While using modest and numerous regression analysis method to test the dimension resulted that hard TQM follows had significant influence on functioning routine. Findings of this research are, continuous enhancement in development, good quality tools and products and techniques. On the other side, dimensions of operational performance include; inventory and quality management performance. The constant advancement and SPC practices show a main position in achieving the desired result of operational performance (Rawan Ali Saleh, 2018).

It is on this premise that this research is evolve around the management practices of good quality products and operational presentation of Kenya Revenue Authority. The targeted people of the learning consisted of 557 employees of Kenya Revenue Authority working at Nairobi Headquarters. Purposive selection system was adopted to choose the size of data collection of the study that comprised of 228 employees of Kenya Revenue Authority. Respondents of the study were selected from commissioners, managers, supervisors and officers. The ideal sample size was arrived by using Krejci and Morgan scientific formula. Both first hand data and data which has been gathered before was used. First hand data was gathered using the standard question sheet which includes nearby items and exposed questions. Secondary information was also sourced from quality assurance reports, Government economic reports, customer satisfactory survey reports, journal articles and related academic research papers. Reliability of the research

instrument was govern using Cronbach Alpha coefficient of 0.7. Qualitative data was analyzed using key themes of published content to make deductive arguments about the research findings. The study concludes that unless KRA adopts TQM policies which includes the learning and development of staff, continuous improvement and system automation in the changing business environment, achieving operational excellence will be a difficult task (Alfred Maritim Kiprotich, 2018)

3. Research Methodology

3.1 Hypotheses

H_{a1}: There is a significant relationship between total quality management practices and operational performance.

H_{a2}: There is a significant relationship between total productive maintenance practices and operational performance.

H_{a3}: There is a significant impact of total quality management practices and total productive maintenance practices on operational performance.

3.2 Data collection

This section includes the development of questionnaire, selection of participants in the survey, TPM and TQM practices and data collection tool. The populations of present study are the professionals presently working as a supply chain executive, production managers or quality executives in manufacturing industry of Pakistan. The size of sample of this research is 400; due to the issue of trustworthiness, convenience and also population is unknown, in this case no formalization and any statistical technique will work (Saunders et al., 2009). In this research, non-probability sample practice is used, which is convenience sampling. A survey instrument had designed by Sharma (2016), the instrument is adopted and questions related to study variables from various previous researches to calculate the special constructs of the variables studied in this research of value chain management. The instrument is comprising of thirty-five questions associated to each independent and dependent variable. The responses to the questions were coded on five-point Likert scale, the scale comprise of answers label from 1 to 5. The practice of facts collection is very useful in a situation where closed ended questions

need to be asked in order to get precise and to the point data from the primary sources. Present study data is collected using survey questionnaire, respondents are asked to fill the questionnaire with their consent or without any persuade. The questionnaire was distributed using electronic mean of communication like internet.

3.3 Content Validity and Factor Analysis

Validity is known as the efficiency of a questionnaire regarding measuring elements. The instrument must include a set of items to ensure that it tap the concepts in order to be valid (Sekaran, 2003). For instrument to be valid and consistence, the Cronbach α result figures should be in the array of 0.60–0.87 because the research is exploratory, therefore 0.50–0.60 is considered satisfactory. Data reduction method is used for the analysis in which large number of factors is decrease (Coakes, 2005). The study used exploratory factor analysis based on principal component method to identify reasons from dissimilar objects of each paradigm i.e. Independent and dependent variables under study. Each item loads in to a main factor based on the factors loading which have also been identified.

3.4 Correlation and regression analysis

To quantify the relation among two different variables analysis of correlation is used. The strength of association among two constraints can be easily identified from the coefficient of correlation. Coefficient value can take any value between ± 0.01 to ± 1.00. A relationship can be of two nature; positive and negative. Positive coefficient shows a positive relationship. By contract a negative coefficient represent a negative relationship, as growth in charge of one inconstant decrease the value of another variable (Sauders, 2009). When we want to regress several variables together to find out the value of one variable which is the dependable variable is called regression analysis. Change dependent variable is also explained in can be with respect to the independent variable. The co-efficient of determination (R^2) shows the degree of prediction which your regression equation can find. The co-efficient of determination can take any value between ± 0.01 to ± 1.00 (Sauders, 2009).

4. Result and discussion

Table 4.1 illustrates demographic factors of the study respondents. These demographic factors include experience, sector, marital status, gender and education. Analyzing the table, it is identified that 1-3-year experience holders contributed 41% in participating in this survey as compared to other all. Among the total respondents who participated in this survey, 42% and 38% holds master's and bachelor's degree which indicates the high level of literacy of the participants. The data represent that majority of the participants who participated in the study are engage with other than chemical, pharmaceutical, textile and food industry. Further details of the demographic distributions are explained in the table.

Table 4.1

Particulars	**Categories**	**No**	**%**
Experience	Less than 1 year	50	19%
	1-3 years	110	41%
	4-6 years	45	17%
	7-9 years	25	9%
	10-12years	25	9%
	13-15 years	5	2%
	Over 15 years	10	4%
Sector	Chemical industry	16	4%
	Food industry	16	4%
	Pharmaceutical industry	40	11%
	Textile industry	56	16%
	Others	232	64%
Education	Metric	0	0%
	Intermediate	8	2%
	Bachelor	136	38%
	Master	152	42%
	Other	64	18%
Marital Status	Married	104	29%
	Un Married	256	71%
Gender	Male	288	80%
	Female	72	10%

The reliability analysis is presented in table along the items with alpha value of Cronbach's of each dependent and independent variable used in this research. The outcome specifies that Cronbach's Alpha values are all reliable and can be process further.

Table 4.2

Variables	No. of items	Cronbach's alpha
Total quality management	15	.815
Total productive maintenance	12	.803
Operational Performance	7	.899

Table 4.3 illustrate factor loading of each construct of IV and DV, it shows how every item. Factor loading value should be greater than 0.40 of each item into its element of qualified principal. There are total 34 components as a whole, while 15 of it are for total quality management, total productive maintenance also consists of 12 items and operational performance is consist of 7 items. As per the standard and rules factor loading values among all components range from 0.481 to 0.856. All values are automatically above 0.40 which mean no cross leading were disregarded since of the charge less than 0.40 criteria. The result globally satisfies the criteria of validity construct.

Table 4.3

Variables	Items	Factor 1	Factor 2	Factor 3
Total Quality Management	TQM-QDR1	.761		
	TQM-QDR1	.535		
	TQM-QDR1	.721		
	TQM-QDR1	.767		
	TQM1-PI1	.732		
	TQM1-PI2	.962		
	TQM1-PI3	.542		
	TQM1-PI4	.568		
	TQM1-R&D1	.832		
	TQM1-R&D2	.733		
	TQM1-R&D3	.567		
	TQM1-R&D4	.784		
	TQM1-TM1	.753		
	TQM1-TM2	.578		
	TQM1-TM3	.643		
Total Productive maintenance	TPM-M1		.457	
	TPM-M2		.864	
	TPM-M3		.566	
	TPM-M4		.467	
	TPM-HK1		.764	
	TPM-HK2		.657	
	TPM-HK3		.564	
	TPM-HK4		.677	

	TPM-OI1		.653	
	TPM-OI2		.765	
	TPM-OI3		.754	
	TPM-OI4		.467	
Operational performance	OP1			.862
	OP2			.742
	OP3			.402
	OP4			.766
	OP5			.667
	OP6			.752
	OP7			.678

Correlation and Regression Analysis

Table 4.4 demonstrates the outcome of correlation test. The table represent that there is a moderately high association relation among total quality management and Operational performance, the value of probability is equal to 0.001 at confidence interval level of 0.05 (2-tail) which specifies that the association is significant, the result supports the acceptance H_{a1}: There is a significant relationship between total quality management and Operational performance in manufacturing industry of Pakistan. The result further explained that total quality management and Operational performance have positive association which indicates that any development in total quality management will contribute in performance of organization.

Table 4.4

		TQM	**TPM**
OP	Coefficient	.687**	.567**
	Sig. (2-tailed)	.001	.003
	N	370	370

** Correlation is significant at 0.05 level (2 tailed); TQM= Total Quality Management; TPM= Total Productive maintenance; OP= Operational performance

Another correlation test result is also demonstrated in Table 4.4, the p value is equal to 0.003 at 0.05 confidence interval level (2-tail) which indicates that the relationship is significant, this result supports H_{a2}: significant relation has been found between total productive maintenance and Operational performance in manufacturing industry of Pakistan. The result also indicates that total productive maintenance and Operational performance have positive relationship

which means increasing total productive maintenance expands Operational performance. It can also be seen that there is a strong relation of total quality management with Operational performance as compare to total productive maintenance which is according to theory as total quality management focus of overall organization where total productive maintenance only focus on production or productivity.

Table 4.5

Regression Model Summary					
Model	**R**	**R Square**	**Adjusted R Square**	**F**	**Sig.**
1	.699[a]	.599	.544	77.338	.000b
a. Predictors: (Constant), TQM, TPM					

Table 4.5 represent the degree of goodness fit of regression model in the model summary result section. The R value is (0.699), which indicate that there is a moderate high impact management of total quality and performance of operations. The value of R2 is (0.599) which states that only 59.9% of variation in dependent variable which is Operational performance can be described by all the two-independent variable combine in this regression model. It is also observed that Significance F value is less than 0.000 which states that combined effect of all independent variable is significant.

Table 4.6

Regression Coefficients						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	.456	.221		2.893	.060
	TQM	.673	.322	.643	2.812	.000
	TPM	.462	.421	.389	1.333	.000
a. Dependent Variable: OP						

Table 4.6 illustrates the regression details summary which indicates all independent variables assessed in this research and the coefficients and significance level of all the independent variables. For variables, which is shown in the table, coefficient value (0.673) and (0.462) respectively. So, for every unit increase in management of total quality and maintenance of total production there will be 0.673

and 0.462 unit increase in Operational performance. If we analyze the significance values of management of total quality and maintenance of total production which is p=0.000 and p=0.000 respectively in conjunction to the coefficient, the result provide evidence that there is a significant and positive impact of management of total quality and maintenance of total production on Operational performance. Based on the analysis and the result of coefficients the regression equation is as follows:

$$OP = 0.456 + 0.673(TQM) + 0.462(TPM) + e$$

Here 0.456 is the value of constant, 0.456, 0.673 and 0.462 are elasticizes of management of total quality and maintenance of total production respectively. OP refers to Operational performance that is our dependent variable, whereas TQM is total quality management and TPM is total productive maintenance and e is error term.

The outcome of current investigation is constant with the finding of researches conducted in different countries of the world. According to Sharma (2016) study, TPM practices significantly impact plant-level operational performance. It was identified that when the practices of management of total quality and maintenance of total production combines together to increase operational performance to total productive maintenance with having heavy impact on production operation. Both TQM and TPM significantly and build strong correlation in favor each other to achieve operational performance. It was further cleared that total productive maintenance influence management of total quality in turn impact effectiveness of operational activities. The paper goals to inspect the influence of maintenance of total production and management of practices total quality on performance of operations and the among association in pharmaceutical sector of India. Further (Ahlam Mohammed Alamri, 2014) research in the largest company of Saudi Arabia i.e. Saudi telecommunication. The data collected in this research is by the survey in which 421 employees were participated. Performance of an organization is strongly correlated with customer focus and, employee relations, but negatively correlated with supplier quality management. Moreover, the study of (Norah Dhafer Al-Qahtani, 2015) indicated that strategy use for applying management of total quality having very positive impact in satisfying customer. Nevertheless,

conclusion of this study is the implanting the management having good knowledge of product and services is the result of customer satisfaction and make customer loyal towards organization.

5. Conclusion

In the list of largest manufacturing country in the world, Pakistan rank 30th, and twenty percent output of the economy of Pakistan is produced by the manufacturing sector of Pakistan. This sector is growing with time and almost over the last five years manufacturing sector of Pakistan is increased by 4 percent. This industry is divided into two institutes and they are LSM and SME which is also growing with the ratio of two and eight percent respectively. Supply chain management practices contribute as a building foundation when it comes to the achievement of manufacturing business and the management of total quality and maintenance of total production practices provides an advanced way towards the path of success. The objective of this research is to examine impact of TQM and TPM on performance of operations in manufacturing industry of Pakistan, Practical and theoretical guidance on how these two strategies or policies can be used successfully and increase their impact on operational performance in a manufacturing company (Rawan Ali Saleh, 2018).

The research conclusion gave evidence which indicates that practices of total quality management including reporting of data quality, management of quality, innovation of products while having good command on R&D and have significant effects on performance of operations in manufacturing business of Pakistan. Moreover, the second variable of study which is maintenance of total production also have significant positive influence on operational performance. All the key components of total productive maintenance i.e. maintenance, housekeeping and operator involvement have positive influence on operational performance. Further it is identified that the key factor that influence operational performance in Pakistan's manufacturing production is total quality management practices because of the maximum percentage of coefficient in regression test, followed by total productive maintenance (Alfred Maritim Kiprotich, 2018). This study fills gap by undertaking research on these variables and this research will support the managers of supply chain or production on

manufacturing companies to get the importance of TPM and TQM and its effects the process of quality, products and operational performance. It may be found that TPM and TQM have effects while they combine and work efficiently.

From research implementation and significant viewpoint, manufacturing industry will get huge benefit from this study as this research establish and appreciate the effects of adopting and implementing management of total quality and total productive maintenance in the organizations. Organization looking forward to take complete benefits from this research through the management of total quality and its effects to enhance service delivery in their respective company. The research will also facilitate further industries to know the benefits of quality management systems in enhancing customer service and delivery process in their industry and also help to enhance the competitiveness in the market. This study is very important and gave the importance of the two-management system and enlightened its impacts on the business. This study is fruitful for the manufacturing sector in the Pakistan industry.

5.1 Future Recommendation and Limitation

In terms of finding the effect of management of total quality and maintenance of total production strategies that affect only in manufacturing companies in Pakistan but in future researcher may conduct research for finding TQM and TPM strategies affect specific to overall all sector or any other sector companies. In addition, this research present strong support the operational success and better operational performance in manufacturing industry and it can be the great extent to determine the management of total quality and maintenance of total production which shows that the research variables are limited in order to get the good result and avoid errors. But it is a good opportunity for the future researcher by having this as a sample and explore more variables. Furthermore, the implication of this examination is restricted to the Pakistan but here is an opportunity for the upcoming researcher on the relevant topic that they can explore the retailing industry in the other countries of the world. This research is conducted in a country where the supply chain management is in its emerging phase. The condition at the back of this is lack of advancement, regulation and management culture.

Many companies have been facing difficulty because they do not have functionality of supply chain; they still work in stagnant culture approach.

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