BUSINESS ANALYTICS LED QUALITY MANAGEMENT SYSTEM (QMS) AND ITS IMPACT ON FIRM PERFORMANCE – PAKISTAN PERSPECTIVE

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DEDICATION

To my parents whose prayers helped me to reach at present state.

To my wife and children who allowed to spare time and work on this document.

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ABSTRACT

In the current age, we are surrounded with a huge set of information and we continue gathering data and business information from across the products, services processes life cycle, and company performance as long as we bring thoughtful information. Daily we develop, gather, keep, and access large data sets of addresses, manufactured item records, quality of service/products, competition and customer reviews. The competitive business conditions are pushing organizations to embrace latest methods of work mechanization which promise the success of their daily tasks. The methods of business management mechanization and effectiveness are today known as business analytics. Analytics portfolios when coupled with quality management systems let companies to better determine and meet customers' needs while mitigating challenges of facilitating company to create better tomorrows. Now, the integration of QMS & BA may reduce costs charged on manufacturing goods or delivering services, maximize result, and facilitate to enhance firms' overall performance. The quality management system has been implemented in Pakistan since the late 1990s owing to growth in the automotive industry and ISO standards certification encouragement by government. Selected quality management practices like strategic leadership & management, production/operations management, customer satisfaction management, risk management, and human resource development were chosen to further study quantitatively. A sample of more than 400 professionals working across the country was collected to know the direct and secondary outcome of different chosen dimensions on company performance. Self-managed questionnaire approach was adopted to collect data from study participants. PLS-SEM approach has been deployed for data analysis and assess hypotheses. The business analytics practices application in Pakistan was found at an introductory to mid-level. This was mainly due to the low level of business analytics and firm performance awareness studies and perceived high project costs. This quantitative study elaborates on the factors influencing plan, make, source, delivery, and marketing analytics operation at Pakistani organizations. These factors when aggregate also have a direct impact on firm competitiveness and innovativeness. The study has also investigated the combined effect of QM & BA practices to enhance performance.

Keywords: Business Analytics, Performance Measure, Decision Support, Quality Management System, Internet of Things.

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LIST OF ACRONYMS

QMS	Quality Management System
BA	Business Analytics
SML	Strategic Management & Leadership
HRD	Human Resource Development
POM	Production Operation Management
CSM	Customer Satisfaction Management
RM	Risk Management
PA	Plan Analytics
OA	Operation Analytics
SA	Source Analytics
DA	Delivery/Dispatch Analytics
MA	Marketing Analytics
PM	Performance Management
PMA	Performance Management Analytics
ISO	International Organization for Standardization
BDA	Big Data Analytics
IoT	Internet of Things
BI	Business Intelligence
TQM	Total Quality Management

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- Rana, I. A., Yab M. Ali & Rehman, C. A. (2020). Quality Analytics Led Human Resource Management and Its Impact on Customer Satisfaction. International Review of Management and Business Research, pp147-156, Vol. 9 Issue 3 (1).

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CHAPTER ONE: THE INTRODUCTION

1.1 Background of the Quality Management & Analytics Study

During the past few years, with the development in information systems the work environment has undergone certain phenomenal changes in the area of Information System (IS) and its research. Because of rising market issues, businesses have sought to achieve a competitive advantage over particular rivals so that they can not only maintain but also increase the profit of their enterprises. (Tayyab, et al. 2020). Thus, it is not unusual that the organizations in today's market place have been investing huge amount of their resources in Information system and research to arrive at advanced concepts and work tactics which help create value could provide them an economic advantage on their rivals (Hindle, G, et al. 2020 and Khan et al. 2018). Market Analytics, which typically applies the widely available functional data and information in order to have greater policymaking capabilities, has established such an innovative approach and has therefore contributed to a greater competitive advantage. But it is necessary first of all to understand the real methodology to Business Analytics (BA) to better understand how the BA has led companies to build value and competitive advantage. In this connection, a previous research conducted by Harjot, S et al. (2010) provides an extensive view of the BA approach and in what ways it emerged in the work systems around the globe. BA field got global recognition across the industries but the effectiveness of the field with its impact on decision making and performance is yet to be established in Pakistan context (Malik, et al. 2020). Application of analytics in telecom sector of Pakistan can be termed as satisfactory. This sector is highly associated with growth analytics applications (Khan et al. 2018), so, studies related to telecom sector were included.

The concept of Business Analytics is a recent development introduced at business Information System (IS) and work on the topic is still in progress (Tripathi et al. 2020). However, generally in the existing literature, in 2010 Sharma et al. have defined BA as "a process through which readily available business data and information is analyzed and scrutinized to develop novel business strategies that could be used in making smart and profitable decisions". In that way, the information to be assessed gathered from different internal , external elements here inner information often comprise on knowledge gathered from the structured databases and data warehouses on the other hand external data involves

information taken from the internet and external conditions. Thus, it has been argued that analytics allow firms to examine big piles of information data on a desired aspect at fix intervals through advanced data analytical frameworks such as data mining and virtual BA activities, to reach at effective decisions. (Sharma and Singh, 2010).

1.2 Business Analytics

Devlin elaborated the BA field as "the process of developing optimal or realistic recommendations for real-time, operational decisions based on insights derived through the application of statistical models and analysis against existing and/or simulated future data, and applying these recommendations in real-time interactions". It was further concluded by Devlin (2013) that many vital elements were needed to enhance firm results such as "operational analytics applies to organizations of all sizes in all industries along the entire length of supply chain. Understanding customers' behavior and optimizing their experience and profitability is equally important regardless of the size of customer base. Interactions with suppliers and partners are also subject to the type of improvements that operational analytics can bring" (Devlin, 2013; Polyakova et al. 2020).

Alternatively, quality management field was generally highlighting product system improvement through problem identification, assessment and strategy deployment through old and latest QMS techniques and methods in order to make businesses, public sector and community organizations prosperous and delighted (Polyakova et al. 2020). The study will be focusing on how quality management practices guide better and timely performance evaluation as well as help professionals and organizations use problem solving tools in a unique way in order to facilitate distinctive and timely decision making and paving the way for technological innovation by way of analytics (Nam et al. 2019 and Kim Naudy et al. 2013). Quality management has discipline almost helped every sector to work on improving performance from supplier evaluation and improvement to marketing, retail and customer satisfaction measurement and delight (Evans, 2018).

Technological innovation in quality management use factual approach to timely decision making to manage high growth of respective businesses and industry by way of

merging quality management with analytics discipline to provide guidance on activities and system innovations related to products and services (Nam et al. 2019).

Duan et al. (2020) was of the view that in the field of marketing, performance monitoring and evaluation offers professionals an informational means to facilitate on "planned marketing activities while produce desired results". This definition of marketing highlights that that there exist some strategy and mechanism of interconnected stages (plans) with which one can measure actual performance and can compare this with set performance indicators. These can be set deploying quality principles which help establishment of metrics through use of those professionals and managers in marketing can easily learn to improve performance of their processes and programs by changing the related market promotion activities (Fraser & Hite 2008). Same is the true for retail management discipline which also require use of specified metrics to obtain desired outcome. The new developments have led to a purely new discipline i.e. quality analytics study.

Quality Analytics can be defined as "User Friendly Design, Collection, Analysis, Use and Retrieval of Customers' Critical to Quality information for improved performance, right decision making every time to create business value" (ASQ WCQI Imran Rana 2014).

Now, the business analytics led quality management system can be operationally termed as; In order to offer better insights to professionals on their daily activities, business analytics core elements were added to quality management system to enhance performance.

In connection with above study requirements, Resource-based View (RBV) theory was taken to serve as conceptual framework in the study, through which quality management system and business analytics have been linked to enhance firm performance (Barney, 2001). Quality management and business analytics researchers have deployed resource based view (RBV) theory to collect, analyze and interpret QMS & IT systems capabilities to elaborate how the integration will create value for organizations instead of working in their separate technological and operations management spheres (Popovič et al. 2019; Castelló et al. 2017; Wade & Hulland, 2004). Popovič et al. (2019) and Castelló et al. (2017) were o the view that the mutual worth of quality management and analytics systems depend on the breadth and depth of both systems application in routine tasks in an organization. As the firm equip their

process activities with QMS & BA the more supportive it will to provide unmatchable distinctive competencies.

1.3 Research Gaps

Professionals are well aware of several management related activities and their effect on organizational outcome. QMS and analytics related studies (Xianghui Peng et a. 2020; Sin et al. 2020; Anil 2019; Mahmood et al. 2018; Lai et al. 2018; Hafeez et al. 2018) have been conducted to investigate the relationship between management practices and decision making processes, service quality and firm performance, selected quality activities and business performance, leadership quality and decision making, ERP systems and firm performance, HR quality and R&D effectiveness. Quality management system (QMS) is among key pillars of TQM. However, there is dearth of studies on linking quality management practices to the firm performance across various sectors in Pakistan (Malik, et al. 2020; Abbas, 2020; Tayyab et al. 2020; Waqas et al.. 2018). Moreover, very limited data was found internationally where few quality management and business analytics practices have been linked together to know their combined effect on company performance (Thomas Foster et al. 2019).

Khwaja et al. (2020) conducted a study to know the outcome of selected quality practices on firm level results. In the study performance was evaluated through the use of balanced scorecard approach. They selected four aspects of quality management comprising on leadership, top management commitment, process management and training. The selected dimensions were in line with current quality analytics study where five dimensions were selected to move further. The reason being that in some earlier researches (Akhir et al. 2017; Mardani et al. 2016; Jabeen et al. 2015) QMS dimensions were adequately was evaluated and it was concluded that quality management has almost eleven different factors and majority of the dimensions have now been obsolete. So, the widely known now valid factors were noted as strategic management, customer-management, production / operation process management, risk-management and HRM. It was pointed out that more empirical researches are needed to measure the impact of emerging advanced quality management approaches (Khwaja et al. 2020 & Wong et al. 2018).

1.3.1 Theoretical Gaps

Tayyab, M, et al. (2020) discussed in their healthcare study that a combination of supply chain and quality management is rarely discussed in Pakistan. They developed a theoretical model for a specialized sector (pharmaceutical industry supply chain). Tayyab, M, et al. 2020 stated the model being for specialized industry may not be generalized for other sectors. So, further studies need to be conducted to know the impact of quality on supply chain practices. The interaction between quality and supply chain analytics metrics based progress evaluation system deployment and company result assessment were yet need to theorized (Khan et al. 2018; Hafeez, et al. 2018; Lai et al. 2018). Behavioral analysis for advance innovations informs that management system progress assessment are taken as corrective measures rather than proactive. Recent study in Indian IT related SMEs was conducted by Basu et al. (2020), the study although provided the theoretical framework but it was limited to quality management practices implementation in small and medium IT companies in specific region of the India. Quality management relation with any other disciplines to enhance company performance was not discussed by Basu et al. (2020) in their research.

1.3.2 Empirical Gaps

Some of the known empirical studies which found assessing the association among business analytics, quality performance management systems and firm performance have yielded inconsistent findings in specific settings. Like Sin et al. (2020), conducted the quality management study in hospitality industry. The study proposed the decision making model to evaluate various quality management practices but study couldn't provide any insight on empirical model for quality management and analytics usage even for hospitality industry. There are a few quantitative studies that examined some of selected elements to know the cross interaction and impact of both (quality management & analytics) on firm performance but in Pakistan there is dire requirement to carry out studies on the subject. Further to this, Podder et al. (2020) conducted the business analytics study on smart education management system in Indian region. Based on implementation experiences they discussed use of advanced technologies to improve learning environment. In the study link or interaction of business analytics tools, techniques and practices found missing with that of quality management system practices in education institutes.

Anil and K.P (2019) stated that as per current corporate performance management needs association between specific quality activity and automated result areas is required to be investigated in future studies. Queiroz et a. (2018) stressed on the need to conduct future empirical work on impact of big data analytics and various other aspects of supply chain performance in different regions of the world. Lai et al. (2018) elaborated in their research work that use of analytics at supply chain management is still in infancy stage, current implementations vary from different dimensions. Their research work further highlight that most of the researchers focus on IT professionals irrespective of business management professionals. So, the need arises to study impact of analytics in reference with some structured system like ISO 9001qms.

1.3.3 Contextual Gaps

By now, a very few quantitative research studies that examined quality management relationship with firm performance in association with business intelligence and firm performance in Pakistan setting. Shah et al. (2018) were of the view that extensive study needs to be conducted across all sectors of Pakistan to know the impact of different quality management elements which are contributing to the organizational performance. Saffar et al. (2020) shared in their research that quality management practices contributed to enhance employee performance in public sector organizations. They concluded that further studies may be conducted to know companywide impact of quality management practices across the regions, sectors and disciplines. The study by Sanchez-Marquez et al. (2020) validated the positive relation of statistical process analysis of set performance objective on improving customer feedback mechanism in quality management system. They concluded that future research may be conducted including other parameters of advance quality management and business intelligence systems in other sectors including manufacturing and services environments.

In 2018 Mahmood, et al. applied the convenience sampling to assess the connection between parameters of service quality, customer satisfaction and customer royalty in finacial sector. They suggested to conduct future researchers in other sectors or all sectors of Pakistan to investigate impact of service quality on customer loyalty. Sumbal et al. (2019) suggested although their work on value creation in oil and gas industry through data analytics implementation provide suggestions to implement big data for value creation in various

industries but the study can't be openly generalized to different settings. This highlighted to conduct general study on the application of quality analytics in Pakistan. Hafeez, et al. (2018) has also explored the linkage between Total Quality Management practices, business innovativeness and firm performance in textile sector. The study was limited only to the textile sector and linkage with informed decision making was not investigated. Wamba et al. (2019) pointed out the requirement for exploring big data analytic quality (BDAQ) construct in some other contextual dimensions that could influence firm performance. Linkage with quality management system was not found in this wok too. Ahmad, K, et al. (2019) analyzed the competencies and capabilities of academic librarians with respect to introduction of big data analytics (BDA) in Pakistan's libraries. In this research, need of future studies on BDA identified to cover various challenges in large-scale libraries and in other parts of Pakistan in connection with BDA. Similarly Khan et al. (2018) found the impact of big data analytics on telecom industry. The study revealed that till 2050 around 95% population of the world will be using internet but the viable strategy to deal with huge amount of data created by telecom users is still not clear. So, there is need to work on the data mining strategy in the field.

Cogollo-Flórez and Correa-Espinal (2019) stressed on the requirement to develop predictive analytical models and integrate the same with quality at supply chain environment. They further asked to include several products categories, time series wise at phases of supply chain mentioning their result areas and overall core functions in future research. They were optimistic that recommended research dimension will support organizations to know how supply chain performance can be impacted by integration of quality management and analytics. Mahesar et al.(2017) highlighted the findings of a data analytics study conducted at two main retail chains of Pakistan. The study focused on integration of customer relationship management and data analytics in retail context. Authors pointed out that was very limited collected from two chains, so, its findings can't be generalized to other business areas.

1.3.4 Practical / Managerial Gaps

In 2019, Milena Ališ discussed a managerial cum professional need for a theoretically grounded as well empirically tested firm performance and value creation models that enable managers to determine the usages of business analytics based management system which to manage firm performance. Hindle et al. (2020) discussed future agenda for business analytics research in association with other disciplines that can help professionals know impact of

business analytics. Muhammad Waqas, et al. (2018) recommended that future research study should be conducted to examine role of strategic planning and quality strategy on firm performance from a practitioner's point of view. Milena Ališ, (2019) asked that multiple benefits may be achieved by integrating ISO 9001quality management system with information technology tools and techniques like developing apps to gauge firm performance on QMS model.

1.4 Problem Statement

Purpose of current study as also highlighted by different researchers (Kureshi et al. 2020; Ali, 2020; Musalem et al 2020; Duan et al. 2020). Sumbal et al. (2019) is to investigate the impact of quality management in integration with business analytics practices on firm performance in Pakistan perspective. The study bridges above given research gaps and address below research questions. Researcher, has studied different local researchers (Kureshi et al. 2020; Ali, 2020; Musalem et al. 2020; Khurshid & Awan, 2017; Kureshi, 2016; Ijaz, 2014; Irfan, 2014), selected area of study was found neglected in local context but internationally and even in neighboring countries there was a dire need to study the emerging Business Analytics discipline encompassing quality management practices (Torres et al. 2020; Podder, 2020; Chawla and Gupta 2020). As also highlighted by Thomas Foster Jr. et al. (2019) that managing quality across the supply chain is currently an area of high interest which need to be studied with emerging technologies like internet of things (IoT) and data analytics. This will help firms in providing better insights for improved decision making as well as ensure quality of their management systems which in turn add to financial value.

Tripathi et al. (2020) conducted a literature review on business analytics field and pointed out that although many studies conducted and published in different sectors on the application of business analytics but still there is a gap in literature to extract new patterns covering technical and managerial aspects (Conboy et al. 2020; Saha, 2019; Kunc & O'Brien, 2018). They also proposed to integrate analytics with other different disciplines having impact on strategy and performance. How this can be used in combination with other business approaches.

Dmitry Ivanov et al. (2019) stated in their work that future decision-making process will be equipped with latest technologies so these need to be bind around integrated resilient network structure, proactive planning and situational proactive control measures with other management tools. The study will be employing quality management practices and business analytics elements in a supply chain environment to better assess firm performance from multiple dimensions.

Uddin and Singh (2014) conducted the study to find the computer science related projects collaboration among SAARC countries. The study witnessed that due to certain similarities highest number of computer science projects were collaborated between India and Pakistan than any other SAARC region country. Khan et al. (2009) in their study discussed that India and Pakistan share many similarities and common practices on corporate governance like resource management, independent management system assessments and working to maximize value. Moreover, impression management strategies at workplaces research was conducted by Khilji et al. (2010) which point out that Indian and Pakistani managers share similar set of practices on different aspects of business cultures and they commonly depend on advice from peers or seniors. The professionals from both countries cater more to relationship focusses strategies than purely the job focused. It can be concluded from these studies that business analytics study is equally important for Pakistan too and current state of business analytics education and implementation India may be supportive to conduct such research in Pakistan setting. Bhasker Gupta (2020, 2019 and 2018) Analytics India Magazine's studies stated that analytics industry is witnessing fast growth with trends of revenues generated and other benefits achieved by adopters. The study highlighted that this industry is earning around 2.71 billion US $ per annum in revenues and is experiencing satisfactory growth rate of 33.5% CAGR. Out of this growth 11% is from advanced analytics and 22% is contributed by big data. The growth trend is given below in Figure 1.1 that showed the forecast of the analytics industry growth trend in terms of revenue from 2019-2025:

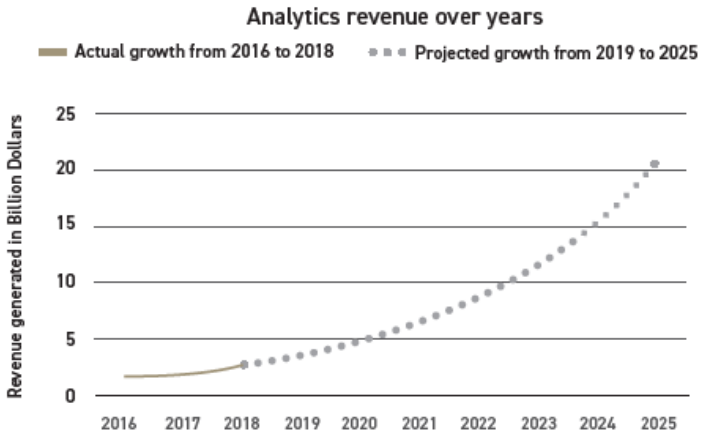

Figure 1.1: Analytics Industry Growth Trend & Current State

(Analytics India Magazine & Analytixlab's Study 2018)

1.5 Significance of Research

This study will help identify worth of business analytics supported quality management system impact on employee and firm performance for Pakistan with a brief reference to neighboring countries. Apart from that it will open the paradigm for growth of technological entrepreneurs and on enhancing the quality analytics skills in organizations. Secondly, as the quality and business analytics professionals and new entrants will also be touched upon so it will further guide organizations on how to and what actions can be taken to delight their customers. Business Analytics is gaining momentum in region and Pakistani organizations will be taking advantage of regional growth. The organizational resources and competencies are only appreciated by stakeholders if they have the capabilities to reduce the company cost and enhance the profitability against the situation if such tools have not been applied. The purpose of conducting the study was to link the business analytics and quality management system in multiple ways that may help organizations add value to related process activities, the major area where such integration can enhance revenue and create value are customer services related processes like sales & marketing, internal processes of the company and general management. Davenport et al. (2014) has stressed on the need to study integration of business analytics tools with established management systems. It was discussed that the integration will develop and refine decision making abilities of the employees (Li et al. 2013).

The researchers agreed on the conceptual work that if the resources are used in daily management activities across the company to make analysis of internal & external customers, product process control activities as well as evaluating the market conditions against set objectives or competitor performance support in gaining competitive advantage more than previous condition (Davenport, 2014). The organizations can benefit from integrating quality management systems activities and business analytics to improve their market condition while improving internal operations while developing human resources. The rich information analyzed against quality management objectives may help creating a better match between a company and its customer's satisfaction measures more than earlier level. Quality management system and business analytics both have been recognized as the strong systems of initiating continual improvement with a key objective to enhance innovative and financial capabilities of the firm, their integration has not been studies in any known research globally. As per the literature findings business analytics practices haven been found supporting organizational processes from strategic planning, risk management, production management to human resource development in a number of ways (Waller & Fawcett, 2013). The contribution range from improving professional insights, better equipment and pant availability, waste and inefficiencies reduction when coupled with six sigma methodology and lastly helping organizations reducing market failure risks, defective product claims and repair maintenance related costs.

1.6 Motivation for Research

There is satisfactory data that firms which are effective currently have low probability for being successful in the future as they fall short to maintain value creation and innovation due to lack of data insights. For instance, Christensen's (1997) research related to computer hardware industry, Henderson & Clark's (1991) research related to photolithographic alliance devices industry, Tripsas and Gaviti's (2000) research on electronic imaging, and Tushman et al(1996) .'s research on mini-computers, air and cement have both shown that businesses that were formerly successful have collapsed to succeed to maintain their high levels of performance as they could not maintain value development. In today's changing circumstances, for companies to survive and succeed, they need to innovate (Bessant, 2003; Damanpour, 1991) on launching new services and products, new methods of working with data, firms found capable on enetering into different markets, create advance technologies, enhance abilities and

adopt changes in their economical environs (Danneels, 2002; Eisenhardt et al. 2000; Brown et al.1995; Doughtery, 1992; Damanpour, 1991; Schoonhoven et al. 1990).

Goffin et al. (2005) quoted Peter Drucker, the importance of innovation is well established in current times, the organizations are now required to study different pattern of innovative work promotion (Goffin et al. 2005). Now, experts are saying that innovation is important, there are numerous companies embracing performance measuring systems or performance control mechanism (Neely, 2005; Rigby, 2001; Silk, 1998) that could restrict their innovative capability. Generally three different aspects highlight the impact of quality performance measurement methods through analytics on a company ability to innovate each have sufficient facts to support the point. First aspect shows quality performance assessment systems limit innovation as they discourage ingenuity as well as in experimentation (Neely, 2005). The second aspect shows performance assessment systems as encouraging creativity because they initiate investigations, encourage execution and advancement (Godener & Soderquist, 2004). On the other hand third element discussed performance measurement systems, bearing no significance for innovation as it was primarily applied at signaling and found with no effect on innovative capability in dynamic situations (Goffin et al. 2005).

1.7 Research Objective

Quality Management Systems (QMS) will be supported with Business Analytics (BA) activities and skills in challenging time to help emerge breakthrough performance and move from traditional low performing businesses who could not make desired growth despite all efforts only due to analytics work and low analytics skill base in Pakistan.

Purpose of the research is to conduct empirical study on Quality Management Analytics to reduce the risk to firms' growth. The study includes only the perceived firm performance on customer satisfaction and generated financial income. The variables like performance of the organizations at stock exchange, share price, industry rating etc. are not included. The focus of current study is development of measurement instruments of quality management system, business analytics and their combined impact on performance of the organizations.

The Objectives of this study are:

RO-1: To assess the impact of QMS practices on business analytics practices
RO-2: To assess the impact of BA practices on firms' perceived performance
RO-3: To assess the mediation effect of BA between QMS practices and firms' perceived performance
RO-4: To assess the impact of QMS practices' elements on firms' perceived performance

1.8 Research Questions

RQ-1: Do all of the selected quality management system practices supported with information analysis are equally linked with business analytics practices.
RQ-2: Do BA Practices help advise a model or framework to add or itegrate data analysis into decision making to nurture firm performance?
RQ-3: Do all of QMS practices through BA practices have similar effect on firm performance?
RQ-4: Do all of selected QMS practices have a similar type of effect on firm performance?

1.9 Delimitations of the Study

The study is confined only to one country Pakistan at its introductory level of Business Analytics application in country this may have impeded less number of responses from respondents. Future researcher can take large amount of data from any specific group of professionals or consider comparing discussed practices or include other quality management and business analytics practices in multi sectors and multi regions to go in deep detail. The studies in future can also be conducted on any specific sector like only including small enterprises or including medium or large one or studying 1-2 dimensions like impact of plan on delivery performance. So, this will highlight the status of analytics performance at different levels.

1.10 Conclusion

The above chapter described the background of quality management analytics study by highlighting the global importance of the selected field along with its local and neighboring

countries status. Moreover, it elaborated on the research gaps, problem statement, significance and motivation taken to conduct the study. Furthermore, research objectives, questions and delimitations of QMA study were adequately discussed. Next chapter will describe literature review.

1.11 Structure of the thesis

The dissertation is comprised on six chapters namely study introduction and background, Review of literature, Research methodology, results and analysis, Discussion and conclusion. After section one, literature review in chapter two discussed several related theories and past studies. In the light of earlier studies, the chapter also discusses connections between selected quality management system and business analytics practices. Moreover, study framework and hypothesis are also provided in the chapter. Chapter three elaborates on research framework, here literature review has supported to develop study variables. The methodology started with discussion on research approaches, research philosophies as well as rational of the selected method. Research framework was also discussed.

Chapter four analysis and results, highlights results obtained by analyzing study data. The chapter also discusses why PLS-SEM analysis was preferred over other traditional approaches to examine reliability and validity. Data distribution is discussed through descriptive statistics results as well as assessment of reflective measurement and structural models is adequately discussed.

Chapter five provides discussion on study results with reference to direct relationship and mediation effect of business analytics. Lastly, chapter six will be concluding the whole study in relation with study objectives and research questions. The chapter also narrates study recommendations, limitations as well as direction to carry out future research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Each business is running multiple operations to successfully yield set objectives i.e. from adequate material sourcing, supplier selection, buying to receiving quality inspection to storage to manufacturing, assembling, packaging, market planning, distribution, customer segmentation and customer satisfaction monitoring. Then there are other associated processes and functions that provide support services to core functionalities of manufacturing and selling (Evans, 2014; Aydiner et al. 2019). The support services department perform services as dealing with human resources, motivating and training them, health & safety, project management, legal services, engineering services, storage and marketing services. All these operation and functions require certain set of information which can help in major or even routine decision making. On day to day or activity to activity basis companies are going through varied types of decisions. In small to medium organizations decisions are normally based on intuition and some time these are run on facts. Randy (2013) and Duan et al. (2020) in their studies had pointed out that when there is scarcity of facts, we depend on opinions which have their critical biases. Now the present times are pressing us to make quick and smart decisions at the fraction of time. It has been well known rather a best practice that decisions which are made based on some facts or data are significantly better than one which are done on the basis of opinions. The decision making matures itself over the time spectrum, under dynamic conditions it becomes factual.

In order to make them better, organizations depending on their resources are trying to develop such system which will help them in their decisions. In this regard, companies are encouraging and are involved to create value in their decision through effective data management and trend exploration by engaging business analytics and big data tools and techniques (Arfat, Y. et al. 2020; Sahal, R et al. 2020). The same element has been further recommended by Chen et al. (2012) by articulating that business analytics applications have the potential to facilitate organizations to dig deep their businesses and markets to explore hidden trends as well as point out opportunities. Likewise, it has also been observed that financially good organizations take decisions after having thorough analysis twice than the low functioning organizations. These are the companies which are extensively working on analytic

insight to perform daily tasks and make strategic as well as policy decisions (Lavalle et al. 2011).

2.2 Business Analytics (BA)

BA discussion starts with data elaboration (collecting of data or a data document) or regularly with a database (an accumulation of data records that contain data on individuals, areas, etc.). As databases becomes large, they should be put away at some separate place. Advances, for example, PC clouds (equipment and programming utilized for data remote stockpiling, recovery, and computational capacities) and data warehousing (a gathering of databases utilized for reporting and data examination) store data (Aydiner et al. 2019). Database stockpiling territories have turned out to be large to the point that another term was formulated to portray them. Big data depicts the accumulation of data sets that are so expansive and complex that product frameworks are not really ready to process them. We have experienced and observed that the terms like analytics, business analytics, and business intelligence are interchangeably used with each other in business literature. Analytics can be characterized as a procedure that includes the utilization of factual strategies (measures of central tendency, charts, etc.), information framework programming (data mining, sorting schedules), and operations research systems (direct programming) to investigate, envision, find and convey examples or patterns in data (Duan et al. 2020; Martin K et al. 2019).

Thomas Davenport an authority on analytics is defining this as “analytics is the systematic use of data and facts both in quantitative and qualitative ways to reach at decisions” Analytics can be characterized as a “system that comprises of the use of statistical methods (measures of central tendency, graphs, and so on), information technology system applications (data mining, sorting routines), and businesses research methodologies (linear programming) to explore, visualize, discover and convey patterns or trends in data”. Saxena et al. (2013) has defined analytics as it is more of the rational way to get things done from ideas to execution. Furthermore, the researchers in their work had provided following analytics pathway. Likely, BA was defined by Anil et al. (2019) as “a process beginning with corporate data collection and consisting of sequential application of descriptive, predictive, and prescriptive analytic components, the outcome of which facilitate and exhibits decision-making and firm performance”.

Business analytics possess deep roots historically, we can contend that it is at the base level of the subject of management itself, since Frederick Taylor utilized analytics strategies from perception to execution. Experts began to give analytics related services/administrative facilitations to companies, associations and would straightforwardly work with their business customers. Business experts begun to get utilized to help management teams and to tackle some analytics parts, particularly to make reports. The apparatuses and procedures of mechanical cum industrial engineering as well as quality control, insights and operations exploration, were created and utilized by a various group of professionals who gave expert opinion to companies around the globe. Business analytics specialists regard this as their expert heredity.

IT groups saw chances to give reports to management teams, and the idea of Management Information Systems (MIS) was conceived. These frameworks were utilized to report operations performance at senior level. This took IT groups in the position of giving analytics to the companies and management teams as reports and dashboards, and they try to give "the right information at the ideal time to the right associates". Business Intelligence (BI) and Data Warehousing (DW) groups in IT divisions added this legacy to their core disciplines (Saxena et al. 2013). Since last few years, associations keep on increasing spending on information technology (IT) and their financial plans keep on rising, even notwithstanding potential financial downturns (Bhasker et al. 2018). Nonetheless, reasons for alarm about financial conditions and expanding rivalry make weights to cut costs, which oblige associations to gauge and analyze the advantages also, expenses of technology. Actually, associations are keen on knowing the arrival on these ventures. The effects of IT are frequently aberrant and impacted by human, authoritative, and ecological components; along these lines, estimation of information frameworks (IS) achievement is both complex and illusive. IS are produced utilizing IT to help a person in playing out an undertaking. Given the moderately short life-range of the IS field, it is entirely momentous the number and assortment of uses and frameworks that have been sent.

There were IS that reach from hedonic, created for delight and fulfillment, to users, introduced to enhance individual and group implementation (Chernetska, D. 2017; Van der 2014). Such connections focus on generating, using, and evaluating utilitarian IS. There is a enough of utilitarian IS utilized as a part of associations, for instance, preference sentimentally supportive networks, desktop interceded interchanges, e-business, information administration frameworks, and also several others James (2015) and Chernetska, D. et al. (2017) had

identified that decision management system are of various different types. First one is the agile which is meant for dealing with various changing scenarios and add into continual improvement of processes and activities then is the analytic type which based on past data help identify and manage risks, fraudulent activities and pinpoint improvement or emerging opportunities. Then there is adaptive decision type which relate to the exploring new and modernize tools and approaches to manage activities and processes.

These analytics have become so common that they are getting to be the culture of each business considering available convenience and its easy usage. According to the study conducted by IBM Corporation, business analytics "lead their peers with 33 percent higher revenue growth, 12 times more profit growth, and 32 percent higher return on invested capital…Organizations that have well-established analytics capabilities are three times more likely to be outperforming their peers than those who are just getting started…high-growth companies proactively craft data into actionable information 61 percent more often and are 29 percent more likely to ensure that data is reliable and secure." (IBM Corporation, 2012).

Use of readily available information to make better decisions is a common place among human beings, but it is how the business arena started realizing this capability and utilizing it to their advantage that led to the evolution of the concept of Business Analytics (BA). Singh et al (2012) debated that with the ever-growing rivalry in the present times, it became essential for the profit seeking organizations to take specific data from the repositories, integrate, interpret and transform it and use such information in making better managerial decisions (Chernetska, D. et al. 2017). In this way, organizations were able to stay ahead of their competitors. Thus, in order to achieve this purpose, organizations developed Enterprise Resource Planning (ERP) systems that facilitated on not only look for key data from data warehouses but also to integrate such data for further use. ERP systems were probably the first data gathering systems devised in the field of Information System. However, it has been argued that the ERP systems had two major issues.

These issues, firstly, not investing in training and change management and secondly, not having an active load testing environment, have not only limited the scope of ERP systems but also rendered its findings unreliable for the businesses. Thereof, the companies began looking for alternative decision support methods that might possibly offer substantial and dependable choices. In this regard, Singh and Sharma argue that with the innovations at

analytical handling techniques like data mining, these days, analysis of integrated information system have turned out to be much easy than before and knowledge and its reporting gathered from data bases and warehouses have become highly efficient. Similarly, unlike before, data from several new sources such as web, research papers and reports have also been successfully at use in businesses (Dai, H. N et al. 2019). Thus, it has been argued that the concept of Business Analytics (BA) evolved by assimilating, integrating and analyzing huge chunks of structured (data from warehouses) as well as unstructured data (data from other resources) through advanced analytical tools to come up with profitable decision making and eventually enhancing the market advantages for the companies. (Sharma et al. 2010)

BA lead in creating the firms better from the beginning of accumulating and immersing of data to offer potential results from insightful decision. By using such analytics, businesses can easily distinguish between the things in which it is lacking the desired output value. Dmitry Ivanov et al. (2019), discussed the emergence of newly invented technologies that has directed the analytics to a newer stage in which it is convenient to keep and record the possible solutions for even a multi-national team. These analytics are getting embraced in all form of corporate transactions and are moderately useful for producing and keep massive revenue. (Dmitry Ivanov et al. 2019)

2.2.1 Background of Data Science/Analytics

During the year 1974, Peter Naur (Danish creator/developer at software engineering and Turing grant winner) distributes "Concise Survey of Computer Methods in Sweden and the United States." The book as a study of contemporary data handling techniques that are utilized in a varied scope of uses. It was sorted out at idea of data as characterized in an “International Federation for Information Processing (IFIP) Guide to Concepts and Terms in Data Processing”, which characterizes data as a portrayal of facts or thoughts in a formalized way equipped for being conveyed or controlled by some procedure (Dmitry Ivanov et al. 2019; Gil Press 2012). The Preface to the book inform its readers that a course plan was introduced at the IFIP Congress in 1968, titled "Datalogy, the study of data and of data procedures and its place in Education training," and that in the content of the book, "the term 'data science' has been extensively used." Naur offers the accompanying meaning of data science: "The field of managing data, when they have been built up, while the connection of the data to what they speak to is appointed to different fields and sciences."

2.2.2 Business Analytics Scope

Present day advanced analytics may be seen as a coordination at three key elements: BI / data frameworks or information systems (BI/IS), statistical measurements, and quantitative techniques/operational research (see Figure). These element have been around for the greater than a 50 years (Ivanov, D. et al. 2019; James R. Evans 2015). In any case, their combination, facilitated by different instruments, for example, excel based spreadsheets, software applications, and increasingly complex business knowledge suites that coordinate data with investigative analytics programming, have prompted new and all the more impressive business approaches to see, comprehend, and deploy information and data wisely (Majeed, A. 2020).

Showcasing data, model outcomes, and investigations can uncover astounding examples and relationships and give a method of effectively imparting data on several sections of a company. Ren, S et al. (2019) discussed that BA is frequently portrayed at three points of view. Present day BA is frequently connected with big applications of data. Analytics experts have instituted this term to allude to monstrous measures of business data from a wide assortment of sources, quite a bit of which is accessible continuously, and a lot of which is unsure or eccentric. IBM has coined the terms for the features as volume, veracity, variety, velocity. Regularly, big data revolves across behavior and attitude of specific customer. In this way, big data give a chance to organizations to increase and enhance their competitive edge—if the inherent information can be comprehended and broke down adequately to provide good and informed decisions (James R. Evans 2015 and Fosso Wamba et al. 2019).

2.2.3 Big Data Analytics Essentials

The objective for this part is to basically analyze the idea of big data. It covers the definition, qualities, development, sources and the utilization of big data. Big data will be data complex as far as volume and relativity to its sources; making it hard to analyse with ordinary database management methods (Manyika et al. 2011; Power, 2014; Yoo, 2015). It is data produced from a developing sources which run from click on the web, portable exchanges, business exchanges, client created content, internet based social channels, just as deliberately created content through sensors (Davenport, 2014; George et al.2014; Marr, 2015; Mayer-Schonberger and Cukier, 2013). The term big data is an immediate reference to the size of data:

an enormous aggregate volume of heterogeneous data retained at an expanding pace and fashion. The data being referred to varies in various qualities and sources (Yoo, 2015).

Big data is one of the largely used word at current data handling advancements globally but the recommendations and significant advantages for businesses to classify the resources into "big data" are required to be yet to be acknowledged in the coming years. As indicated by IBM (2013) consistently we make 2.5 quintillion (Gil Press 2012/IBM 2013) bytes of data and as much as 90 percent of the world's data today has been developed over the past two years. The worldwide data blast is profoundly determined by technologies including digital video and music, cell phones, and the Internet (Oracle 2012). This data has its inceptions in multiple sources counting web look, sensors, business exchanges, online life communications, sound and video transfers, and cell phone GPS signals. (IBM 2013)

2.2.4 Decision Making Processes at Firms

Purpose of adding the section in this chapter was to fundamentally look at the inherent concept of data driven decision (DDD) processes or activities prevailing in organizations. Thorough consideration has been paid to know the potential effect of big data and data-driven techniques in technical studies and the sociological sciences (Brynjjolfsson et al. 2011; Messelt, 2004; Tambe, 2014; Villars et al. 2011). Data driven dynamic is the activity of settling on decision making dependent on the examination of data, instead of depending exclusively on inherent instinct (Brynjjolfsson et al. 2011; Economist Intelligence Unit, 2012). Subsequently, the decision making processes in firms has progressively experienced a change: from depending on a chief's instinct to the use of data examination (Constantiou, 2012; Power, 2014; Silvestro, 2016). Popovic et al. (2016) propose that the move towards big data based performance markers in association's empowers leaders to logically use the idea in considering various approaches when seeking after established strategic objectives.

Messelt (2004) was of the view that data driven decision making (DDD) is the process to reach at and conduct analysis of data in a significant manner. Data driven decision environment likewise mean giving data to the individual professionals who require it in their day to day operations. At the end of the day, it could mean utilizing data to build performance and improve proficiency just as passing on data-driven decision choices to key partners (Power, 2014). In addition, DDD can likewise be depicted as the communication of data from various

stakeholders for decision making to leaders (Constantiou, 2012; Villars et al. 2011). In this manner, DDD can be imagined to be a cross breed /hybrid method to deal with dynamic that consolidates parts of investigation and instinct (Brynjjolfsson et al. 2011).

2.2.5 Applications of Big Data Analytics

During previous some time, the development of Big Data analytic has begun to change the scene of BA application world in a few different ways, for example, giving the capacity to accumulate data for the whole or some portion of the whole population in a study instead of a taking small random sample , (2) moving from centrality measures to meaningful advanced estimations, (3) utilizing consistent data streams instead of point- in- time studies, and very significantly (4) making it increasingly reasonable to gather and connect data from numerous sources and structures to produce insights (Verhoef, Kooge and Walk, 2016).

Public Health and Health Policy, Buckeridge et al. (2014) resembles supermarket buying designs as narrated by Nielsen at the family level with healthy benefits communicated by the item producers alongside clinical records for the inhabitants of those postal divisions, to consider the adequacy of mentioned public wellbeing instruction activities. Utilizing comparable datasets of clinical records, Lix et al. (2012) had the chosen to display predictive and forecast algorithms for case ascertainment as a method of checking physically entered ailment and sickness codes. In the field of Civic Behavior, an examination of Tweets distributed across 4 years were analyzed in classical way with the Gold Standard Report, to recognize explicit watchwords that were a forecast of an immediate happening in Latin America (Korkmaz et al. 2015).

Those can be consolidated to show the long- term effect of environmental change. In Education, a huge data set of nearly 3 million educational programs assessments over a time of 12 years were examined by Reese et al. (2014). This is seeking and concerning to attract to advertisers in light of the fact that the customer venture is getting increasingly divided and stumbles into numerous channels (Lemon, 2016). For instance, a customer may (1) develop a plan to purchase something dependent on a companion's Facebook post, (2) at that point scan for class data on Google, (3) look at assess information on Yelp, (4) do examination of price comparisons for shopping on a few sites and (5) gauge whether to make the last buy on an e-tail site like Amazon or go to see in a brick- and- mortars retail location like Wal- Mart, and

(6) at the last snapshot of procurement, choose to download and utilize a markdown coupon from Retailmenot. Lemon (2016) presents the idea of "genuine time pertinent" advertising, where, in view of immediate data, the organization can start a discussion with the customer right now of truth.

2.3 Business Analytics Activities/Practices

During the current years, firms have developed advanced performance management system (PMSs) for assistance of their decision makers with specific insight at the required times. Such systems are utilized to assess performance data as well as identify key success factors in the firm. Hence, PSM is normally to elaborate firms key goals and objectives (Broadbent et al. 2009; Bourne et al. 2003; Garengo et al. 2005). The study introduce performance management analytics (PMAs) based on following five types as the significant utilization of information analytics techniques to know significant work dynamics, to successfully manage important performance parameters as well as fully enhance corporate performance.

1. Plan Analysis
2. Production/Operation Analytics
3. Source Analytics
4. Dispatch/Delivery Analytics
5. Marketing/Customer Analytics

Due to the impact of enhanced competition in market, performance analytics can be a possible achievements aspect of PMSs' use and create for the upcoming times. Existing PMS concentrate their emphasis on managing the implementation of policy, although they are less interested in understanding the market complexities of planning and decision-making. PMA can provide a potential explanation for the missing link between highly sophisticated PMSs (from a technological or instrumental point of view) and their successful execution. To date, the relationship between the distribution of these types of strategies and organisational success is inconclusive (Micheli and Manzoni, 2010). Our goal is to contribute to the discussion on the reasons why these systems are still not commonly implemented, for their efficacy to be

regarded as doubtful, and for them to {move forward to disappoint their advocates (Innes et al. 2000). Moreover in terms of performance management, studies indicate a paradigm for business intelligence that incorporates existing theoretical and technically defined problems in order to design an effective and usable structure for research and practice implementation. In conjunction, the research indicates where business intelligence may be beneficial inside the PMS and create recommendations on how to incorporate data science into the PMS operation.

2.3.1 Plan Analytics

The abilities of analytics application at plan activities highlight market demand that expects to make data analysis to predict customer requirements (Trkman et al. 2010) and supply plan that include incorporating supply plans intends to comply with market requests with resources in an efficient way (Chae and Olson 2013). We do exclude SCA in convey in the research model in light of the fact that numerous organizations decide to completely or partially re-appropriate the "deliver" procedure to logistics co-ordinations specialist firms (Chu and Wang 2012; Hindle G et al. 2020), and in this manner the effect of SCA around there might be restricted (Trkman et al. 2010). Presently, we talk about the impact of SCA on operational supply chain straightforwardness from the previously mentioned three measurements beneath.

The results implications of planned thinking have been a fundamental field of investigation for experts over the past years. There may be a number of research findings on the relationship between formal strategic planning (FSP) and corporate success, but several of these studies have shown dubious outcomes. A few recent studies have suggested that there is no obvious systemic association between FSP and firm efficiency (e.g. Shrader et al., 1984). Some have argued that FSP might not be adaptive if it imposes rigidity and promotes unnecessary red tape (Bresser and Bishop, 1983). Evaluating data to forecast consumer patterns for goods and services; until recently, these have generally been performed in the form of monthly and annual reports by the marketing and finance divisions.

2.3.2 Production/Operation Analytics

Major purpose of deploying business analytics applications in production/operation environment is to enhance efficiency by decreasing expenses without scarifying product quality

(Lade, P. et al. 2017 and Rendall, R. et al. 2018). This, provides the opportunity to transform manufacturing operations effectiveness like introducing key deliverables standards like increasing product yield, process cycle time, overall equipment effectiveness, perform predictive maintenance, predictive testing frequency, calibration operation etc. these are some of the openings where analytics found serving or may support operations (Lade, P. et al. 2017). The exact manufacturing of every tock item not only for any certain period, but also about each production accessory and for each order. Shank's version that was actually built on the work of Sharma et al, was a very distinct model for explaining how the use of BA can enable a company to gain business value. The top half of Figure 2 shows that Dynamic Business Analytical Skills sometimes result in leader behavior that in effect, result in changes in operational business analytic capabilities. The lower half provides a punctuated-equilibrium viewpoint of the Company's Organizational BA Capabilities as they are improved first from Point 1 to Point 2, then from Point 2 to Point 3, etc.

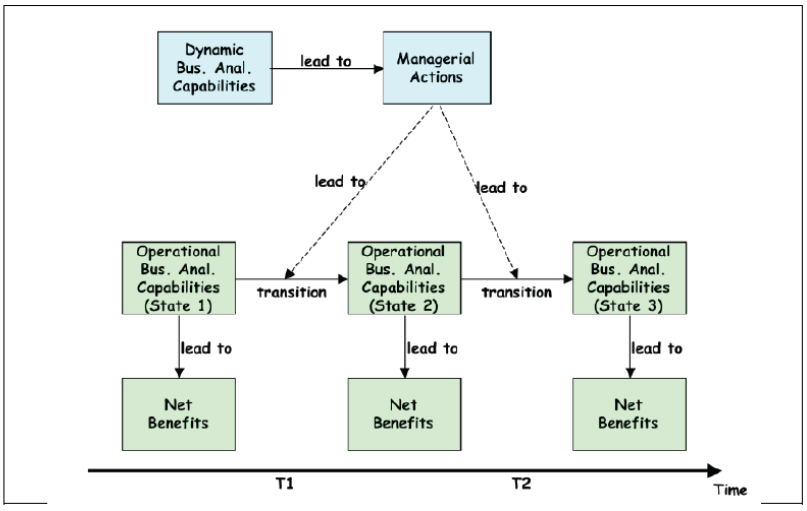

Figure 2.1: The Business-Analytics Success Model

Extracted from Source: Shanks and Bekmamedova (2012)

Shanks et al. (2012) version has the worth as it attracts attention at major kinds of BA usage, specifically: (a) use resulting in changes at how one business perform tasks (capability to transform being a dynamic capacity (Baretto 2010, Helfat et al. 2007, Teece et al. 1997), and (b) regular use of present BA capacities (Operational BA capacities). Operational usage of BA capabilities seems to be a significant source of business value from BA. By way of instance, Tesco's usage of BA capacities for sending out tens of thousands of vouchers to clients, said previously, is operational BA usage. Third version that gives another very different perspective

of how companies derive significance from business analytics is Seddon et al.'s (2010) organizational advantages from business systems (OBES) version, shown in the given figure. OBES asserts that organizations derive from enterprise-wide packed applications, such as information storage applications, by conducting consecutive tasks that provide new computer based operation to the business. Wixom et al. (2001) embraced a comparable project focused perspective for the way by using that companies take gains from information storage.

Frequently, production operation specialists rely upon their field specific information to recognize the reasonable key elements influencing product quality and afterward run the design of experiments (DoE) on these couple of elements (Lade, P. et al. 2017). Advances in business analytics and machine learning identify the location of key components influencing quality and yield effectively. This, combined with area information, empowers snappy discovery of main drivers of defects. In any case, there are some interesting data science challenges in production. When data is gathered from various gadgets and put away in databases, a system for assembling data investigation is required. Any item that is gathered or delivered in a plant experiences a progression of quality tests that decide if it must be rejected or not (Rendall et al. 2018).

High piece production rates result from the open door cost of not conveying items to customers in an opportune way, loss of staff time, misuse of nonreusable segments, and the offices management cost. Since scrap rate decrease is one of the essential issues makers need to unravel, we center our conversation on this subject. A technique to lessen scrap includes distinguishing the causes of low quality of defective items (Edwards, M. G. 2018). During the product assembling procedure, data about the status of the activity, the conditions of machines, apparatuses, and parts created is ceaselessly handed-off and put away (Torres, G. S. et al. 2020). A significant issue that operation professional come across is that they don't have a clear yet far concise diagram of the total production arrangement. Similar review will assist them with settling on best choices and know the updated condition before any unwanted occasion happens (Zhou, G et al. 2019).

2.3.3 Source Analytics

Implementing an agent-based procurement program through a procurement design, hunt, negotiation and analysis agents to enhance vendor selection, price negotiation and vendor

analysis along with the method of supplier selection/evaluation. Supply Chain Analytics – SCOR. The current study is investigating the impact of business analytics though a major application area of business analytics that is supply chain management, previous researches has pointed out the need to assess application the area via SCOR model. (Davenport 2014). The area of SCOR emphasized the distinguishing variant type of operational activities and exhibit the broader scope of supply chain activities. The SCOR standard poses inquiries about how corporate activities line up with strategic business procedures or encompassing overall supply chain frameworks tactic both inside the firm and in the more extensive way outer aspect of supply chain i.e. including customer members. This is done to empower standard procedures to be planned and deployed inside the complete supply chain framework (Cohen and Roussel 2005, Li et al 2011, p. 34). SCOR has six essential management activities which are narrated here as under:

1. Plan
2. Source
3. Make
4. Deliver
5. Return
6. Enable

Based on the guidance and elaboration for return and enable components in studies by Shao, B et al. (2018), Akkawuttiwanich, P. (2018) and Lima-Junior, F. R. (2016) the last two elements of SCOR return and enable have been transformed for the ease of current study by grouping as "Marketing/Promotion". Sourcing Operation planning is the activity by which the organization determines the goals, assignments, resources, and estimations KPIs expected to control sourcing supply management activities. The request to dispatch process is regularly estimated as far as the delivered order or the degree to which each activity of this procedure is defect free (Trautmann, G. 2009). This includes process activities like order dispatch, receipt, receiving inspection, payment payable, client facilitation, and dealing with in-process products and overall order management. This segment contacts numerous activities, majority of which are outside the domain of a sole section like commercial however this extensively effect vendor performance (Edwards, M. G. 2018).

2.3.4 Delivery/Dispatch Analytics

A variety of BA programs in transportation control have been created to be able to bring goods to market better. But since conclusions about delivery are often in the end of the decision cycle and many companies have subcontracted their delivery activities the effects of BA in shipping could be limited. At traditional dispatch and delivery mechanisms, the products from manufacturing sites are sent to warehouse location in bulk quantities containing a single type of product which is commonly known as solid packing. At washhouses the products are then picked and bundled up and shipped to customers as per their needs. To productively disperse different items to numerous customers and retail outlet leading manufacturers have brought up assortments technique into its supply chain through application of business analytics. As opposed to solid bundles, the word assort packing is recommended to ensure speedy delivery through analytics (Sung et al. 2020).

Globalization has brought about enormous teams of services or products providers, production units and warehouse site areas. In spite of the fact that the development chances in business are on ever increase, the customer desires for worldwide accepted items is developing quicker that has brought about an unpredictable system of local supply chains which must be checked carefully. In order to verify ongoing basic occasions and KPI's through numerous connection areas, the utilization of cutting edge investigation driven 'control measurements' is a must requirement for future entry. Executives at all levels are required to putting resources into supply chain perceive-ability to settle on choices to intensify supply chain responsiveness, automatically know step wise cost and satisfy customer desires (Torres et al. 2020; Kumar et al. 2018).

2.3.5 Marketing/Customer Analytics

A web search for “marketing analytics” denoted as MA provided around half million hits. MA, a “technology-enabled and model-supported approach to harness customer and market data to enhance marketing decision making” (Lilien 2011) comprise on two kinds of usages: The ones that include their customers in a decision support structure and the ones who couldn’t (i.e. marketing analytics auto way). Before half-century, the market advertising studies have recorded a lot of advantages of the usage of these advertising analytics, such as enhanced result uniformity (Natter et al. 2008), investigations of wider choices (Sinha et al. 2001), along

with an ability to estimate the relative effect of decision factors (Silk et al. 1978). One of frequent theme in this literature is that the improvement in the total decision-making procedure (Russo et al. 1989). Speedy high-tech and ecological changes have been changing the content and structure of advertising managers' jobs. These modifications include (1) noninvasive, networked, high powered computer systems; (two) setting off huge sets of information; (3) more complex clients; (4) Increasing the necessity by direction to show positive returns on marketing investments; and (5) a global, hyper-competitive business climate. On the dynamic situation, chances apparently need to innovate for deploying advertising analytics to boost profitability (Kannan et al. 2009; Natter et al. 2008; Zoltners et al. 2005; SilvaRisso et al. 1999; Hoch et al. 1996; Lodish et al. 1988; McIntyre 1982).

It's been around a century now that decision- making has extensively gone through advanced application level inside the advertising, marketing fields. At first, the basic mathematical techniques were being deployed to showcase the status of corporate business activities, then at a later phase, models based on mind , psychology and social sciences and financial or economics fields grab the attention ten to give noteworthy insights. In the third phase of advancement, demonstration began to get progress within the expansion of econometric and operational research standards. As innovation gave access to new information, the investigators and statistician entered into new techniques to store, access and break down the data for financial benefit. Given Figure 2 has provided the concise and set of information developed by Wedel and Kannan (2016):

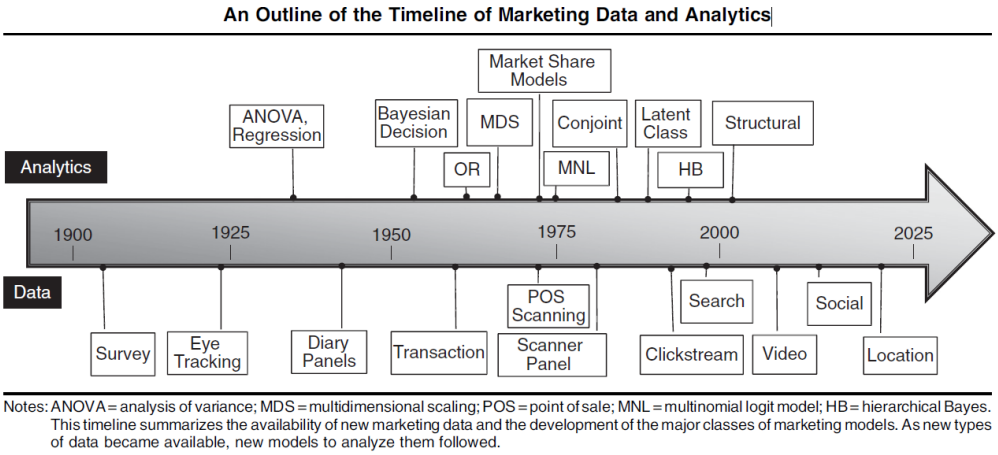

Figure 2.2: An Outline of the Timeline of Marketing and Analytics Progress

Source: Wedel and Kannan (2016):

Managers frequently apply consumer feedback information to establish objectives and track results on quality aspects companies assume to be key measures of corporate governance in the coming years (Hauser et al. 1994, Ittner and Larcker 1998). Companies typically collect input data through customer surveys using feature level and general satisfaction measures, behavioral loyalty targets such as repurchase probability and likelihood of recommendation, and actual loyalty habits such as recommendations (Griffin et al. 1995, Morgan et al. 2005). For goal-setting and performance-monitoring roles, managers' value consumer input indicators that are easy to interpret and communicate and have easy and clear predictive links to prospective company activity.

However, there now isn't any empirical understanding related to these key drivers accessible standard client feedback systems are of most importance in forecasting future company functionality (Rust et al. 2004, Ambler 2003, Griffin and Hauser 1993). There is a significant difference in marketing understanding for lots of factors. To begin with, although the literature recommends client opinion enquiring mechanism as a way to protect and developing client connections (Westbrook 2000, Griffin et al. 1995, Day 1994), low concentration was given to that metrics which lead the company's focus on the elements of customer connections that provide the best future benefits (Griffin and Hauser 1993, Shugan 2005). Secondly, identifying client responses metrics that forecast future company performance is essential to developing successful advertising and marketing control systems that choose appropriate criteria for communicating and setting advertising objectives (e.g., Rust et al.. 2004b), monitor proper targets to assess advertising results (Morgan et al. 2002), and also manage timely corrective actions where applicable (e.g., Fornell 1992). Finally, the available literature found that defining which client response metrics better predict future company success would provide predictive value advice to investors beyond that given by accrual accounting info, contributing to a productive functioning of various institution (Ittner et al. 1998, Wallman 1995).

Advertising and Marketing professionals are accustomed to clarifying the complexities of human attitudes as far as causal powers support to grasp the means that might be taken to translate the human attitude is concerned. However, the procedure of causation is entangled due to Big Data because of the conceivable presence of "extra and generally uncontrolled behavioral variable , covariates and relationships among them, and among the distinguished other factors" (Shiffrin, 2016, n.p.). At the point when data from various channels and sources

are accumulated, the advertiser are recognizing the intricacy of this present reality with enormous, interfacing biological systems and this makes causality considerably increasingly hard to nail down (Kambatla et al. 2014). Another issue pointed out by Varian (2016). In statistics the combined investigations, causality can be dictated by contrasting a test element with a control element. On account of Big Data, for example, click stream or on the other hand online networking streams, there is no experimental group and control gathering, henceforth it isn't as evident how the "accurate" might be tried against the "counterfactual".

Mentally, when a Business Intelligence investigator enters into the Chief Marketing Officer's office with heavy documents in Excel tables and charts, it is anything but difficult to get overcome by the size of the data and acknowledge every last bit instantly. Simultaneously, it is conceivable that the data investigator is under serious pressure from his customer to "recount to a story" with their data. This is the place advertisers should be careful about deceptive relationships that were addressed in the past area. As indicated by Klous and Wielaard (2016), "if one carelessly misuse the computational excel files, you will come to numerous findings that are not significant or that one can say be misdirecting". Consequently the data investigation must be separated through three levels – initially the calculation or "calculating", then analysis by some data expert known as data scientist and thirdly, pointing out the real- world, important, significant insights produced closely by data analyst and the end- user marketing or advertiser.

2.4 Analytics and QMS

In quality management field rapid changes in practices, technologies and methods are being introduced which are showing initial level results or make promises to uplift performance. Same are being evaluated and tomorrow will be extended and be in extensive use. A common future-looking routine in today's leading firms is that revived importance in consumer attention and risk management practices to be in the market (Fosso Wamba et al. 2019). As more businesses enhance IT usage and execute just-in-time and lean manufacturing techniques, a growing amount of made-to-order services and products will become accessible. Controlling quality in the year 2025 will require new kinds of quality management functionalities, much more intensive supplier-qualification systems, and also shared layout and manufacturing details (S. Thomas Foster et al. 2019).

IDC Market Analysis estimated the IT services market worldwide in 2011 as of 855.2 billion US$ and it is projected to increase in 2016 as of US $1,071.9 billion, this demonstrates five year CAGR of 4.6%. In the list the cloud services offering are rapidly growing in the market. IDC report highlights the worldwide market for general IT cloud services expenditure is actually anticipated to grow from US $ 40 billion in 2012 to 98 billion USD in 2016, a compound annual growth rate (CAGR) of more than 25%. Cloud is actually changing the economics of information and how it was dealt in past. Beside that Mobile as a category is also the fastest growing segment. A major shift occur in every decade which force entities to rethink all aspects of their IT strategy. Currently, shift is powered by mobile, social, and open technologies. The IDC global expenditures study on specialized services related to the deployment of cloud services amounted to $5.5 billion in 2011. By 2016, this is projected to rise to $20.0 billion, a CAGR of 29.2 percent over five years. The mobile enterprise application network market was $1.2 billion in 2011 and is projected to expand to $3.7 billion by 2016, a five-year CAGR of 24.1 percent, according to the same source.

Based on Gartner, global social media earnings (comprising on revenues from allied subscriptions i.e. gaming, and advertising were estimated at $11.8 billion in 2011 and $33.5 billion increase is anticipated by 2016, a five year CAGR of 23.0 %. The progress in need for technology services by enterprises seeking to adjust their business models to these emerging similar market trends and technologies represents the market opportunity of ours.

2.4.1 Quality Management and Enterprise Internet of Things

The Internet of Things (IoT), often known as A web everything Or Enterprise Internet or the Industrial Internet, is a modern technological framework described as a worldwide network of computing devices designed to interact with each other. IoT is considered to be one of the most important aspects of future technology and draws broad interest from a wide range of industries (Dai, H. N. et al 2019). The real advantage of IoT for businesses would be fully understood as connected devices are able to communicate with each other and interact with vendor-controlled inventory systems, customer service systems, business intelligence applications and BA. Gartner (2014) estimates that IoT will hit 26 billion units by 2020, grown from 0.9 billion in 2009, and will have an effect on the learning necessary to supply chain partners as well as how the supply chain works. From manufacturing plants and storage to local stores and inventory closet, EIoT improves business operations by offering more precise and

real-time insight into the movement of materials and goods. Firms will invest in IoT to overhaul factory workflows, boost inventory monitoring and optimise delivery costs. For instance, both John Deere and UPS seem to be using IoT-enabled vehicle monitoring technologies to reduce costs and boost supply quality.

In addition to IoT, different service sectors are in the process of implementing IoT to raise sales through better service while becoming champions within their sectors. Disney's MagicBand is a new RFID chips wristband which acts like an entrance pass and links to Disney's information systems for park guests. Kroger's innovative IoT-based platform, Consumer Location Technology, is a suggested price system for video analytics, wireless devices, POS devices, mobile sensors, IP cameras and soft-software video management designed to help shoppers obtain a better customer experience by more easily finding the products they want and improving efficiency at checkout. The implementation of this technology is rapidly gaining traction as technological, social and competitive pressures drive businesses to evolve and change themselves. As IoT technology progresses and a growing number of companies embrace the technology, IoT risk assessment will be a primary priority. Owing to the possible but unpredictable efficiency and high operating costs of the IoT, businesses need to closely examine any opportunity and challenge posed by the IoT to ensure that their resources are invested wisely.

2.4.2 QMS & Identification and Tracking Activities Management

Identification and monitoring technologies that are part of IoT include RFID systems, security code and sensing systems. The simple RFID circuit consists of an RFID reader and an RFID tag. Owing to its capacity to classify, track and track devices and physical items, the RFID system is gradually in use in enterprises including transportation, project management and health care surveillance. Other advantages of the RFID system involve Having adequate real-time information on the systems involved, reducing labor costs, streamlining the business process, increasing the quality of transaction data and improving business efficiency. To date, a number of manufacturers, distributors and retailers in many industries have successfully used the RFID system. The new advancement of Sensor technologies consists of the following elements: 1) RFID - based applications with distributed transmission; and 2) systems to controlling RFID applications. There is more than enough space for RFID-based technologies to grow. In order to further encourage RFID technology, RFID could be combined with WSNs

to help monitor and track stuff in timely manner. In general, evolving wireless smart sensor technologies, like magnetic sensors, bio-sensing, off-board detectors, monitor labels, independent tags and sensor modules, further accelerate the adoption and implementation of production applications and services. By incorporating information obtained from intelligent sensors with RFID data, very effective IoT systems which are appropriate for commercial settings can be developed.

2.5 Business Analytics & Quality Management Scenario - PAKSITAN

The report is based on the height, occurrence and in usefulness of company break-through and administration of new inventions in the Pakistan. Innovative work could not be effectively adopted but never be continued unless handling & screening provided information movement on day-to-day basis (Shah et al. 2020). Business Executives in South Asia appears losing the chance where due to the practical knowledge and brand-new crucial skills they could enable major contributions to invigorate companies from mediocre to best performing (Shah et al. 2020). Integrating Analytics over the organization can grow innovativeness it absolutely was therefore as it is unnecessary to just carry on knowing exactly what has occurred and just why. Business leaders will be in acute need of updating on their own on which is occurring as of this right time, what's vulnerable to take place next and just what actions should our organizations take to obtain the outcomes being optimal (Kumar, V et al 2018).

2.5.1 Business Reporting

Reporting is process of organizing information in type of summaries. That can help the various types of stakeholders of the company and provide a detailed approach to the demerits and merits of respective report critically. (Ahmad, S. et al. 2019). We can utilize various ways to collect product that is the real order to achieve this task, while each approach seems to have its own meaning in terms of study requirements. But in accordance with research literature, case study was viewed as a useful method for conducting close research that is micro level research (Ko & Gillani, 2020). Comparing with quantitative and qualitative research. Lots of experts like Stake (1995), Yin (1984) and Simons (1980) had actually recommended below actions to carry out research study very effectively.

- Describe and identify the considerable study questions
- Choose the complete case, discover information collection and evaluation tools
- Prepare to get the data
- Gather information for specific industry
- Evaluate and analyse the information
- Develop the report

2.5.2 Business Analytics Framework

The part of company creation and deployment of analytical methods is of the extreme significance therefore, 3rd group organizations that are planning, executing, analytics tasks will be the base to offer strategic edge to the firms. A framework originated which will provide both purposes facilitate IS entrepreneurs to grow their application procedure along with company using services which can much boost their applications to make operations competitive (Siddiqui et al. 2019). These types of companies in Pakistan are tiny scale entrepreneurs who are either offering their application that is own or certification this is an understanding with BA. So first of all, the company guarantees the value of the agents delivering these resources. Given BRP framework will achieve the purpose as well (Ko & Gillani, 2020).

2.5.3 Current Situation of Pakistan Economy

In July of 2019, Pakistan joined as a 39-month Fund that is extended center utilizing the Overseas Monetary Fund (Shah et al. 2020). Restoration steps under the EFF were supposed to reduce aggregate demand pressures across the market. Key drivers proposed a slowdown in progress during the first 7-8 months. The production of large-scale production slim as of 3.4 % during Jul-Jan. Contrary to this, farming segment, nonetheless, registered growth into the livestock and rice sub-sectors. The financial deficit stood at 2.3 % of GDP, compared to 2.7 percent in the first half a year of FY19 in the first 50 % of FY20. The adjustment that is financial gains by rising domestic tax collection and slowing down the growth of non-interest-bearing operating expenses. Although it is the pandemic that is COVID-19 more is likely to place considerable pressure on spending, while revenue gathering is anticipated to be adversely impacted. Pakistan's financial obligation that is public which stood at 87.5 per cent of GDP by the end of FY19, may rise as a result (Shah et al. 2020).

2.5.3.1 Early History of Business Progress by Nations' GDP

Whenever Pakistan came into being into the face of earth then the development price of Pakistan economy is greater than the todays development rate that is current. Normal yearly GDP that is real development was remained 6.8% during years of 1960s whereas it was 4.8% within years of 1970s, risen again to 6.5% within the 1980s. Normal development that is annual to 4.6% into the 1990s with significantly lower development within the last half of this ten years (Shah et al. 2020). Pakistan's income mobilization remains low when compared with other countries that are developing countries because they are doing the taxation work anticipated for the country's development. Pakistan was facing major difficulties in achieving its potential to collect income tax revenue. This would create the much-desired financial space for growth-enhancing priority spending on infrastructure, education, health care and targeted social assistance. Pakistan has climbed 28 positions to 108 in the World Bank Ease of Doing Business Ranking, according to the World Bank. Below image of GDP growth from 2009 to 2020 (Shah et al. 2020).

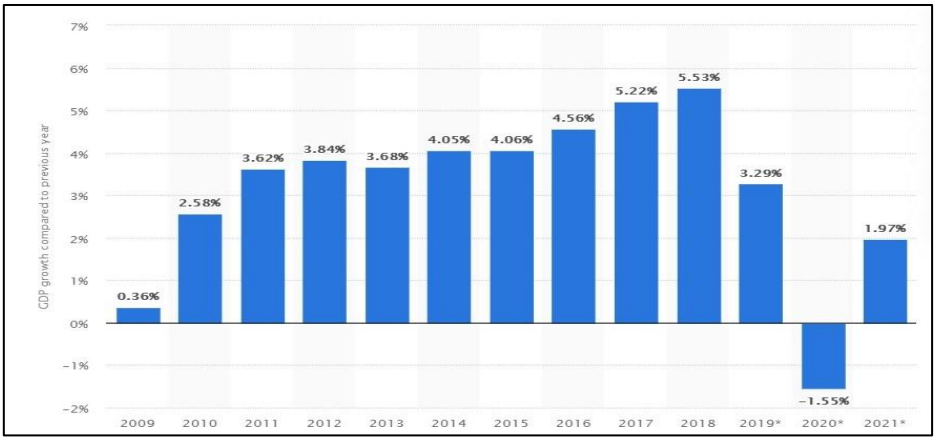

Figure 2.3: GDP Growth Percent of Pakistan

Source: www.statista.com (Pak GDP)

2.5.3.2 GDP Growth Percent of Pakistan

Pakistan's revenue mobilization stays low compared to other nations that are developing. Pakistan faces major challenges in realizing its tax revenue potential thereby providing the much-desired financial room for growth-enhancing priority paying for education, corporate and healthcare infrastructure related focused support in social sector (Shah et al.

2020). Pakistan higher up as 28 places and achieve the stage of 108 in the World Bank Ease of Doing Business index according to World Bank.

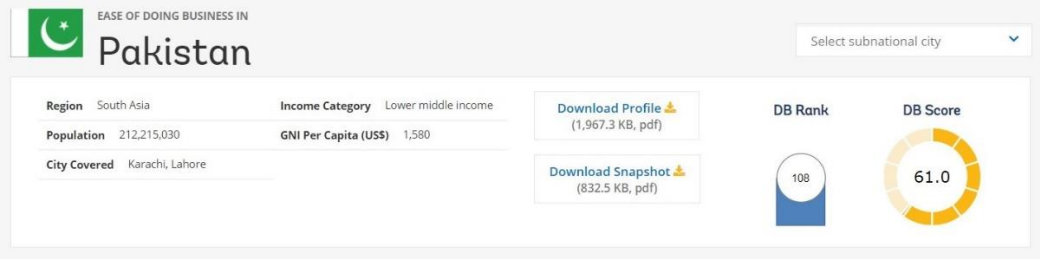

Figure 2.4: Ease of Doing Business Analysis

Source: doingbusiness.org

When we talk about the businesses or countries' progress then GDP and consumer price index are the main figures that describes their progress. The curve of growth % is declining as the time passes and businesses are shifting down in many aspects. Any country's GDP shows both sides of a business's progress whether is it going towards inclination or declination. Pakistan is deindustrializing prematurely it's growth rate of manufacturing lags behind India, Sri lanka and Bangladesh. Let's take a look at the GDP of Pakistan and compare them with past years (Shah et al. 2020). Fiscal year 2004 had the GDP growth rate at 7.70%, then 7.52% in 2005, 5.56% in 2006 and these ups and downs lead to the economy falling down below 0 percent in 2020 to -0.38%.

2.5.3.3 CPI Growth % of Pakistan

Consumer Price Index (CPI) assesses the average of prices at basket of consumer things and services on a weighted basis. CPI growth % was 7.3% in 2004, 4.7% in 2005 and 7.0% is in 2020 that shows the negative impact (Siddiqui, D. A et al. 2019).

2.5.3.4 Growth Rate Comparison of Different Fields of Pakistan

Atlantic media company reported that Pakistan's economy is stronger than most Asian countries in 2016. AMC informed for the dated January to July 2020, the 100-point index for India was 6.67% on the other hand in Pakistan our Karachi Stock Exchange (KSE) has attained

100-point index at 17 percent (Siddiqui, D. A et al. 2019). Industrial sector percentage data by the Pakistan bureau of statistics also shows the declination in their revenues and growth percentage. Fiscal year 2004 growth rate is 17.37%, 6.51% in 2005 and 3.63% in 2006 following these systole and diastole led the agriculture growth rate down to -2.64%. Mining and quarrying sector growth rate of fiscal year 2004 was 21.78%, -15.83% in 2005, 3.63% in 2006 and was declining in the next years and in 2020 is -8.82% that shows there is a need to took some serious actions (Siddiqui, D. A et al. 2019). According to World Bank report the manufacturing statistics are going down as in 2005 the growth rate was 17.5%, 13.3% in 2007 and in 2018 is 12.1%. Steel mill had closed from 2015. As the manufacturing is going down exports are also being affected negatively. There are lots of reasons for these losses such as fiscal policy that depends on revenue from imports and does not promote wealth creation and accumulation. Export rates are also low in Pakistan compared to many other countries even Bangladesh has more exports than Pakistan. Pakistan's share in world export is 0.12% and Bangladesh is 0.2%.

According to report collected from ministry of finance and PBS Agriculture sector growth rate is increasing in some corps such as wheat. its production rate was 19.5% in 2004 and now it is 24.9. On the other hand, agriculture sector is also showing a downwards curve that is showing instability in the most important business field in Pakistan. Similarly, a shortfall in cotton negatively impacts the potential of value-added exports. Cotton growth rate was 10% in 2004 which increased in 2005 but declined to 9.2% in 2020(Siddiqui, D. A et al. 2019). Data of corporate sector taken from Pakistan bureau of statistics shows a significant fall in service sector growth rate. Service sector growth rate was 5.13% in 2013 and now is -0.59% that is drastically dangerous for small scale businesses. If we sum it all up, we took the reviews of government revenues and expenditures. Reports by ministry of finance show, the government revenues and expenditures in 2004 was 794.1b PKR and in 2020 is 4689b PKR. Only once it shows the negative was in 2018 fiscal year. On the other hand, fiscal deficit is also increasing dramatically from 129b PKR in 2004 to 1686.2b PKR in 2020.

2.5.4 Business analytics and Pakistan

BA tools and their methods employed by the companies are only restricted to a number of giants the businesses in Pakistan, small and mid-sized companies have never used this process that is analytical. In little size companies, supervisors are not aware this approach and

look at it as a process that is expensive is just appropriate big organizations. These managers are mostly unaware of BA and its effectiveness (Shah et al. 2020). Some of big organizations which use this practice are takeout brands, banking sector, tech giants of Pakistan, media and activity companies on the other hand.

Business analytics and information which can be big:

The study outcomes suggest that there is know-how that is extremely limited the employment of business analytics and big data technology in business companies in Pakistan. Additionally, there is not enough understanding and expertise in Pakistani businesses on how to prepare by themselves in adopting the top data system to be able to meet with the needs of this technology that is growing is making numerous functions of company obsolete. The greater amount of outcome that is positive of survey is really a greater realization within the administration accountants to get the top data technology being an 'additional skill' as well as for this purpose they will have evinced fascination with taking part in any training program on this subject to be organized by ICMA Pakistan (Qureshi, I. A et al 2020).

What are analytics in business:

As per Watson & Wixom, (2010), business intelligence can be elaborated in many methods by the scientists and there's no actual definition that is particular of has been accepted yet. But generally, it may be understood to be:

"Business Intelligence (BI) relates to technologies, tools, and practices for gathering, integrating, analysing, and presenting large volumes of information make it possible for better decision making."

The SAS company is offering its BI application all over the globe, describes the BI as: "Business cleverness facilitates the decision makers to make better decisions also to provide help to take advantage that is competitive offering right information to your right people at right place." BA is just a procedure of explore information into significant insights that could better be used to understand, improve also to make informed business decision. Company analytics makes use of tools that are different ways to determine business dilemmas,

requirements and advises viable resources to meet those issues. Then the appropriate question arises what can help companies to keep their competitive side? An answer could be business analytics since it is the only approach that is significant strategy for any company to remain ahead of competition (Farman et al. 2019). Succeed is definitely a considerable tool that is analytical is user-friendly. It also employed by the World Bank to produce the analytical financial report of countries on their site in form of graphs and sheet that is excel.

BI (Business Intelligence) use advantages:

Generally, BI advantage factors could be split into three categories being major enhancement in information support, better choice help and resource administration. But data support describes all characteristics which are pertaining to report its own enhancement. Improved support to facilitate fast decisions comprise on all characteristics associated with choice support. Enhanced management of resources elaborate on attributes supplying the help on controlling all associated elements.

2.5.5 BI Adoption Challenges

In many of Asia pacific area, bad BI execution and management happens to be viewed as important factor that is challenging there was having to execute extra tasks about BI in your community. A bulk of businesses in pacific area of Asia were trying to satisfy their objectives in terms of real value distribution to your continuing activites (Tripathi, 2020). Nonetheless, increasing influence of changing company circumstances for reporting standards, the essence of existing market rivalry and critical information streams are major obstacles (Mehta, 2009). It's Patrick et. Al, (2010) who introduces three main forms of issues; first, issue linked to BI usage such as for example complications in report building, 2nd, issue regarding quality of information retained like opposing issues of data, application faults and protection that is inadequate and 3rd, issue regarding connectivity display like partial information export.

2.5.6 Business Intelligence and Globalization

During previous some years, numerous firms engage actively in global market, that is now have become an integral part of their operational system (market or non-market). As per

Gartner's, though financial, development in most areas or regions on earth is extremely sluggish but company cleverness software marketplace is growing rapidly as a result of adoption that is increasing of cleverness tools by the businesses to boost their business abilities. One major reason of these big development has been found in a person study carried out by Gartner, may be the improved decision making as well as its power to provide information from distribution phase to decision period in an way that is efficient (Tripathi, 2020). Employed in a domain that is big off with several workplaces at different worldwide places, company cleverness is present all over the world. But according to Watson & Swift, BI usage varies all around the globe.

2.5.7 Business Intelligence in Asia Pacific Area

The pacific side of Asian region is moving through the primary phases of company-wide intelligence solution use procedure. Nonetheless it was highlighted as the BI profession across Asia n countries like Korea, Vietnam, India and Australia is growing for at an enormous pace in 2007, the market in China has crossed the figure of 2 billion yuan or 260 million US$ that has been about 35% development than year 2006. It consisted of 900 million yuan for BI number authorization and 1,1 billion yuan for BI device integration. Approximately 80,000 workers now operate in the form of product designers, integrators, manufacturers and solutions providers, and more than 500 BI organisations in China. According to Gartner in 2009, Australia is the leading Asian Pacific intelligence corporation with sales of A$243.8 (US$212 million) by 2012. Moreover, the sectors of the businesses like transport, tourism, and retailing etc. were among the fields that are known as to deploy firm decision support applications in the forthcoming days (Shah et al. 2020).

2.5.8 Business Intelligence in Pakistan

Businesses with their viabilities to operate worldwide don't think on physical location of their human resources, because their designated people execute their duties further than the discussed scope. In this way, currently firms are now having desire for huge datasets from across the globe, although they have set their systems on a central database. Like, in Pakistan, Nestle Switzerland here in Pakistan is Nestle Pakistan Limited that engages in executing, manufacturing, sale and processing of meals and drinkable items like juices, milk, ghee, yogurt, coffee, cream and bottled beverages. In Pakistan, the company sell its globally famous items.

This was noticed that telecom and banking sectors were among large BI users in Pakistan. But some of the education related organizations, departments of government were found as potential users of BI modules (Qureshi, I. A 2020).

2.5.8.1 Implementation of Business Intelligence

In 2006, Fryman et al. highlighted the cope of BI implementations because the degree of consistence performance of an application provide the information that is important for better decision making. The applications often delivers data that is filtered through various transaction structures or knowledge sources to support work managers. Moreover, Manager must possess and hone their abilities based on learning resources which can be new processes necessary for acquiring information and result analysis (Qureshi, I. A 2020). The consumer interest as well as use of BI having said that, it's key to comprehend the limitations and perplexing issues having impact in BI use, as informed by the research, problems regarding data supply and quality was now considered like the primary source of restricted implementation of BI within the organizations or even often, high quality information is stored in the system with many other aspects like data traceability, relevance and presentation impacts. Because of this, architectural viewpoint of an enterprise is essential to develop client based BI as the application which offers better solutions for the requirements of the various user related difficulties faced by BI. Pakistani businesses in applying BI are given as:

- In-suffiecient HR and other sources
- Low budgets for software applications
- Type of present company competitive conditions.
- Increased impact of changing market conditions on regulatory requirements.
- Essential sources of data..

Though, many of the given aspects have actually much impact at BI application but initiation of latest technologies have given you the greater opportunities to businesses such as; previously, information ended up being obtainable in huge volumes that has been hard to manage to make analysis that is valuable often, it had been not accessible to execute research tasks in a nice way. Indeed the implementation of the BI had motivated employees and the subordinates by enhancing their distinguishability skills to identify the motorists. BI provides

the true results of an activity to the concerning employees by integrating information from various means. Worldwide BI potential has affected the BI industry in Pakistan. Also, in present BI application studies, challenges about BI have been discussed at length.

The study highlighted a true wide range of crucial factors of business analytics use in the country for example participants opinions on existing business analytics market potential and trend, In fact, BA vendors have become highly busy and there is a lot of work to do, which is why they're only available in this area now (Qureshi, I. A 2020). In addition, telecommunications and economic sector organisations Pakistan have already matured in terms of carrying out an examination of large and complex data sets in order to run the business effectively and steadily, and production and other sectors have begun to apply the application. More industries are now growing over with BA tools in Pakistan. However, there is still a strong need to raise understanding of BI technologies and academic research plays a key role in this.

2.5.9 Business Intelligence Adoption Maturity Model

Companies are planning on their own to manage issues when taking on BI and trying to turn risks into opportunities. Model proposed by Lavalle et al. (2010) demonstrates the degree of sophistication of analytics in a BI-based organisation and offers three features of BA ability that are Aspirational, Experienced and Transformed. Aspirational discussed about the firm vision that is having efficiency or automation of existing procedures also to discover ways to lower steadily the expenses. Additionally, HR, procedures or techniques have already referred to as the key foundation in carrying out the analytics based insights. Experienced will be the benefits have been taken by the businesses of aspiration stage like reducing the costs and struggling with latest and good ways to gather and work on BA tools for company optimization (Jan, B., Farman et al. 2019; Tripathy 2020). Transformed stage relates businesses analytics being experiencing its different functions and make use of analytics for competitive differentiation. Even in this era, organisations continue to concentrate less on lowering costs than other two specified phases; Aspirational and Experienced.

2.5.9.1 Pakistan’s Telecom sector and BI Implementation

Business Intelligence sector in country has additionally been affected with the BA application globally. The Telenor, which is a European is rolling out company cleverness focused strategy. After applying BA, the company has accomplished greater outcome in numerous key aspects of joint usage like the micro segmentation, up cross and selling. In conjunction, by incorporating company intelligence into its support department, the telecom company has strengthened its customer service operations by providing improved connectivity with its customers. According to the study, significant return on investment growth has been achieved by making quicker operational decisions since the introduction of the BI in this sector (Khan, M et al. 2018).

2.5.9.2 BI experience in Pakistan Railway

As per 2001 figures, the Pakistan Railway had served approximately 72 million passengers per year, 4.4 million tons of cargo and relied on paper-based system for handling business processes. Pakistan Railway has enhanced its reporting by introducing business analytics that is conventional analysis enabling that increased company analytics capabilities. The old processes were replaced with automatic data systems that got more efficiency and improved customer care. This research features a true range of main factors linked to BI implementation in Pakistan. Just like participants' opinions on current BI market opportunity and indicators.

2.5.10 Adopting Big Data

The use of business analytics and Big Data just isn't restricted to IT and technology associated organizations, instead it offers develop into a requisite for each and every company that hopes to keep a competitive benefit in market and build fool-proof safety system in today's global business situation. The concern that is first intended to understand in regards to the amount of awareness in Pakistani companies on Big Data technology. The Survey reveals there is awareness that is restricted use of Big Data technology in Pakistani organizations. Just 24% participants say that they have 'adequate' awareness, whereas the remaining 76% have either lower than sufficient; minimal or no awareness at all about Big Data technology.

The survey reveals that there surely is really preparedness that is low of Pakistani firms in adopting the newest Big Data technology including Business Analytics. Around 64% survey respondents say that we now have no initiatives under way or planned in their businesses towards acquiring data which can be big. Almost 14% of participants have stated that initiatives have now been taken plus in progress whereas 22% say it really is had by them within their planning (Qureshi et al. 2020). 80% agrees 'big data' assuming importance for Pakistani companies Over 80 percent of the survey participants have responded in affirmative to a survey question which asked them to share their experience as to how important is big data for the Pakistani companies. They agree that big data is gradually assuming significance for Pakistani companies in this age of technology. The survey revealed that big data should be implemented in banks and financial institutions; manufacturing and export-oriented industries; telecommunications and public sector organizations (Musalem, A. et al 2020).

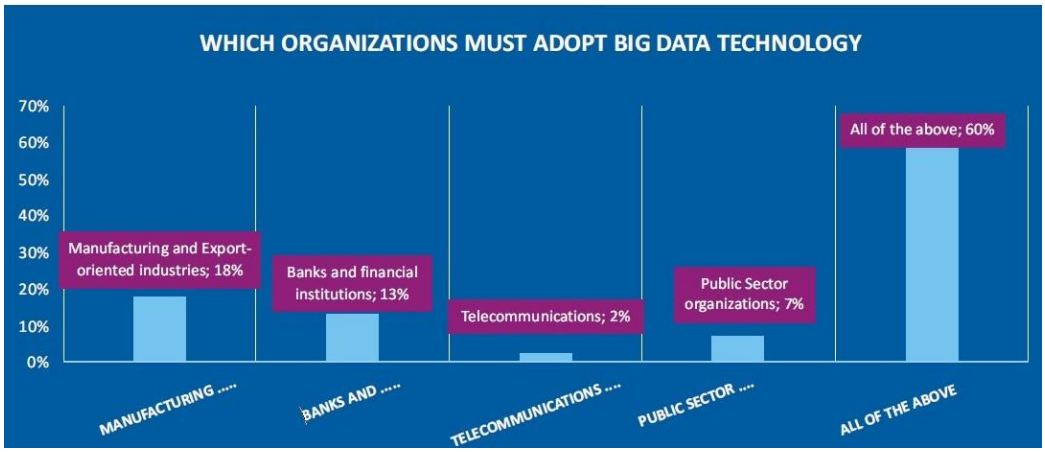

Figure 2.5: Sector wise analysis big data

Concluding Points:

Through the above discussed advantages of company analytics, it is regarded as one of best way for the professionals who are in struggle to grow to grow their firms. The application of business analytics realize benefits for the product improvement as well as reducing threats of supply because of the strategy that is best that makes it feasible. These ideas assist organizations to cultivate much more therefore, BA applications are preferred by professionals for producing earnings being high keeping the finish users more pleased. Moreover, another challenge that is very important halts companies' progress with Business Analytics may be a dilemma for the skills and knowledge needed in various areas of company analytics, such as information integration, modelling and forecasting of potential behavior. It has been noted that

such expertise is not so much in companies or simply confined to a few units of organisations, and thus there is a need to expand this expertise to all the organization's devices in order to optimise the benefits of continuing company analytics projects.

Market analytics has given businesses the ability to build methods to improve the sales and customer loyalty in a competitive world. It has helped to overtake the space between decision-making and action to meet the basics of the continued business. These analyses help to preserve records and to review them in order to meet functional requirements. In addition, market analytics offers a user-friendly platform for the implementation of more complex and advanced tools to identify needs. The management of the company has made it simpler and more competitive to generate higher profits with less risks.

2.5.11 Quality Management and Business Analytics Global View

In spite of the heavy volume of work encompassing analytics in business and the educational world, the quality fields of today have been seen, by all accounts, to be lingering behind logical patterns provided by analytics. Just a couple of articles in leading quality professional publication “Quality Progress” have covered a small portion of the ideas of present day analytics. "Ongoing data handling fields is turning into the standardized practice. These advancements are having and will keep on impacting how quality experts and analysts organize their item and procedure related plan and quality improvement projects (Snee, DeVeau 2014)." Liu (2015) sees that "Taking care of big data isn't simple." An investigation discovered in excess of 70 percent of corporate officials think they are unequipped for utilizing what data are stating, and in excess of 50 percent of organizations don't even have the foggiest idea how to settle on business choices dependent on predictive side of analytics. Be that as it may, he refers to just conventional instruments, for example, fishbone and fondness outlines for examination.

The information and data display are known as the key method to share and disseminate explanatory data. Sun et al. (2013) conducted a research to review the latest display analytics features and applications by arranging the same as per distinct classifications of reality, multivariate, content, chart and system, and others (Ashrafi et al. 2019). Likewise with other systematic procedures, data representation or showcasing is not a latest technique but is in practice since years. For instance, Ashrafi et al. (2019) talked about the utilization of representation strategies to improve the approval of framework quality. Two representation

algorithms for survey framework instrument sound qualities are portrayed, which permit a framework director to convincingly record the recognizability and security of the instruments in a huge framework. Bisgaard and Huang (2008) propose a straightforward strategy for picturing the aftereffects of principle component analysis to supplement existing graphical techniques for multiple variables on trend data series relevant for process investigation and control.

Clause 7 of the Baldrige Performance Award depends only on powerful data representation of performance results. The performance excellence framework need exhibition of compelling performance levels, positive patterns, relative data, and reconciliation with business technique. Data and information display are frequently summed up in "dashboards" and "scorecards" to highlight measures of work performance. Dashboard normally showcase a lot of vital corporate performance measures as per some scheme. This idea is gotten from the similarity of a vehicle's board, which show vehicle running speed, gas or fuel level, power terminal connected, temperature, etc. Data replication or mock up gives helpful explanatory capabilities in the profession of quality. Ivanov, D et al. (2017) explains, procedure replication or mock up commonly known as simulation, has been utilized for quite a long time to examine issues of limit, capability, throughput, usage, and other profitability measures, and as replication innovation has progressively available to non-specialists, applications has been witnessed in the fields of quality control, quality management and quality improvement, planning, process re-building etc.

Procedure recreation is a valuable instrument for Six Sigma applications, particularly those including customer administration improvement, process duration decrease, and changeability decrease (Ivanov, D et al. (2017)). Monte-Carlo reproduction haphazardly chooses model information sources and assesses the results, prompting conveyances of potential results of key model factors alongside their probability of event. This kind of recreation gives an evaluation of the risk related with a lot of choices that explanatory techniques for the most part can't catch and is appropriate to spreadsheet applications. Monte Carlo reenactment is regularly utilized in Design for Six Sigma (DFSS) to recognize key parameters driving variety, make powerful plans, and enhance parameters and resiliences. It is likewise utilized in plan of investigations for the examination of resistances and dependability or to measurably evaluate the impact of individual resiliences on a gathering or procedure. Liu (2015) takes note of that quality experts must gain proficiency with the abilities related with

big data—insights, prescient demonstrating, and essential computer programming—and figure out how to work firmly with big data researchers. One of the most remarkable techniques for present day analytics is data and content mining (Evans 2015).

2.6 Advantages of Six-Sigma

It has been known that Six-Sigma is a management framework and a metric which is based on statistical philosophy that was created in 1986, the primary focus of framework was to increase the product yield, by decreasing the variance in daily activities as well as reducing abnormalities in all kinds of service or manufacturing related items at the rate of 3.4 parts per Million occurrences (PPMO) (Henderson et al. 2000). Six-Sigma is an enterprise wide performance enhancement system that centers on satisfaction of stakeholders, process duration and operation cost reduction, and it tries to take out the causes, defects, abnormalities both in processes and its output (Keller, 2011). Also, this is a thorough control system relying on facts, centered and profoundly viable usage utilizing a lot of measurement metrics and methods (Henderson et al. 2000).

2.6.1 Place of Six Sigma in Analytics and Quality

The Greek word Sigma (σ) is used in analysis for estimating the variance, inconstancy; moreover, the six sigma incorporates standard deviation, Six sigma is also a numeric value that is linked with standard deviations on each part of the mean value, that as per, in information science, the normal spread narrated by Chakrabarty (2009) of any dataset includes around 6 σ or standard deviations. Moreover, in year 2009 Chakrabarty expressed this way, a Sigma phase or level shows the quantity of abnormalities, wastages or scrap units which will occur; notwithstanding, the increased level of Sigma showed that the operational function contain the less number of imperfections. In this way, the Sigma method concerns an imperfection level which must be 3.4 erros, a defect per million openings (DPMO) or even less, depending on the Six-Sigma target; table (2.1) shows the Sigma value relative to the DPMO and the normal output at each point.

2.6.1.1 Six Sigma Philosophy

It is claimed that Six-Sigma has two main ideologies. DMAIC is indeed a procedure to improve Six-Sigma included to improve current operations, DAMDV was another Six-Sigma approach that was used in design related work, these techniques are given as the guide of Six-Sigma arrangement (Andersson et, al., 2006; Seen et al. 2005; Henderson et al. 2000; Kumar et al. 2009). Both approachs are coordinated with measurable instruments and strategies. In any case, this examination is centered more around the DAMIC procedure. DMAIC; represent; first is Define phase, next comes in stage to Measure, followed by Analysis of data, next phase is Improve and last stage to sustain progress is Control. The DMAIC system is viewed as one of the major procedure regarding better decisions tool to resolve problems or defect reductions within an operation or manufacturing phase in which the strength of the DMAIC originates through a viability of the five phases: define known as characterize, measure, analyse, improve and control

2.6.1.2 Six-Sigma Measurement System

Seen et al. (2005) and Seow et al. (2004) expressed as major element in Six-Sigma work is to diminish the undesirable impacts of variance in twofold structure, one through moving the activities spread to the ideal objective level and secondly by diminishing the variance around mean. The outcome in the two strategies is to get the negligible variance at the correct normal step; it was essentially the vital effective parameter for accomplishing the business outcome through Six-Sigma; so, the most ideal approach to manage the operation variance is to utilize numerous tools and techniques, where the idea of applied statistical techniques is to point out, gauge and comprehend the variance. Beside this, the statistical techniques are relying more on the business facts and tasks' information investigation, objectives, their judgement that is triggered through realities and are relying more at data. It is one of the main instrument of Six-Sigma for wiping out certain abnormalities that cause to enhance routine operational problems.

2.7 Total Quality Management (TQM)

Companywide management of quality tasks has been a way of thinking and a strategy for improvement also, reconciliation of all elements of the business, it expects to accomplish nonstop improvement and fulfill customer needs. 'the term total ' indicates everything engaged with the organization, it additionally comprises on the firm processes including HR, general means and their intervals (Powell, 1995). The methodology had launched at the start of 1980 as a quality management framework, especially in production field, numerous scholars on quality, for example, Deming, Ishikawa, Crosby and Juran have contributed a lot, in quality management field (Juran, 2016). For the most part, TQM isn't restricted to production functions only; it additionally is equally applicable at services operations in organizations. According the study of Boaden (1997), TQM covers the quality of managing daily activities like improving the product yield by concentrating on three perspectives: basic design change, technical change and above all is social transformation. Beside this, Hellsten et al. (2000) characterize TQM or company-wide quality like a management framework that was depending on the basic beliefs of customer centric approach, on going improvement philosophy, process approach and employee participation. Thus, TQM has been granted as many of the incredible quality control practices.

TQM definition

Numerous experts, gurus, senior leads, professionals had elaborated this tool to arrive at a typical meaning; “a management function that seeks after to accomplish nonstop improvement in each activity of the entire firm so as to accomplish a high level of quality in all items and services in compliance with consumer and market needs”. Boaden (2007) and Mehra et al. (2001) accepted that quality is a level of performance and quality management system was a management framework that involves best use of numerical techniques and internal external cooperation to increase the quality of products and services.

TQM Concept

Quality management is a quality assurance technique where the representatives and management engaged with the ceaseless advancement of the production and service operations,

TQM offers powerful strategic methods, devices and tools to accomplish improvement in quality of products as well as in the outcome or results of the company (Mehra et al. 2001). In such manner, Hellsten et al. (2000) contended in way which describe this tool as the set of strategies to accomplish great yield for instance through valuation, regular management of tasks and item structure. The techniques are valuable for examining the data to help the problem solving. Hence, quality management comprise on totality of business perspectives not just the production activities; hence, each of process activity can be influenced and enhanced (Lewis and Smith (1994).

Fundamental components of TQM

Deming (1994) accepted that TQM framework expects to build inside and outer satisfaction of stakeholders and effectively decreasing inefficiency, on this Hellsten et al.(2000) called attention to a quality management system or total quality system as a technique comprised at two factors that were related to scheduling and communication. In this conecction a study talked about the standard and key elements of company-wide quality maagement, (in the same place) by elaborating that TQM comprises of seven fundamental components (Boaden (1997):

- Top management commitment and engagement; everybody associated to achieve company objectives and meet the customer needs; in this way, everybody ought to know required time, process know how and lastly item yield.
- Regular sustainable improvement; TQM isn't the last resort or the destination but is an ongoing process.
- Customer center; Every employee should know about the center of quality management that fulfill purchasers' needs.
- Benchmarking the best in class; workers must look for the excellence and attempting to meet this or surpass it.
- Workforce Engagement; partnership has a broad responsibility and power to enhance the process and output of each part of the business.
- Team cohesion; people within the company are aligned with the overall goal of strategic thought and collecting control of the operation.

- Knowledge of Quality management Methods; every team members should be trained for quality management and development strategies;

2.7.1 Organization Change and TQM Process

Generally, TQM strategy elaborates in recognizing the vision and characterizing the organizational objectives alongside checking the execution of the procedure that is the main job for senior management. Although Senge (1990) points to the main level of management as the capacity to build a common goal. Bergman and Klefsjö (2002) advise the TQM framework must be focused on the consistent accountability of the management. Again, TQM is perceived to be a far-reaching systemic reform (Bon and Mustafa, 2013), as a result of which the operational change is organised with the TQM approach in the organisation, and further the process change is focused on the training and growth of staff, as well as improvements in the organisational framework, principles and management style. All these variables should be considered until the Quality management has been modified.

2.7.2 Six Sigma, Analytics and TQM Similarities

Numerous quality philosophers and gurus have examined quality management and Lean Six, therefore, Andersson et al. (2006) argued there are still various relations and differences across Six-Sigma Analytics and Quality management across several respects., for example, cause, hypothesis, process view, approach, procedures, prediction, forecasting techniques and visualizing impacts.

2.8 Quality Management System Elements

Quality is a management theory created over years on the basis of three interlinked methodologies which include; corporate strategy, system and tools. Numerous experts like Juran, Ishikawa, Deming, Crosby, Shewhart, and Feigenbaum have recognized the value of this theory. The main role of quality management is to identify the use of development in items, service and related processes with an objective to achieve superior performance in activities and, in this way, fulfill customer needs and wants (Joseph Defeo 2016). Hence, the quality management writings shows that none of these approaches can resolve all of the quality related

problems of companies when are deployed in isolation of each other. However, when these tools are integrated with other models like Lean six sigma, quality function deployment, these can surpass the improvement rates and accomplish performance excellence (Antony, 2009). Therefore, the linked system of quality management tools and techniques become an efficient quality management framework as far as accomplishing high performance and practical enhancements goals (Johannes, 2013, Antony, 2009)

2.8.1 Definition and Concept of Quality Management

Quality can be termed as a general word and it is a bit hard to settle on a particular description. Every quality or management science guru has defined it in its own way; But if we critically review each of them the inherent objective and message is almost same. Some of the commonly discussed definition in the field are as:

Juran (1988) has defined this as “Fitness for use” Deming (2000) defined the quality “Non-faulty systems” Crosby (1996) was found explaining this as “Conformance to requirements”.

Deming (2000) expressed that quality in professional and specialized fields may have two basic implications; one is characteristics, features, elements of service or item which are appropriate to fulfill the necessary needs for a range of customers, the other is item and service out of mistakes, defect, errors and any inadequacies. Furthermore (Joseph Defeo 2016) expressed best quality support companies to accomplish customer satisfaction, meet item adaptable and accomplish market economy benefits, to enhance market share and profitability. So as to accomplish operation excellence objectives, companies are required to ensure below components:

- Reduce the product/service defect rate;
- Decrease process rework;
- Prevent and minimize market failure rate;
- Reduce customer dissatisfaction
- Improve access and dispatch performance

2.8.2 Tools and Techniques of Quality Management

In 2004, De Mast has characterized the quality techniques as; "Such an improvement system that consisting on a cognizant sequence of ideas, steps, methodological principles and tools which direct quality expert in enhancing the quality of an activity or item to a remarkable level (innovation)". The widely used quality management techniques which has been created and deployed practically for more than10-15 years are; ISO 9001, CWQC and Six-Sigma. Hence, companywide quality methods, techniques and strategies are unified methods utilized for evaluating the quality issues and evaluating the activity performance, the quality management techniques are gadgets that have clear job and focused use, while quality strategy has a more extensive usage as per Johannes, 2013, Mcquater, et, al., 1997. As highlighted by (Mcquater, et, al., 1997), quality management methods and techniques are categorized based on their professional usages, applications and capacities as following:

1. Checklists
2. Histograms
3. Cause & Effect Analysis
4. Pareto Method
5. Control charts
6. Flowcharts
7. Scatter plots
8. Benchmarking
9. Instances of quality procedures
10. Statistical quality control (SQC)
11. Quality function deployment (QFD)
12. Design of experiments (DOE)

2.8.3 Significance of Quality Management Tools and Methods

Quality methods and tools help an organization to achieve its vital strategic goals and targets through its recognized tools and techniques. Mcquater et al. (1997) summed up the benefits of the quality methods in manufacturing processes as follows:

- Product and process activities are monitored and evaluated through specific tools
- Engaging the employees and process teams in improving the daily activities
- Solve operational problems easily
- Support in maintaining and controlling improvement
- Strengthen staff through critical thinking and
- Improve the day by day flow of business process

2.8.4 Strategic Leadership

Strategic Leadership element has been known as of most significance to the maintenance and ongoing development of companies specifically in Asian region. This comprised on the capabilities and abilities of the senior and top management (Carter et al. 2000). Prior to reviewing the significance of senior leadership characteristics of business visionaries in small companies, a prologue to the qualities of business people has also been given concisely. In the study embraced by Story (Joseph Defeo 2016) to comprehend the development of micro level and small companies, pioneering factors recognized as positively affecting the development of organization were noted as inspiration, instruction, executive experience (before beginning the business), number of organizers, and practical abilities to handle daily routines. A portion of the previously mentioned attributes of business visionaries were additionally required to illustrate solid leadership. A firm achievement frequently depend on its proprietor's leadership abilities portrayed by solidarity of ownership, management, obligation and risk. In any case, most of proprietors of little firms do not have Strategic fundamental regulatory abilities and in this way managerial culture was practically missing (Joseph Defeo 2016); Churchill and Lewis, 1983; Wessel and Burcher, 2004; Garengo et al. 2005a).

On the planning part in strategic planning, it was discussed that planning as a term varies, subject to the different circumstances in which the word is utilized. In reality, as examined by Aldea, A., Iacob (2014), "planning" as a word is utilized in such a significant number of various types that it is at some risk of "declining into an emotional sound". Elaboration on strategic planning and management are common in various regards. A general evaluation of the writing offers various narratives of "strategic planning ." Aldehayyat, J. S (2008) diagrams strategic planning as the process of perceiving, choosing and applying activities which will improve the all-encompassing working period of an organization by giving orientation and framing a consistent adaptability midst of the inner aptitudes and resources of a firm and the dynamic outer setting inside which it operates. Johnson et al. (2008) have a practically identical portrayal of strategic management to Viljoen (1994), focusing on the orientation and similarity of an establishment inside its specific situation. For them, the procedure comprises of the orientation and degree of an establishment in the all-encompassing term, which suits its resources and its adjusting setting.

The goal of this piece of the examination isn't to build up a widespread depiction of the expression, but instead to set up a reasonable elaboration which will help the target of the research. Mintzberg H. (2003) attests that the prerequisite for a depiction isn't focused for making space for management planning but instead adjusting its present situation as per set method. Along these lines, Mintzberg H. (2003) embodied various definitions inside one fine depiction of planning, portraying it as an official procedure to create a communicated finding, 'as an incorporated arrangement of informed decisions'. From this point of view of planning , Mintzberg (1994) attracts us closer to put plan in relationship with system, as it assesses the relationship among choice, formalization of techniques and execution, making a fundamental component of this research.

2.8.4.1 Strategic Management Leadership and Problem Solving

Strategic Leadership has been widely researched against the application of critical thinking for problem solving (Afshari et al. 2011; Andriopoulos, 2001; Mainemelis et ah, 2015; Mumford et al, 2000). In accordance with this, leadership is a significant factor for critical problem thinking inside the organization, regardless of a stereotype view that innovative individuals will in general work in isolation (Mumford, 2000). Therefore, despite

the fact that inventive people will in general be increasingly set free without the monitorin and supervision of leadership, they are probably going to be not able to think of their imaginative best without powerful leadership (Mumford et ah, 2002). Leadership is seen by some as a hindrance to critical thinking (Mainemelis et al, 2015). To this end, leadership is a multi-faceted idea inserted in leadership styles: community oriented, pioneering, transformational, value-based, shared and so forth. (Mainemelis et al, 2015; Yammarino et al, 2005).

Strategic Leadership in wake of problem solving environment could be normally comprehended with a viewpoint among leaders and individuals working in the company. In a study Pirola-Merlo et al. (2002) considered the job of group heads in light of negative occasions, they discovered that the relationship a group head or leaders has with the individuals from a team could either take an inspirational, emotional or efficient work measurement. Then the researchers discovered that group heads will in general oversee enthusiastic, intra-group problems as well as colleagues in a group. It was set up that strategic leadership and firm performance was intervened by the culture inside the team and that a transformative leadership style decided how they control the negative occasions. This point of view likewise reveals insight into how leadership can affect the achievement or weakness in legging behind in an innovative activity. Generally significant (and increasingly pertinent to the scope of this research), Thite (2000) investigated leadership styles in data innovation projects. The observational research discovered that a blend of transformational leadership practices with different structures could supplement the adequacy and lead to the achievement of projects in most environments.

2.8.4.2 Strategic Planning at High Growth Firms

Initial investigations of high growth firms were introduced through proper arrangement and strategic standing experts' thought, verifiably expecting which business development was dependent on "planning for an impressive future" with a purposeful concentrate on item/service possibilities (Fombrun and Wally, 1989). These examinations found that high growth firms gradually move from dependence on experience and instinct at the innovative stage to an increasingly formalized, momentary period, and comprehensive however cultured strategic planning process as the firm go on experiencing. For instance, Shuman, Shaw, and Summers JK (2012) examination of the 500 quickest developing organizations across five distinct

enterprises in the United States demonstrated that their uncommon development rate legitimately connected with formalized strategic-arranging activities.

For instance, Littunen and Tohmo (2003) demonstrated that high growth firms in the Finnish metal based assembling and business companies' ventures were more ready through designs for adjusting their activities in production and marketing more regularly than a benchmark group. Conversely, Demir, R et al (2017) compared in an investigation of US firms didn't locate any critical contrasts among moderate and fast development firms as far as their accentuation on strategic arranging or objective setting. They did, nonetheless, find factually noteworthy contrasts in wording of firms' vision and development orientation (Demir, R et al (2017). High growth firms research has had a steady enthusiasm for distinct system as for item/market decisions and their consequences for high development are concerned. Siegel et al. (1993) found that small reduced or low-development firms will in general settle on a sole item technique, while bigger high growth firms have a progressively generous arrangement of items sold in a few or more markets.

The relationship among technique and high development focuses on the broader understanding which identify a solid indicator of high development (Demir, R et al (2017). The high growth firm distinct academic writing accentuates that high development is all the more frequently came to by method of a sole item methodology offered to a single market at an early stage and gradually copied to other regions where opportunities are established (Littunen et al. 2003). Demir, R. et al. (2017) in their analysis, proposes that although some progress has been made to leadership studies for high-growth companies, the five distinct drivers of high development (human capital, strategic element, HRM, creativity, and capacity) that they saw appeared to review separately from one another, with roughly 50% of the examinations in the review tending to just a single driver of strategic management.

2.8.4.3 Leadership Style

The control of management in private entities was for the most part through straight monitoring or supervised management by owner(s)/manager(s) when contrasted with designation or decentralization of common obligations to staff as saw in huge firms (Joseph Defeo 2016). Control by the proprietor/chief of everything may smother the development

procedure in little firms. Recognizing the leadership of small businesses was a core segment of the interaction between management and dynamics, management styles, culture and structure, and corporate development patterns (AlAnazi 2016). The ownership of huge firms was typically removed from its management and control, which was not clear in most of SMEs. Enormous organizations were normally bureaucratic, depending on formalization of conduct and designation of duties at the office/utilitarian level to accomplish co-appointment.

2.8.4.4 Strategic Planning

A thorough review of strategic management and strategic planning literature on companies (Shrader et al. 1984; Mainemelis et al. 2015; Tripathi 2020; AlAnazi 2016) recommends that strategic level process exercises were found to be of casual, instinctive, undetectable, and regularly owe more to an expedient reaction than a top to bottom investigation (as exhibited in huge firms). Senior management choice in SMEs is regularly founded on uncertain data and subject to change. This might be credited to the unstable and momentary nature of existing markets incorporating the SME. SMEs work in unsure and dynamic condition, where innovative practices, adaptability, and approachability might be indispensable for business endurance. Strategic arranging is frequently seen as wrong. In such firms, the strategic procedure was rising and natural instead of fixed and managed as in numerous enormous firms. This methodology was progressively suitable and proficient for SMEs to convey when coordinating their business exercises with the serious condition (AlAnazi 2016).

2.8.4.5 Company Structure and Strategic Management

SMEs have level organizational structure, for example less degrees of management, and less departmental boundaries advancing an adaptable workplace for everyone (Demir, R. 2017); Ghobadian and Gallear, 1997). Quick response, speedy dynamic decisions proccess, quicker execution, and less obstacles in introducing change were a few favorable circumstances of the level structure for SMEs contrasted with bigger organizations. Enormous organizations have higher level of formalization, normalization, and specialization contrasted with the natural idea of little firms, for example nonappearance of normalization and the commonness of free and casual working relationships (Yusof and Aspinwall, 2000 a, b; Youssef et al. 2002;

Garengo et al. 2005a; Deros et al. 2006). Tidd et al. (2001) firmly contended that level organizational structure and smoothed out business forms were acceptable in present moment to have an effective and profitable business, however in the long haul this would not advance the improvement of creative items or administrations, and along these lines was sidelined to react to regularly changing business sector and innovation.

2.8.5 System and Procedures

The degree of formal frameworks in small to medium level firms go from insignificant/non-existent to essential level contrasted with big companies, where they have implemented viable and officially settled processes and systems (Churchill et al. 1983;Ghobadian et al. 1997; Yusof et al. 2000a, b; Deros et al. 2006). Basic level of accounting or eyeball/individual control were qualities of the little firm, which changes to a conventional control framework and management by goals as the firm becomes bigger. The basic procedures in SMEs permitted adaptability, energized innovation, and fast reaction to customer wants /requests (Deros et al. 2006). Despite the fact that the firm have the benefit of adaptable and versatile procedures, they despite everything utilize the casual assessment, control and revealing strategies; accordingly advancing choices dependent on premonition.

2.8.6 Human Resources

It is simpler in the small medium enterprise (SME) condition to teach and develop their staff because of the less human resource base as contrasted with the bigger companies where H training is an issue due to multiple reasons. The hours needed to develop or educate the lower level production floor staff was a lot of shorter. Be that due to one reason or other, because of shortage of resources (scholarly capital, HR, and money related capacity) or offices to convey viable projects' live training (Yusof and Aspinwal, 2000 a; Thomas et al. 2003; Wessel et al. 2004), SMEs attempted to allot adequate assets for developing regardless of development needs of staff being raised (Lee and Oakes, 1995; Ghobadian and Gallear, 1997; McAdam, 2000).

2.8.6.1 Human Resource Management (HRM): An Overview

Human Resource Management (HRM) seems to be serving in multiple ways to person management almost anywhere in the world (Price, 2011) and has been in use for nearly four decades. As regards its definition, there is no universally accepted definition of HRM, and the literature refers to various definitions of HRM by various creators, and from alternate points of view. Some of HRM definitions are recorded in Appendix I.

Interestingly, 'soft' HRM techniques features the 'human parts of people management, and is worried about correspondence and inspiration; henceforth, workers are driven rather than oversaw, being involved in deciding and achieving strategic objectives (Price, 2011). Cost (2011, p. 30) contends that softer models of human resource management characteristically indicate the human resource administrators must become Enablers: Empowers: Facilitators: From this observation, chiefs are no longer bosses, similar to the case in the 'hard' HRM models, and associations move away from inflexible hierarchical structures and force distinctions to individuals assuming obligation regarding their own work (Price, 2011). Nonetheless, however HRM models have been described as either 'hard' or 'soft' models, it has been noted by Truss (1999) that although the approach of HRM is soft, the reality is to a huge degree hard, in which the association's interest beat those of the individual.

2.8.6.2 High-performing Work System (HPWS)

There is a close proximity acceptance to the description of HPWS as just a separate group of HRM activities that function collectively like a framework that act as a vital element on facilitating the company to accomplish goals and boost its performance in order as an increasingly economical entity (Delery et al. 2017; Stanton et al. 2013; Bartram et al. 2007; Macky and Boxall, 2007; Kalleberg et al. 2006; Becker et al. 2006; Datta et al. 2005; Appelbaum et al. 2000;). reason for this connection would be that the HPWS is oriented about generating value, individuality, experience and skills for workers who are not immediately replicated by someone else, that consecutively deliver improved results and a competitive leeway for the company. (Zhang et al. 2014; Wright et al. 2003). Though there was poor agreement on HRM activities that make HPWS, and these typically vary between concerns. (Posthuma et al. 2013; Delery et al.2017).

Usually, the HPWS comprises 'types' of activities like hiring, learning, leadership development, incentives, role design, and engagement and participation. (Wang et al. 2017; White et al. 2018; Sun et al. 2007; Datta et al. 2005; Zacharatos et al. 2005; Kalleberg et al. 2006; Macky et al. 2007; Takeuchi et al. 2007;). In this manner, while assessing the HPWS, the incorporation of activities as a unified model should be addressed in accordance with the strategy or framework; such activities should not be made up of various categories, as a number of inquiries had already accomplished (Boon et al. 2017; Saridakis, Lai and Cooper, 2017; White and Bryson, 2018). Since this core principle is focused on the cooperative energy of HPWS activities, it will be increasingly fitting to analyse the entire Human resource framework (Delery, 1998; MacDuffie, 1995, Huselid, 1995), and while the bunch of Human resource management activities were deployed the researcher will have a stronger prescient force. (Delery et al. 2016).

2.8.6.3 HR Recruitment, Selection

The employee selection activities including recruitment are commonly thought of like one method which at the end of the day, seeks to fill a vacant role in an organisation with the best individual for a job, that can also be found locally or through the labor pool. (Leather Barrow et al. 2018). Most scholastics concur that recruiting the opportune individuals in any case is one of the methods for achieving the organization's competitive favorable position and along these lines thinks about raising its organizational performance (for example Huselid, 1995; Pfeffer, 1998, Purcell et al. 2003; Desta, 2008; Leather pushcart and Fletcher, 2018). The people management process must comprise the training as a major activity on what the organization depends to build up skilled workface. The middle east background chosen for this analysis, as discussed, poses a challenge in HRM due to a political climate that facilitates the influence of some variables, like factions and family bonds (Al-Jahwari and Budhwar, 2016), that might lead to the spread of certain undesirable recruitment and selection practises due to ties, rampant corruption. (Budhwar et al. 2018). The staff training a reflection of the motivational testing test opinions of this learning in based on the skills need to control such problems through use of good available skills to fill positions in a logical and unbiased manner.

2.8.6.4 Training and Development Process

The organized development program is among the most effective methods of building the knowledge and potential of staff in any organisation. and is closely linked to business effectiveness. (Delery et al. 2016; Vlachos, 2008; Way, 2002; Tharenou et. al 2007; Garson, 2012; Pfeffer, 1998). So, Keep (1989) had focused on the requirement for learning activity is the key element of people management system. As per Poole (2002) 'training must be viewed as an investment rather than an expense to be rationalized away'. The HR management research in UAE has identified a void in the employability skills, the outcomes of the learning environment and the requirements of the labour market in Uae. (Swailes et al. 2012).

2.8.6.5 Performance Appraisal

Performance evaluation is the mechanism wherein the individual performance of the employee is assessed across a set time period. (DeNisi et al. 2014). The learning is among the key activities in which a company can evaluate and improve its employees' insufficiencies or shortcomings in outcome of employees (Noe et al. 2017, Subramony, 2009). This flaw may later be caused by relating the outcome of evaluation to the rapid and potential learning environment of the workplace (DeNisi et al.2004). The consequences of this assessment can also be related to motivation and reward schemes, meaning that the consequences of this assessment may lead the workers and employees to accomplish much to enhance their capabilities (DeNisi et al. 2006). Given the significance of this training and the prevailing culture in UAE, this training was included in the HPWS to guarantee reliability and accuracy in this framework, as well as recognizing where employee's views on their interest in objectivity and integrity in performance evaluation are built to avoid the implications of inappropriate working performance such as cronyism..

2.8.6.6 HRD and Organizational Performance

There have been various steps to the idea of organizational success: the partner strategy that relies on non-financial metrics for measuring organizational results, and the investors futurist vision, that concentrate mostly on applying financial performance measures (Paauwe

et al. 2005). That definition of organisational performance has grown over time (Abu Khalaf et al. 2019) though this began to determine the degree to whom the business accomplished its objectives as in 1950s. There in present era, it has carried on a more comprehensive and increasingly far-reaching aspect through the participation of every one of partners (Abu Khalaf et al. 2019).

The discussion on the type of logical (financial) or psychological (non-financial) metrics used to measure business outcomes and their confirmability are extensively known for decades. Objective metrics are usually driven by economic measures such as stock returns, asset returns and Tobin q. These metrics are obtained either through direct exposure to companies or through distributed financial reports. While non-financial or abstract indicators such as employee outcomes (employee perspectives and behavior) and performance effectiveness (service quality satisfaction) are derived from managers or employees on the basis with their own beliefs. There is therefore a strong belief among the scholastics that rational calculations are increasingly reliable and valid, because they are based on simple logical rules (Singh, Darwish and Potočnik, 2016). Instead of what could happen, for example, in the second case, to managers or workers when they overstate or decrease business success elements (Singh et al. 2016; Rauch and Hatak, 2016; Rabl et al. 2014).

2.8.6.7 Theories Linking the HPWS and Organizational Performance

In the course of recent years, the underlying linkages among SHRM and success have been prevalent in related scholastic and professional studies (Purcell and Kinnie, 2008). Researchers contend that cutting-edge HR practices known as HPWSs assist organizations with achieving better results (Shin et al. 2017). This research review presented two specified application to the establishment of the SHRM-organizational practices and its impact: the recommended method or universalist method (Pfeffer, 1994) as well as the optimally strategy (Schuler and Jackson, 1987; Wood, 1999). The previous model recognises that a predefined series of HRM activities would still yield unrivalled market results, and what the conditions, in many cases, regardless of the methodology used or the industry (Paauwe and Boselie, 2005; Katou, 2009; Zhang and Morris, 2014; Katou, 2017). The last process suggests that the activities of HRM should be consistent with the strategy and background so that to increase performance (Zhang et al. 2014; Katou, 2017; Paauwe et al. 2005).

In their ongoing meta-survey of SHRM, Jiang and Messersmith (2018) distinguished more than 20 hypotheses or theoretical perspectives used by researchers to describe the relationship between SHRM and organisational success, which is also referred to as discovery (Boselie et al. 2005; Issue and Held, 2015). The theories most commonly used were the resource-based view (RBV), the capacity-motivation-opportunity (AMO) model, and the theory of social exchange. These theories and theoretical points of view aim to rationalise the instrument of effect of the HPWS on the various components of organisational performance and the pathways of that impact, which most researchers believe begins with the factors closest to the HPWS, in particular the outcomes of employees which in turn influence proximal factors such as operational and economic outcomes (Katou, 2017; Jiang et al. 2012; Colakoglu et al. 2006).

2.8.7 Market and Customer Focus

Tsinidou et al. (2010, p. 228) portrayed that consumer specific satisfaction is the major characteristic or feeling of a customer towards a physical or non-existent or substantial thing or service dependent on its utilization". It could be legitimate to acknowledge that the customer is an adequately identifiable individual, there has been immense conversation inside the customer center literature around who is the customer of a specific substance, business or industry. For sure, there is no specific significance of the customer (Davies et al. 2001; Michael et al. 1997; Motwani and Kumar, 1997; Sirvanci, 2004). Research in the USA and Europe (Ghobadian and Gallear 1997; Haksever,1996; Yusof and Aspinwall, 2000 a, b; Youssef et al. 2002; Garengo et al. 2005a, b;Deros et al. 2006) have pointed out that small medium enterprises are progressively more receptive to customer needs, increased flexibility to implement change, and progressively imaginative in their capacity to address customer issues (Haksever, 1996; Moreno-Luzon, 1993; McAdam and Armstrong,2006). SMEs are exceptionally near their items and customers that permit quicker data stream among customers and the organization, making an expanded awareness of other's expectations. Numerous fruitful SMEs purposely decide to abuse a specific market section where they can either have practical experience in quality upgrades not offered by huge firms or accomplish a cost advantage by offering a specific aptitude or particular information (Beaver and Prince, 2004). Companies are regularly relying on a short customer segment (in a neighborhood or territorial market) with restricted outside contacts. Despite what might be expected, bigger firms have a wide range of their processes scattered remotely with more extension for an enormous customer segment.

2.8.7.1 Customer Satisfaction Management

The concise understanding of customer satisfaction is significant in the quality management discipline's writing. Because of the multifaceted nature and utmost competitive environment, organizations focus to upgrade customer satisfaction. Precisely reviewing studies on customer satisfaction support in identifying numerous background theories of customer satisfaction. Researchers guarantee relationship marketing direction and business performance are significantly related through the basic factor of customer satisfaction which is considered as the core element of relationship marketing and quality enhancement concepts (Patterson, Johnson and Spreng 1996), in the interim Researchers (Shehu and Mahmood 2014; Reza Jalali et al 2013; Grönroos 1995), suggested that organization need to fulfill customer requirements so as to build up solid sustainable relationship. With regards to building sustainable business relationships, customers are not just assessing the customer-characterized promotional direction of a company, however they are elaborating assumption regarding the customer-characterized future practices of an organization. In this way, the customer sees assessment of customer-characterized market direction of their service or product supplying organization as well as impact of their existing activities to satisfy customers (Webb et al. 2000). Since, the info got from customers help the organization to better comprehend the market needs and supporting to be on the path for upgrading customer satisfaction (Ramamurthy, 2015).

2.8.8 Process /Operational Improvement

As characterized in the work by Phelps et al. (2007), operational improvement means "a move from 'if it ain't broke don't fix it' towards an awareness and understanding of process capabilities and the implementation of best practices oriented towards efficiency gains and avoidance of error". Deployment of top tier management tools, for example, TQM, Lean, Six Sigma, and Kaizen, to have a few from enormous list, in bigger companies is very much reported and referred to in writing (Banuelas and Antony, 2002; Antony et al. 2005). In any case, existing proof proposes that SMEs were less behind to receive such formalized management tools in their entities because of absence of comprehension of framework, absence of resources and information of specific tools, and short range focus of executive management (Garengo et al. 2005b; Kumar, 2007; Phelps et al.2007; Antony et al. 2008). The comprehension of operational improvement exercises and its estimation will compel such

micro small and medium firms to do strategic management, deploy effective arrangements, and recognize holes between the organization's present performance and its targets.

2.8.8.1 Process Value Creation/Innovation Through QMS

Innovation is a vital foundation that ensure competitive edge for companies , as referred in multiple research activities. There are various ways of thinking that have discussed the overall benefits of small and big entities under the innovation perspective (Rothwell, 1989; Nooteboom, 1994; Vossen, 1998; Hallberg, 2003; Tidd et al, 2001) and have arrived at oppositely inverse resolutions. Hallberg (2003) concentrate obviously expressed that organizations have an edge over huge organizations as for innovation, while Tidd et al(2001) contends that SMEs were not in every case progressively imaginative. The general preferred position of huge firms lies for the most part in utilizing their resources/economies of scale and great outer systems administration, while firms are moderately solid in innovation where impacts of scale are not significant when contrasted with their social properties including pioneering dynamism, proficient system participation, adaptability, closeness to advertise requests, and inspiration (Rothwell, 1989;Nooteboom, 1994; Birchall et al. 1996; Vossen, 1998; Karlsson and Olsson, 1998).

2.8.8.2 Networking and Value Creation

Systems administration and associations, partnership assume a significant job in the improvement of competence of business people in small organizations and give them a chance to develop market recognition that offer upgraded competitive benefit. It further aides in making new customer value, extending scope of customer bases or the span of items, enhanced profitability due to high sales, good comprehension of developing technologies, and sharing of top tier management , process of functional practices (Ostgaard and Birley, 1994; Barbosa and Fuller, 2007; Mazzarol, 2007; Chen and Huang, 2004). Research had demonstrated that SMEs were better ready to improve when they were a piece of groups (Mitra, 2000, North et al. 2001). Making of Science Parks advances grouping of firms, where systems of little firms may communicate with one another to moderate the impact of absence of resources. Neighborhood Universities additionally assume a key job in dispersing most recent specialized information to little firms through cooperative projects.

2.8.9 Risk Management

Chapman and Ward (2002) have tried to address whether risk management is only an 'add-on' or 'extra burden' process, by concentrating on whether risk management is a key for ineffective organizations and activities which have neglected to meet focus regarding time, cost and quality. They have additionally researched whether risk management is a strategy for working with more tight deadlines and minor possibilities, exploiting assets for different exercises, and catching open doors for beneficial speculations. Be that as it may, Voetsch et al. (2004) recommend that risk management has put behind this uncertain stage and is by and large practiced as a subset of business management process. To address these inquiries, this section assesses Risk Management (RM) with deference to Small and Medium Enterprises (SMEs) in the development industry. The conversation depends on three primary areas: prologue to risk and risk management, SMEs in the development industry, and risk management in SMEs in the Asia and neighboring development industry. To contextualize conversations and understand the advancement of RM, the main area presents the meaning of risk and risk management. The advancement of RM is then examined to feature the job of RM inside organizations. Inside this unique circumstance, conversation proceeds on key procedures of RM which should be actualized and polished. The second segment at that point centers on RM among SMEs, and different meanings of SMEs and their qualities are laid out in this area.

2.8.9.1 Risk and Uncertainty Concepts

In businesses, risk depends on a wide range of components and relies upon an assortment of occasions or activities. Progress and improvement of exercises can change the states of risks to great or horrible and turn feeble risks to potential dangers or openings (Klemetti, 2006). Risks have no 'on-and-of nature and don't either occur or not-occur (Turner, 1999). In this way, because of the dynamic character of risk, the eventual fate of exercises' conditions in business is difficult to anticipate. Turner (1999), and Ward and Chapman (2003) have proposed that the term risk should be changed to vulnerability as an unbiased word which contains present and future occasions with an assortment of potential results. The term vulnerability can cover the included uncertainty and fluctuation of the meaning of risk. Raftery (1999) and Green (200 1) clarify that the term risk has legitimately implanted the vulnerability

of occasion. Raftery (1999) featured that the natures of vulnerability and risk are extraordinary and vulnerability doesn't follow the risk formula.

RM has been defined as an individual procedure in all venture management techniques yet is consistently attached with other management forms. Thomas (2003) named RM as an apparatus that helps the management group to recognize and survey risks and wellsprings of vulnerability. RM process gives a consistent situation to businesses to actualize their exercises dependent on all around grounded and unbiased choices (ICE, 2011). RM should be actualized at a beginning time of a business. Hayes et al. (1986) and Godfrey (1996) have expressed that the most elevated equivocalness and vulnerability conditions happen at the beginning times of undertakings inside businesses. Henceforth, speedy set up of RM at the beginning stage of each stage empowers the management group to have the likelihood to change the extent of their arrangement (Chapman, 1997). A thorough RM process bolsters associations to:

- Identify, analyze and prioritize risks.
- Concentrate on the most effective risks.
- Make correct decisions on the provisions for adversity.
- Decrease the impact of threats and increase the opportunities to enhance business performance.

2.8.9.2 Risk Identification

Risk identification determines the RM framework and is considered as that of the method for collecting risk information (Ward et al. 2003; Turner, 1999; Chapman, 1998). Failure to adequately assess may lead to insufficiency at entire procedure of risk would basically influence associations' assets. Bajaj et al. (1997) sketched out that the aftereffects of risk investigation; reaction and control rely upon the wisdom of risk identification, and information assortment in this part "holds the key principal job to the entire procedure" (Tchankova, 2002). In associations, risk identification must be assessed in a wide manner which incorporates both conceivable picking up and losing risks (Dickson and Hastings, 1989).

2.8.9.3 Risk Analysis

Subsequently to identification of risks, the recognized risks should be evaluated and organized in light of the likelihood of their event and effect. This necessity can be defended by the confinements of the associations' assets. Baccarini et al. (2001) had elaborated that, because of absence of time and monetary assets, it is difficult to talk on detailed list of risks. Henceforth, having an exact organized rundown of risks inside business is fundamental. Al-Babar and Crandall (1990) portrayed the risk analysis process as a fundamental association between the risks registers rundown and reasonable management. The study discussed the risk evaluation like "a process which joins vulnerability in a quantitative way, utilizing likelihood hypothesis, to assess the potential effect of risk". This procedure should be viewed as a significant component of RM and ought not to be seen as a fair-minded procedure (Jaafari, 2001).

2.8.9.4 Risk Response

Risk Response goes through various stages of risk assessment and analysis. Focal point of this procedure is on the improvement of courses of action and choices to alleviate dangers and upgrade openings (Thomas, 2003, Chapman 2003 and Hillson, 2003). To get a complete risk response plan, the accompanying variables should be thought of: the level of risk, costs related with reacting, wellspring of risk, and the proprietor/taker of risk. The arrangement of risk responses defines by and large the subtleties of utilized techniques to arranging responses to the risks (PMI, 2(08). These methodologies adapt including the positive risks as well the negative risks which are:

- Avoid, Transfer, Reduction and Accept for threats and
- Exploit, Share, Enhance and Ignore for opportunities.

Avoid: this strategy is tied in with declining to accept a risk and applies to the high positioned risk which has genuine negative results. All exercises in this strategy include reappraisal of the business management plan to completely dispense with the negative impacts. Chapman and Ward (2002) expressed that by reappraisal or overhaul of an arrangement the risks can be avoided or diminished. Exploit: this reaction strategy is utilized to accept open doors to spare the associations' assets and diminish the planned expense and time. Hillson (200

1) expresses that the exploit strategy attempts to set up the event of chance by wiping out the vulnerability. The Exploit strategy is situated on the contrary purpose of the Avoid strategy the aim of which is to expand the risks' event likelihood.

2.8.9.5 Risk Monitoring and Control

So last step of the risk loop is the risk monitoring and control time that incorporates the procedures for risk feedback; plan usage; trail and control rest of the risks; new risks recognizable proof; screen ignored threats and openings and survey the estimation of the RM procedure inside the association. The RM observing and control exercises are expected to survey importantly to keep latest revised and overlooked risks' subtleties refreshed. The principle objectives for the process were guarantee:

- Company prospects are still operative
- The assessed dangers had modified or controlled
- RM procedures had been complied
- The defined emergency strategy was well-matched to existing risk assessment

2.8.9.6 Tools and Techniques for Risk Management

This segment surveys literature for the key purpose of the research is "To evaluate the level of SMEs' consciousness of the risk management tools and techniques and investigate their adequacy in SMEs in the UK construction industry". The process of managing risk involves various stages, for example, planning, identification, analysis, control and response. It is usually recognized that the stages of identification and analysis have the most effect on the RM process (Chapman, 1998; Turner, 1999; and Ward and Chapman, 2003). Disappointment in either identification or analysis causes inaccuracy in risk evaluation which could critically sway the association's assets. Bajaj et a1. (1997) expressed that the effectiveness of risks response and control exceptionally relies upon the profundity and degree of risk identification and analysis. These stages assist to: (1) perceive the best and most relevant input data (2) understand the benefits of the process (3) clarify complexity and diversity in risk evaluation (4) perceive risks and their potential impacts (5) evaluate risks with alternative methods, and (6) deliver

appropriate information to senior management for decisions (Wang et al. 2007, Henschel, 2007; Simu, 2006).

The risk identification and risk analysis processes can be cultivated through seeking the judgment of decision-makers in an association (Chapman, 1998). The method these judgments are obtained is exceptionally reliant on the tools and techniques used. In organizational setting, tools and techniques ought to be chosen dependent on material factors, for example, objectives of businesses, needs of decision-makers, type and scope of risks, potential of risks, organizational attributes (for example assets, framework and culture), normality and contractual necessities. The most significant tools and techniques in the risk identification and analysis processes include: brainstorming, interviews, Delphi, registration, essential danger analysis, risk analysis and critical control points, environmental risk appraisal, structure "imagine a scenario in which', situation analysis, business. Control analysis, underlying driver analysis, disappointment impact mode analysis, occasion tree analysis, circumstances and logical results analysis and outcome and likelihood lattice. A couple of these techniques, for example, the Structure "Consider the possibility that' (SWIFT), Environmental Risk.

2.8.9.7 Training for Risk Management

This segment presents the literature audit of the third objective of the study, which is "To evaluate the nature of the training provisions that will be of benefit to SMEs with regard to their risk management process". The operational definition of training in this study receives Dahama's (1979) and Armstrong's (2006) definition which explains training as a process of acquiring explicit aptitudes which supports individuals to perform a vocation better. This describes training as a mechanical process dependent on exercises. The Rethinking Construction report "Duty to individuals" (Rethinking Construction, 2014) expressed that individuals in the construction industry are the key asset of the industry, whose critical commitment provides value for customers and benefits for associations. It added that duty to training and advancement of key faculty prompts upgrades in performance of the entire workforce.

An overview of the risk management studies at SMEs in the building industry displayed some of significant boundaries to training (Chileshe et al. 2013, Akintoye et al. 1997). The

primary hindrance concerns the adjusted financial assets for preparation. A latter was its lack of involvement in an appropriate capacity to conduct an updated learning. As well as the third is the minimal time that individuals need to go to modified learning. Numerous small and medium-sized companies, due to their characteristics, are experiencing the ill effects of the asset constraint, but in addition to the inability to carry out tailored training, despite the need to initiate, schedule and carry out training. Wood and Ellis (2003) have argued that there is insufficient evidence of staff obtaining formal RM instruction. In this way, the essence of risk management training for small and medium-sized companies in the construction industry is an empirical prerequisite.

2.8.9.8 The Job of Risk Management for Improved Competitiveness in SMEs

This area talks about the fourth objective of this study which is "To ascertain to what degree risk management processes add to the competitiveness of SMEs". Studies by researchers, for example, Flanagan and Norman (1993), Akintoye and Malcolm (1997), and Chapman and Ward (2001), have delineated that the process of RM has been transformed from a basic 'add-on' process to an essential and compelling practice. RM is basically intended for technical answers for forestall association from financial disappointment (Hammer, 1972), however is later polished to control human mistakes and occupational safety (Alexander, 1999). In light of a critical literature review, Clink (2001), Woods and Joyce (2003), O'Hara et a1. (2005), Henschel (2007) and Altman et a1. (2009) recommended that the jobs of RM for competitive bit of scope in SMEs are to be as per the following:

- RM in SMEs bolsters proprietor chiefs to moderate risks and negative occasions, and helps them to forestall capital misfortune and think about the return on investments. Raghavan (2005) expressed that the financial survival of firms intensely relies upon RM ability which turns the "keep a watch out" approach to anticipate and oversee process.
- RM dependent on vital planning embraces usable methods to change time in ventures (Leopoulos et at. 2006). It quickens and encourages the decision-making process in coping with association wide changes.
- The process of managing risk improves organizational productivity and profitability by controlling threats and openings which enhances business improvement.

- Formal and efficient process of RM enhances and streamlines internal administrative processes and empowers decision-makers to remain practical in the marketplace. It benefits SMEs in developing and improving future planning and prioritization.
- RM improves the effectiveness of SMEs through an intellectual business management in uncertainty occasions. Deliberate risk management processes forestall effort duplication and spare external costs on insurance.

Doorman (1997) expressed that risk management practice upgrades the organizational competitive preferred position, assists top management to ensure the organization against disastrous misfortunes, and supports prevalent risk returns performance and shareholder value development. Ernst and Young Global (2012) through an empirical research indicated that risks within associations should be transformed into results to improve the competitive bit of leeway of the association. Turning risks into results demands compelling risk management rehearses, which can be attained by: enhanced risk strategy; embedded risk management; upgraded risk management capacities; and improved controls and processes. (Clarke and Varma, 1999)

Literature audit on the construction sector outlined that competency factors need to be thought of and evaluated from both organizational and venture points of view (Oz, 2001 and Flanagan et at, 2007). In any case, a sufficiently evolved method that would encourage mutual improvement of competitiveness at these unique viewpoints has not been set up. Cattell et al. (2003) recognized that associations in any industry need to remain competitive by continuously adding value to their exercises through:

- Improving operational effectiveness by use of technologies
- Mitigating inefficiencies and removing excess costs
- Increasing process effectiveness
- Enhancing business performance - productivity and profitability

An attention to the value of risk management practices and capacity to scale and take benefits of its processes improve construction associations' competitiveness. In 2012, the Ernst and Young study clearly verified the economic progress (productivity and profitability) those were exceptionally associated with the degree of integration and coordination of risk management. To address the recognized troubles, challenges and obstructions in RM, and

analyze the gathered empirical data a powerful research methodology should be embraced and actualized.

2.8.9.9 Consideration of Risk for Strategic Planning

As a major aspect of the growing interest in investigating the explanations for the decline of strategic planning, Grant (2003) affirmed that, as the international commercial setting is becoming progressively assorted and dynamic, strategic planning must be fit for reacting to this alteration, as procedures will be rendered less effective on the off chance that they don't adjust to this transformation. In terms of responding to this reality, Kash and Darling (1998) recommended that the right strategy to utilize envelops remedial and preventive activities in request to control risk, fiasco and emergency. They also guaranteed that strategic planning without emergency control is practically identical to maintaining existence without assuring the quality of life. Within this condition, the unpredictable and quickly altering business setting causes changes within strategic planning (Mintzberg, 2003). Therefore, strategic planning needs to actualize a more extensive view which recognizes peril and risk, and institutions need to set aside some an ideal opportunity to investigate and understand organizational changes within their strategic planning, including technical, political and cultural forces, in request to foresee fluctuated future conditions in order to be equipped for dealing with unforeseen emergencies and catastrophes (Ritchie, 2004).

Calamities and emergencies are difficult to detect, and their outcomes are not clear during their initial stages. In this way, a strategic plan is important within a challenging domain (Grant, 2003). Senior management must be adequately astute to perceive threats as right on time as could reasonably be expected and deal with them within strategic planning. Strategic planning is a useful tool for detecting and translating the "powerless signals" emerging from the business setting that precede likely emergencies and calamities (Lesca and Lesca, 2013). Additionally, risk management can offer institutions a combined offensive and cautious capacity to address their competitive settings, and can also assist in recognizing which most significant viewpoints and commercial zones could be powerless (Herbane et al. 2004). In the event that these segments are incapable of functioning appropriately during an emergency or calamity, this will bring about discontinuity of commercial exercises and could imperil the continued presence of the entire institution. In this setting, risk management may work as an

operator in an initial warning structure for a potential danger, thereby permitting the administration to detect indicators of shortcoming that could therefore form into an emergency or catastrophe (Coombs, 2014).

2.8.9.10 The Rationale for Managing Risk

Risk, disaster and emergency have been investigated generally. These three terms, many might want to believe, share a great deal for all intents and purpose, and sometimes their use can be commutative. Nonetheless, a more profound examination reveals increasingly complex connections under the surface. The continuing contention about these three extraordinary and related viewpoints isn't just about their definitions, yet in addition their relationship, terminology, standards and qualities. Risk has become a crucial financial, technological and political idea. Almost every kind of commercial venture is affected by risk, notwithstanding individual exercises (Merna and Al-Thani, 2011). As can be broadly seen in different conversations, various individuals have their own perspectives on what establishes risk. Numerous associations attempt to provide a standard in request to have a typical reason for understanding risk, (for example Kaplan and Garrick, 1981). They define regular standards within various professions, for example, manufacturing, insurance or finance, so each can concur and cooperate. Notwithstanding, there is no usually accepted universal standard (Rockett, 1999).

Regarding the different viewpoints on risk, two of late forms specifically are deserving of notice. Right off the bat, Murray-Webster (2010) defines 'risk' as "an uncertain occasion or set of occasions which, should it happen, will affect the accomplishments of objectives" (p. 4). Besides, Stanton and Webster (2014) indicate that risk is the probability of an outcome that is more negative than the foreseen outcome; for instance, the probability of some occasion that may adversely effect on the accomplishment of objectives. Their definition is like that of Murray-Webster (2010) however additionally, underlines the antagonistic influence. The above viewpoints cause to notice surprising and negative outcomes; in any case, it is also essential to understand that risk can be, somewhat, estimated (Acharya et al. 2017).

2.8.9.11 Risk Strategies

Knowledge of scenario management and risk management has extraordinary significance for strategic management (Hill et al. 2014). Developments from the past built up risk systems to shield themselves from assaults by invaders and to maintain their thriving. They came to see that they must be practical and anticipate capricious events in order to defend their horticulture from natural debacles and alternative fiascoes. Lindgren and Band hold (2003) guaranteed that future guess additionally assists individuals and networks to survey the authenticity of their assumptions, to ascertain that their expectations are practical and to get an early knowledge of potential alterations in the encompassing condition in order to enhance approach. Indeed, even now, risk despite everything disturbs the life of contemporary individuals. From the 1960s, organizations began to initiate fundamental risk control techniques in order to minimize the impacts of emergencies and debacles; then these systems were applied up to the 1970s (Hampton, 2009). Likewise, organizations controlled risk by passing it on to insurance firms to minimize the heap of financial misfortunes. Additionally, organizations began to invest in new techniques, for example, scenario planning in order to enhance forward expectation and planning. Further conversations regarding the huge risk techniques used by associations are introduced below (Hopkin, 2017).

2.8.10 Other Quality Management System Practices

The most recent fifteen to twenty years have seen enhanced development of continual improvement (CI) deployment and usage in SMEs because of their expanded share in national budgets across many nations. Numerous examples of total quality management (TQM) tools application accomplishments in big size firms have been written in various professional journals, magazines, and summits with little spotlight on small companies prompting ends that TQM and the related advantage it brings to is just for huge organizations (Goh and Ridgway, 1994; Demir, R. 2017). Researching the effect of size of the firms on TQM practices and performance, it was known that bigger firms get more noteworthy advantages from TQM deployment as compared with SMEs (Fisher, 1993; Powell, 1995; Terziovski and Samson, 2000; Garvin, 1988). The real thig behind this was credited to availability of resources and high level engagement and commitment of senior managers and executives in bigger organization (Fisher, 1993; Terziovski and Samson, 2000). Professionals working in SMEs expected quick

advantages from TQM and furthermore making more efforts to get required resources to facilitate adequate deployment.

Parkin and Parkin (1996) study showed more understanding and reception of TQM inside Pakistan firms when contrasted with UK based Japanese-possessed firms. The majority of the SMEs attempted to have set up formal methods and frameworks, for example, BS5750 set up. The biggest test looked by SMEs to execute TQM lies in the interpretation of management methodologies into worker activity. Directing contextual investigations in 10 SMEs on their experience of actualizing TQM, Demir, R. (2017) featured the reasons as why SMEs left on TQM venture to extend the business development and for showcasing reason; predictable with management style supporting QM; changing customer desires; representatives center; and mproving terrible showing of the organization. Workers were proactive in the TQM firms to keep the mistakes from happening as opposed to making a move after the blunders were identified. Davig et al. (2003) directed a study of little assembling organizations in Kentucky, USA and the aftereffects of the investigation indicated that organizations were delayed to grasp the way of thinking and practice of TQM.

2.9 Performance Management (PM)

The enthusiasm for performance management in organizations has critically expanded during the most recent 20 years or so, as companies have comprehended that to enhance the abilities it was important to check, assess and maintain their routine activities (Taticchi et al. 2010). Although, like Franco-Santos et al. (2005) reveled, to deploy a good performance management framework isn't a simple activity, it requires top management deep engagement, disseminating the need at all the functions in a company and the usage of various systematic techniques to spur the joint effort of the work force in the company. However, satisfying every one of listed requirement, still it has no assurance that the executed framework will effectively run. Actually, a few researcher proposed that around 70% of endeavors to deploy performance management frameworks fall flat (Bourne et al. 2003; Franco-Santos et al. 2005).

Another, reason why executing a performance framework is a troublesome job, is the assorted variety of PM framework surviving around businesses. Indeed, Neely (2005) calls attention to that the most significant developers of the framework were from various professional foundations, for example, management sciences, bookkeeping, statistics, data frameworks and socilogy. This makes individuals from various fields attempt to respond to various queries utilizing various methodologies. Neely (2005) additionally closes, "the resultant undertaking of incorporating the information produced by such a various gathering of researchers to empower the advancement of an intelligent and concurred collection of information for the performance management group would definitely be a noteworthy issue" (Neely, 2005).

There are two significant approaches to manage the develops of organizational performance: first is the internal interested parties approach, which feature non-monitory related indicators to assess firm performance, and the subsequent methodology is investor or for the most part known as owners to businesses method that centers around more on the advantages of monetary expectations (Paauwe et al. 2005). Core possibility of organizational performance has developed since years (Abu Khalaf, Hmoud and Obeidat, 2019) since it began to choose how much the organization achieved its objectives during the 1950s. During the ongoing past organizational performance has taken on an increasingly broad and dynamically comprehensive estimation through the relationship of various accomplices (Abu Khalaf, Hmoud and Obeidat, 2019). The most recent significance of organizational performance has been developed as the limit of organizations to suffer by tending to their own needs just as by tending to the prerequisites of accomplices (Griffin, 2003). The organizational performance definition moved well beyond by including high an incentive in the present occasions to organizational performance appraisals. Antony and Bhattacharyya (2010) described organizational performance as an extent of critical worth made for accomplices, for instance, laborers and customers by suitable organization of the organization. Thusly, the possibility of the organizational performance has progressed from its restricted extension to how much the organization achieves its goals to join an increasingly broad thought that thinks about the extent of influencers and those impacted by the performance of that organization through the extra justified, despite all the trouble has made for some various arrangements of partners (Abu Khalaf, et al. 2019; Masa'deh et al. 2018;).

In the below given sections, the performance management area will be talked about and its associations with QMS will likewise be narrated.

2.9.1 The Origin of PM

In 2003 a study by Bourne et al. announced as the performance management area had its causes in ancient era bookkeeping frameworks, with the renowned PM framework as a genuine case of in what ways to keep up a bookkeeping framework without plan of action to significant level strategies. Actually, money related measures have for some time been utilized as an approach to survey management of progress evolutions in organizations. Johnson (1981), refered to by Bourne et al. (2003), archived some key principle phases of management bookkeeping created in the American during years of 1850s and 1920s: per item work based compensation; single to various activities; singular production plans to vertical coordinated business; and individual business to multi-dimensional firms. After the First World War, some bigger organizations like DuPont and General Motors, created more innovative bookkeeping methods, for example, adaptable financial plans and degrees of profitability from the operations (Bourne et al. 2003). Neely and Bourne (2000) discussed that these procedures were generally implemented during the last 100 years and barely advanced in first 80 years of implementation.

In the last few years, Taticchi et al. (2010) adopted the advanced PM sources until the 1980s, when the 'monetary value system' and 'action-based costing model' were developed due to inadequacies in the normal accounting frameworks. These mechanisms promoted momentary dynamic decision-making and were not necessarily suitable for current production environments; they were conceivably harmful to the economy of the organisations that adopted them (Bourne et al. 2003). Kennerley and Neely (2002) argue that these early PM systems used only benefits as a primary success metric and failed to recognise what companies need to oversee in order to render such benefits. Johnson and Kaplan (1987) were pioneers in these deficiencies and since the publication of their study, more researchers have been eager to establish distinctive PM models and processes. Neely (2005) ordered the delivery of the new PM to be published in five broad stages: in the 1980s, the 'problem ID' procedure defined and analysed the shortcomings of the estimation systems and their organisational effect; in the mid-1990s, possible arrangements were suggested (e.g. the modified scorecard), system searches; in the third stage, 'application methods' included the search for a man. This stage is defined as 'exact analysis.'

Taticchi et al. (2010) have pointed out a reality that these days researchers and specialists are giving more consideration to how organizations can accomplish their strategic goals through the estimation of their performance. They discussed that PM frameworks need to empower organizations to all the more adequately distinguish the relationships between their functional activities so as to make an interpretation of PM framework data into successful internal task execution. The researcher likewise propose that organizations don't confront any issues in finding a correct arrangement of Key Performance Indicators (KPIs) for checking their performance; their troubles emerge when they attempt to recognize the reason impact relationship of the estimation of every marker. This announcement is significant for the ISO 9000 set of standard in light of the discussion as explored in the preceding section of this discussion, the ISO/TC 176 technical committee which is responsible to develop ISO 9000 family of standards has incorporated in their 2015 revision of standard the need to develop KPIs as an effective method of evaluating processes and staff performance. Subsequently, ISO 9001 registered companies must know about the issues that PM frameworks are confronting with respect to KPIs therein.

2.10 Resource Based View (RBV) and Quality Analytics Study

Resource-based view (RBV) theory grown as one of the main systems to elaborate in what ways organizations can increase competitive benefit of their interest (Barney, 1991; Barney 2001; Fahy, 2000; Wernerfelt, 1984). RBV theory suggests that the way to gain competitive benefit and outcome realization has always been the vital resources of a firm (Fahy, 2000). Fundamentally, RBV focusses on the capacity of an organization to successfully sustain in open market (Fahy, 2000).

As indicated by resource-based view (Barney, 1991), an organization or unit is considered to increase a competitive favorable position when it execute activities that support value addition which are not done by its business rivals and continue their competitive edge of when such rival companies couldn't possibly copy such strategic moves. Despite the fact that not everything listed as resources can be noted as point of advantage over rivals (Barney1991). As per this discussion to fulfil the competitive resource condition, resource need to be asses on four elements. First one is such items must create value for the business (vital to the organization’s activities), exceptional, which are not executed by some other firms), (can't be effectively duplicated), and it has no alternative (this can't be effortlessly exchanged or taken

by other) (Barney, 1991). Consequently, an organization's people, competencies 'and resource capital that permit the company to consider and complete systems that can prompt develop proficiency and viability are listed as company resources (Barney, 1991).

RBV proposes that a company has a remarkable arrangement of its resources, that are generally comprised on substantial, immaterial, and capacities (Barney, 1991; Fahy, 2000; Wernerfelt, 1984). RBV suggests immaterial resources as major elements for the accomplishment of a firm's goals (Clulow, et al. 2007; Barney, 1991) in light of the fact that intangible resources can facilitate the organization at many fronts as compared to substantial resources.

Moreover, researchers contend that immaterial resources are of vital significance on the grounds that they are important, unique and difficult to recreate, that empower a firm to increase practical upper hand (Barney, 1991; Clulow, et al. 2007). Moreover, organization from small to medium level by and large need substantial resources. Consequently, the present quality management and analytics study centered on resources, which incorporate immaterial resources and competencies of an organization.

RBV is one of the major and significant theoretical structure for mentioned research that portrays the way organizations completely use their accumulation of such resources and abilities so as to gain upper hand edge over competitors, and consequently enhance company's financial performance. The research suggested company resources like unique implementation of quality management system practices and customized application of business analytics elements.

First component of resources in the current quality analytics study was QMS practices, Ali Sajid (2010) and Anil et al. (2019) discussed in their respective researches that quality management practices fall among vital resources of an organization. They further elaborated, QMS practices provide competitive advantage to the implementer firm. The second component of resources in the current study was business analytics practices. Aydiner et al. (2019), Martin, K et al. (2019) and Duan, Y et al. (2020) highlighted BA practices as the unique firm resources which is purely based on customization of selected applications as per processes, people and products maturity levels.

2.11 a) Research Framework

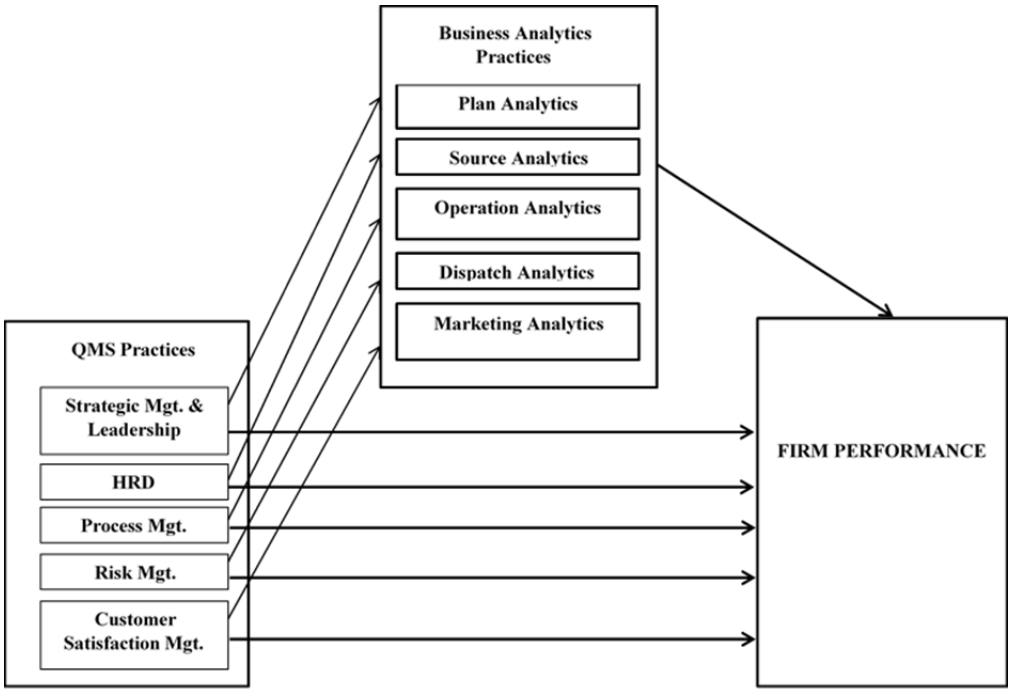

Figure 2.7: Business analytics led quality management system and its impact on perceived firm performance

The left and upper part of the proposed model indicate the elements which are making up "Business Analytics led Quality Management System". These include metrics establishment to its performance measurement at each level in an organization along with risk management, strength weaknesses and opportunities identification and their impact on root cause analysis and corrective preventive action implementation. An important element will be one of the mediating variables i.e. performance management system, competence of the professionals and other elements. Here Quality professionals are being included due to their active role in improvement practices and advocating customer requirements across all organs in an organization. This can also include competence of professionals/managers working in other closely fields included in this study. The importance of the topic can also be ascertained from the academic work given on above pages during the past few years and based on the work, resource-based theory facilitated in creating given below hypothesis of the study. Comparison and contrast identified from some recently conducted studies is also given below in table 2.1;

Table 2.1: Comparisons, Contrasts and Gaps identified

Sr.	Author	GAP Identified - Previous Studies' Recommendations	Year
1	Tayyab, M, et al.	integration of BI led supply chain management and quality management rarely discussed in Pakistan	2020
2	Hindle et al.	future agenda for business analytics research in association with other renowned performance disciplines	2020
3	Sanchez-Marquez et al.	future research; key parameters of quality management and business intelligence systems	2020
4	Malik, et al. Abbas A. Waqas et al.	Lack of studies on linking QM practices to the firm performance in various sectors in Pakistan	2020, 2018
5	Khwaja et al., Wong et al.	Need of empirical studies; to measure impact of emerging advanced management systems and Big Data approaches	2020 2018
6	Basu et al.	QM practices implementation in IT companies of India but not in relation with BI tools	2020
7	Podder et al.	Impact of Business analytics on education management system in South Asia to improve learning environment	2020
8	Polyakova et al.	Concluded necessary components needed to enhance the outcome by way of "operational analytics" at organizations of all sizes in industries across supply chain	2020
9	Thomas Foster & James R. Evans	No known studies found globally; where QM and BA practices were linked together to know impact on corporate performance	2020 2019
10	Cogollo-Flórez, Correa-Espinal	Develop predictive analytical models and integrate those quality management in the supply chain context	2019
11	Popovič et al Castelló et al Wade & Hulland	mutual worth; QM and Analytics systems extended applications in day to day activities	2019 2017
12	Nam D et al.,	Need for Technological innovation in QM by way of analytics integration to provide guidance on product and process innovations	2019
13	Khan et al. Hafeez, et al. Lai et al	Quality and supply chain analytics metrics based performance evaluation system usage; firm performance was not been theorized	2018 2018 2018

Research Hypothesis

The relationship between Quality Management System elements & Firms performance:

H_1: There is a positive relationship between Strategic Management Leadership and Business Analytics Practices

H_2: There is a positive relationship between HR Development and Business Analytics Practices

H_3: There is a positive relationship between Production/Operation Management and Business Analytics Practices

H_4: There is a positive relationship between Risk Management and Business Analytics Practices

H_5: There is a positive relationship between Customer Satisfaction Management and Business Analytics Practices

H_6: There is a positive relationship between Business Analytics Practices and Firm Performance

H_7: Business Analytics Practices mediates the relationship between Strategic Management Leadership and Firm Performance

H_8: Business Analytics Practices mediates the relationship between HR Development and Firm Performance

H_9: Business Analytics Practices mediates the relationship between Production / operation Management and Firm Performance

H_{10}: Business Analytics Practices mediates the relationship between Risk Management and Firm Performance

H_{11}: Business Analytics Practices mediates the relationship between Customer Satisfaction Management and Firm Performance

H_{12}: There is a positive relationship between Strategic Management Leadership and Firm Performance

H_{13}: There is a positive association among HR Development and Firm Performance

H_{14}: There is a positive association among Production/Operation Management and Firm Performance

H_{15}: There is a positive association among Risk Management and Firm Performance

H_{16}: There is a positive association among Customer Satisfaction Management and Firm Performance

2.11 Research Model and Relationships

As discussed above, on the basis of extensive literature review from quality management system practices, business analytics and firm performance, the research model for the quality analytics study is presented in Figure on next page. The model highlights that quality management system practices are associated with firm performance. The model also depicts mediator role of business analytics in the relationship between quality management system practices and firm performance. Mentioned hypothesized relationships were based on resource-based view theory which propose companies are able to attain better performance goals by effectively using company resources and core competencies as compared with their competitors. Business analytics is a technical capability that can affect firm performance. In this study there are eleven direct relationships and five indirect relationships. The quality analytics research model proposes that professionals' perceptions on the quality management systems practices will positively affect business analytic tools success in organizations, that will positively affect firm performance. The model also proposes that business analytics intermediates the association between the elements of quality management practices and the firm outcome. Figure 3 exhibits the specific relationships in the model.

On the basis of proposed model, multiple research hypotheses were developed, these were discussed above. Now, the of various variables and their elements is being explained

2.11.1 Relationship Between Strategic Management Leadership and Firm Performance

The section will highlight the relationship among strategic management leadership (SML) and firm performance management. Mui, H. K. Y. t al. (2018) elaborated strategic

management leadership as the company's top head with the obligation of planning such management activities that incorporate the development, execution and evaluation of the business tactics consistently, the ability to be compatible with changing attributes of external environment, all type of resources of the organization and the mindsets of the managerial group. Hoskisson, Hitt, Ireland and Harrison (2012) characterize strategic leadership as the ability to foresee, to imagine, to keep up adaptability and nimbleness by engaging its subordinates for the required strategic change and to form an achievable goal for the firm.

Hypothesis: There is a positive relationship between strategic management leadership and firm performance.

2.11.2 Relationship between Human Resource Development and Firm Performance

The study conducted by Otoo, F. et al. (2019) show a partial impact of HRD practices on firm performance through mediation of employee performance and Li, R. et al (2019), Waiganjo, E. et al. (2013) showed direct positive impact of HRD practices on innovative and financial performance of the organizations respectively. Some studies show weak to medium level relation between the two (Guest, D. E. et al 2003) and Katou, A. A. (2014) found a context based impact between the two in developing and under developed economies the relation was suggested as no to weak and in at developed one the relation was positive.

Hypothesis: There is a positive relationship between Human Resource development and Firm Performance

2.11.3 Relationship between Production Operation Management and Firm Performance

It is well established through many studies that better the processes and operations including expert reviews of new product or service development; establishing work procedures, specifications, key performance indicators as well as getting staff understood the same; regular evaluation of products/services against set specifications and KPIs by concerning staff (Danilova, K. B. 2019). Understanding of mentioned process operation elements is a key component of process operation management that encompasses different functions at different

stages in a firm (Kohlbacher et al. 2011). Above points are commonly known as process orientation, which ensures to keep focus on the business process operations, the purpose of all this is to create satisfied customers.

Danilova, K. B. (2019) developed business process management framework and found that the process knowledge accrued and experts guidance on process ownership orientation provides a positive relation to implement or further improve process ownership in organization. Danilova K. B. (2019) framework identified key role of senior management as they should empower process owners. They further informed that process operation management serves as a method to develop, review and alter process related roles (Shukla et al. 2015). Likewise, the findings of Danilova K. B. (2019) and Van Assen M. (2018) highlighted some of the possible issues to operational ownership that the firms may face that needed specific thoughtfulness from concerning senior professionals.

Hypothesis: there is a positive association among production/operation management and firm performance.

2.11.4 Relationship between Risk Management and Firm Performance

This part of discussion elaborate the relationship between risk management (RM) and firm performance management. Tse Y.K. et al. (2019) study found that two practices namely supplier development risk and product quality risk are found to impact the financial performance and quality planning of a firm. Agency theory was chosen by Tse Y.K. et al. (2019) as the essential theory to give a unique perspective on in-firm participation in risk management activities. The two types of control component formal control (FC) and social control (SC) were found to positively impact the two kinds of risk management activities (Tse, Y. K., et al. 2019).

Li et al. (2010) described FC as deploying set rules, instructions and specified procedures whereas SC explains mutual benefits and norms in an organization. Another study by Urbański, M., Haque (2019) elaborate statistically significant relation between adequate risk planning and accomplishment of a project, this empowered project owners to sufficiently accomplish their projects being under limits of financial budget. Then on risk management

comes in the risk review and risk evaluation measures in the company. Other research findings (Dionne, 2013; Boholm, 2016; Lexin 2016) showed the advantages of adequately communicating risk in firms related through risk management frameworks, researchers gave empirical data on the benefits of risk review and assessment classifications.

Hypothesis: There is a positive relationship between Risk Management and Firm Performance

2.11.5 Relationship between Customer Satisfaction Management and Firm Performance

This section highlights the relationship between customer satisfaction management (CSM) and firm performance management. Otto, A. S.,et al. (2019) study revealed, positive impact was found between customer satisfaction management measures in a company and its performance. Likewise, Sarra Berraies, Manel Hamouda, (2018) found the presence of a significant relationship between the customer experience and financial performance of organizations. They highlighted the positive impact of customer experience on two forms of innovation, which are called exploitative innovation and exploratory innovation. Furthermore, Sarra Berraies et al. (2018) presented a model in their research work which created the positive links among customer experience management, customer satisfaction, exploitative and exploratory innovation and firm performance. Beside this Chew Ging Lee & Shi-Min How (2019) study also confirmed the positive and statistically significant relationship between the customer satisfaction ratings and hotel industry performance.

Hypothesis: There is a positive relationship between customer satisfaction management and firm performance.

2.11.6 Relationship between Business Analytic Practices and Firm Performance

The study by Aydiner, A. S. et al. (2019) found the direct relationship between business analytic practices and business process performance by demonstrating that the business analytics algorithms and technologies are coordinated with firm procedures (Tan et al. 2016). The combination enhances company's capacity to detect and react to circumstances in the market, and it does brings such information to business processes (Chen, Wang, Nevo, Benitez-Amado, and Kou, 2015).

Hypothesis: There is a positive relationship between Business Analytics Practices and Firm Performance

2.11.7 Relationship between Quality Management Systems Practices and Business Analytic Practices

Ji-fan Ren et al. (2016) and James R. Evans (2015) conducted the studies and found the positive impact of quality practices on big data analytics project success. To depict the relationship between quality management system practices and firm performance following hypothesis were proposed.

H: There is a positive relationship between Strategic Management Leadership and Business Analytics Practices

H: There is a positive relationship between HR Development and Business Analytics Practices

H: There is a positive relationship between Production/Operation Management and Business Analytics Practices

H: There is a positive relationship between Risk Management and Business Analytics Practices

H: There is a positive relationship between Customer Satisfaction Management and Business Analytics Practices

2.11.7 The Mediation Effects of Business Analytics on QMS practices and Firm Performance

In the current quality analytics study, mediation role of the business analytics was proposed through resource based view (RBV) theory. As per RBV theory, organizations can strategize their vital resources in order to take competitive advantage as well as enhance firm performance (Runyan et al. 2007). In this connection following hypotheses were proposed.

H: Business Analytics Practices mediates the relationship between Strategic Management Leadership and Firm Performance

H: Business Analytics Practices mediates the relationship between HR Development and Firm Performance

H: Business Analytics Practices mediates the relationship between Production / operation Management and Firm Performance

H: Business Analytics Practices mediates the relationship between Risk Management and Firm Performance

H: Business Analytics Practices mediates the association between CSM and Firm Performance

Summary

The chapter basically has evaluated previous theories, studies and dimensions of both quality management system and business analytics along with their relationship. It supported connecting various practices of quality management system with business analytics elements and then studied the both in relation with firm performance management. The study found current vitality of business analytics as a catalyst to improve management system performance

which subsequently paved the way for enhanced performance. Apart from this, the chapter has particularly discussed the importance of resource based view theory to this study. The theoretical grounds of the current study are built on RBV that has supported to develop the study hypotheses. The chapter also discussed the development of hypotheses to examine relationship between quality management practices and business analytics and frim performance. The mediating effects of business analytics between quality management system practices and firm performance was also discussed here.

Next chapter elaborates the research methodology and related elements.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

Objective of the chapter is to provide detail on research design, survey instrument, target participants, procedures and analytical methods used to test the hypothesis developed in this study. The research methodology guides to know the impact of business analytics led quality management system on firm performance in a developing country context. This chapter discussed six main element which are given here as follows:

- This starts with a brief discussion of the research philosophies, paradigms and describes the selected methodology.
- Then an explanation of the sampling methodology deployed in this study has been elaborated. It further progresses to define the criteria to recruit the study participants or explain the target population.
- Later the instrumentation
- Instrumentation validity and reliability has been explained in detail.
- Fifth element of the chapter describes data collection mechanism employed.
- Pilot study and data analysis techniques has also been discussed.

The present research study is based on the Positivist paradigm that was chosen and supported by studies by multiple scholars as Bell, E et al (2017), Peters et al. (1982), Deal et al. (1982) and Ouchi (1981), in their respective corporate studies. Firstly the conceptual framework of the quality analytics research was thoroughly examined and then hypotheses relating to Strategic Management, human resource development, process management, risk management, customer relationship management (Parast, M. M., et al. 2006) and elements of business analytic (Trkman, P., et al. 2010) were developed to know and explore their relationships. As discussed above the research will also focus on experimental study methodology which comprised on collection and analysis of quality management analytics data.

3.2 Research Philosophies

The researcher always conduct their research following some particular procedures for the work. Researcher make claim for the knowledge developed based on set guidelines that describe the knowledge along with the mechanism how it was developed (Bryman 2012). The philosophy was elaborated by Oxford English Dictionary 2005 like "the study of the fundamental nature of knowledge, reality, and existence". This further can be discussed as, the scholar's judgements on a specific topic explain reality. In other words, philosophy elaborate states of knowledge which trigger the reasoning about reality of some phenomena. So, to study characteristics of reality or things which make up the reality is known as Ontology. On the other hand, theory of knowledge related to kind of the knowledge scope or range is called epistemology (Weber 2004). Furthermore epistemological principles address knowledge in such a way that take quantitative approach sum up the knowledge around time, value and context free generalization (Weber, 2004). Ontology and epistemology are the two disciplines which distinguish between two main research approaches which are the qualitative and the quantitative approaches (Henderson, 2011).

The association among data and theory is a long-standing question that philosophers have been debating for many decades. Failure to concentrate on a philosophical problem could significantly impact the management science research, as they are central to the notion of research design (Easterby-Smith et al. 2002). The particular awareness related to philosophical concerns can help the researchers: to clarify the research design i.e. not only looking at the evidence gathering and its interpretation, but also having the ability to answer the basic questions being investigated in the research; to choose an appropriate design for their work; and to identify and create designs that may be outside their past experience (Saunders et al. 2007). This chapter also gives an introduction to the research process, followed by discussion on research purpose, research paradigm, and research approach. The methodology section of the thesis is a significant portion of the study as it helps to decide the correct choices of research paradigm based on the rationalization of research needs.

In management sciences and organizational studies the researchers Peters et al. (1982), Deal et al. (1982) and Ouchi (1981) advocated the Positivist paradigm. Moreover, the approach provided by Lincoln and Guba (2000), discussed some of the major thoughts to elaborate major

theoretical models of positivism, post-positivism, critical theory and constructivism. This study is based on the Positivist paradigm. Constructed on the related study literature the theoretical model of the QMA research study was developed and hypothesis for business analytics, quality management practices and perceived firm performance were also developed.

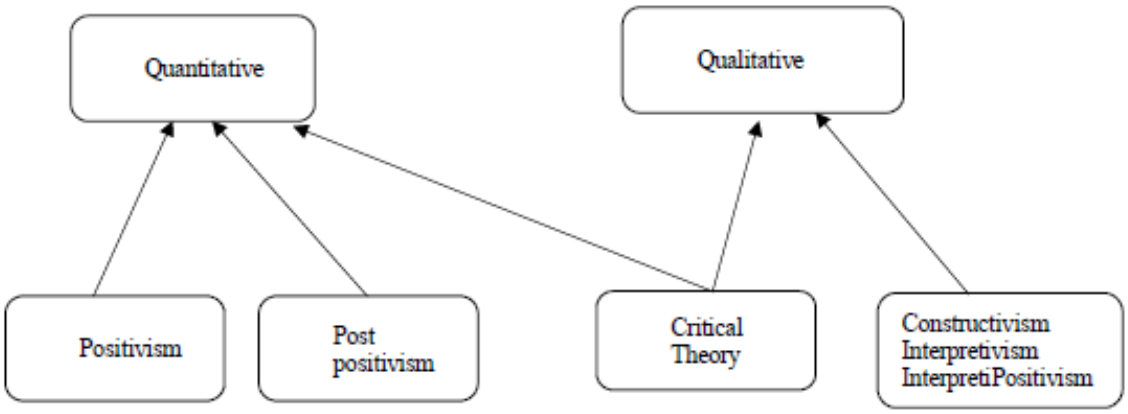

Figure 3.1: Qualitative and Quantitative Research - Epistemological Assumptions

Source: Alvesson and Skoldberg (2009) and Creswell (2009)

The Positivism basically grounded in Latin word poistum meaning put, set, place, or lay. This further elaborates that in case somewhat "is kept, established or worked out; then this element requires to be based on real facts or data, and this need to be available or placed in front of researcher (Bryman et al. 2011, Alvesson et al. 2009,) were of the view that positivism line of thinking adopts a significance (objective approach for physical sciences in research findings designed to explain truth. Then in another report, it was addressed that the investigator and the study objects were regarded as two completely separate things with out any effect or legitimate interaction between each other, which was called a one-way object method (Guba et al. 1994).

Creswell (2009) stated that post positivism approach of quantitative methods was presented in the beginning of nineteenth century, the assumptions related to post positivist are representing the traditional type of research studies. Such assumptions of post positivism work in a best way for quantitative type of research than qualitative one. Bryman and Bell (2011) have further discussed with their views connected with Post-positivism that a positive sentiment about the research knowledge cannot held by researcher while conducting research

for human behavior. Here similarities are found with positivism approach, that states social phenomenon are independent of its connected actors because the concept here relies on objectivism. In the approach, there is only difference in way of investigation that often emphasize on the falsification of conceptual theories or hypotheses instead of simply on the proof of the cause-law impact. So, in other words post-positivism gives birth to another paradigm which help shifting positivism focus from a narrow perspective into a more broader sense to observe problems in a real world scenario (Karla A. Henderson 2011).

Historically the critical theory has its connection with prominent critical theorists of original Frankfurt School. Horkheimer et al. conducted the methodical work in order to apply customary experimental study techniques to further refine and test proposition which was originally taken from the Marxist tradition (Asghar, J. 2013). As also illustrated in the research work of philosopher Roy Bhaskar, which was partially favored From Marx's point of concept of scientific knowledge, either positivism or interpretivism have been used as both superficial and non-theoretical in their research approach (Alveson et al. 2009). The followers of the study are of the view that alongside explaining the world it is equally important to change this. In this connection

3.3 Sampling Methods

The safest and optimal approach for any research research is to find the issue in the population as a whole. In fact, however it is often not practical to study the whole population. Optionally, the researcher analyses a "sample" that is reasonably big and indicative of the overall population. The sample is known as a subset of the population selected to be generalizable. (Dawson B et al. 2004). Through selecting a random sample, we can lower the cost involved, the time needed to carry out the study and also the personnel required to carry out the analysis. The representativeness of the sample involves three elements: 1) sampling process 2) size of the sample taken and 3) response rate. Methods of sampling should be structured and defined in such a way as to as to draw relevant inferences from the sample. In general, probability sampling are graded as the likelihood sample and the non-probability sample.

Anita S Acharya et al. (2013) and Baridalyne, N (2012) elaborated the probability sampling as being the gold standard in sampling methodology that carefully ensured generalizability of the study results to the target population in as as effective way as possible. With sampling technique, we indicate that each member of the population will have an equal chance of being chosen in the sample. Probability sampling would be further described as simple random sampling, Systematic random sampling, Cluster sampling, Stratified random sampling, Multiphase sampling and Multistage sampling methods.

3.3.1 Selection of Positivist Research Approach

Depending on the study requirements and issues being discussed and on previous literature, a positivist method has been adopted. The positivist approach has been elaborated by the Hirschheim (1992), is as "the reasons for a problem based on a deductive process". Bryman (2011) and Creswell (2009) identified that there are three fundamental elements in the positivist/deductive approach that are required to assess the associations via developing the study hypothesis/model through the method of quantitative research approach as well as value-free clarification offered by the scholars on related study issues. This can be known from Alveson et al. (2009), Bryman et al. (2011) and Creswell (2009) in describing the theoretical framework that a particular sample was found to be optimistic because the study looked at the relationship between variables using quantitative measures to generalize hypotheses in a given batch to a larger population. In addition, the research methods currently offered under positivism include observation, assessment, and distribution of open - ended questions, on-site experiments, experiments and case studies (Mingers, 2003).

The main objective of this analysis is to determine the impact of business analytics led quality management systems (including the selected elements strategic management, human resource development, risk management, production operation management and customer satisfaction management) on firm performance. Where the mediated impact of business analytics has been investigated on the QMS and from performance. In this It is advised to examine a positivist approach. As Orlikowski et al (1991) have stated in the conduct of positive ontology research, the researcher's obligation is to define factual physical and social realities through the use of appropriate methods to identify those particular aspects of reality that are being examined by the investigator. The current study as well utilises positivist epistemology as suggested by Chua (1986), who defined information as true or false by means of empirical

results and a hypothetical deductive method. In the ongoing study, Chua's (1986) criteria for the deployment of a positivist concept are specified as the ultimate target of the research, that is to identify factors that affect organizational effectiveness. Thus in order to meet the objectives, a conceptual structure must be established which clearly defines the variables and their associations, including dependent, autonomous, mediating and moderating variables..

Aliyu, A. A. A. Et al. (2014) addressed, positivist approach emphasises that factual, actual and proof can be evaluated experimentally, objectively and empirically, and can be explained by a lucid and rational investigation and research. The key element in evaluating and assessing the soundness and validity of systematic empiric and logical theory is whether the researcher's point of view (i.e. theory based on assumptions and assumptions) is plausible, consistent and accurate through the ability of knowledge researchers to achieve their senses. Positivist research approach and methodology (methodological uniqueness) highlights micro-level testing and discovery as an environment that decreases the intricacy of the outside world (e.g., interpersonal, psychogenic, and financial relations between unemployment, and infringement or suicidal behavior). Strategies are then arranged on the basis of the "scientific and logical method" (e.g. career preparation and teaching for unemployed people, antidepressants in the depths of hopelessness, and prison period for the criminals and gangsters).

3.4 Rational of the Method Selected

Research consists of quantitative methods to look at quality management and analytics practices as well extent of innovative use of the information to enhance performance and its sustainability.

3.5 Research Design

The study scheme could be denoted the similar to a normal framework being used for some investigations. The design of the research help us know the general information and provides readers with structure on how data pertaining to study will be collected and analysed (Nazarian, 2013). In research studies five major organizational research designs make up the way to move forward which are experimental, qualitative, action, case study, and survey

research (Bryman 2012). As per the set objectives of this study in order to test the impact of variables the survey method was used and data collected using structured questionnaire. In this study, the quality management system (QMS) and Business Analytics (BA) as Quality Analytics usage will be investigated in all types of industries across the Pakistan. It will be ensured that the project meet the set research objectives.

3.6 Population

The study comprised on the professionals working across the Pakistan at Quality Management, Manufacturing or Operation management as well as Supply Chain Management departments (including manufacturing/operation managers, HR development, improvement managers, TQM promotion managers, customer services, business intelligence & analytics, analysts, healthcare quality, health safety environment, logistics, warehouse professionals etc) having at least one year experience in their disciplines will be touched upon through structured questionnaire to know depth of their current practices, industry trends, future dimensions and to further evaluate their systems through structured questionnaire design.

3.6.1 Sample

In quantitative studies general protocols are observed to move forward, so, the study employing the same protocols has used probability method of study. Rehman A. (2013) has described in his study that probability sampling methods offers more scientifically proven evaluation outcome as compared with non-probability sampling methods which are less costly and less time consuming but data evaluation there are highly vulnerable. The survey instrument derived from the research study of P. Trkman et al. (2010) and Parast, M. et al (2006) is being used in this study as both were validated. The survey instrument was distributed to 1000 respondents in the country using cluster sampling method. The participants detail were accessed through the Federation of Pakistan Chambers of Commerce and Industry (FPCCI), Pakistan Institute of Management (PIM), PIQC, QSi's members/clients, SGS and TUV-Austria client organizations' data across the Pakistan. QSi (2019) quality summit for Pakistan informed that there were almost 2400 QMS certified organizations in Pakistan. So, the total population of QMS professionals ascertain from the quality summit found as at least 2400 are working to administer QMS and BI activities in there related companies. The online questionnaire link

was sent through email. Questionnaire was comprised on three parts. First part of the survey instrument addressing demographic related information of the study required from the respondents includes, type of the organizations i.e. the sector in which the organization operates, departmental affiliation and experience of professionals in deploying improvement practices, professional qualification, certification, designation, hierarchy level, salary range etc.

Second part was containing questions related to the Quality Management Systems (QMS) practices management and leadership, human resource development and professional career growth, process management, performance management, risk management. The questionnaire was adopted from the research conducted by Parast et al (2006). The third part of the study derived from study Trkman et al. (2010) was comprised on questions from Business Analytics (BA) practices like analytics capability of plan, analytics capability in source/suppliers' related operations, analytics capability in manufacturing or operations, analytics capability in delivery or dispatch and analytics capability in marketing. To ensure credibility of the study a seven point Likert scale was used. Cox EP (1980), Chang L. A (1994) and Pearse N (2011) discussed in their studies that 7 point Likert scale is more appealing as this provide better description and options about the selected topic of study. Pearse N (2011) pointed out the problem with a five point Likert scale where responses may fall between two of the descriptive choices. On reverse or repeated questions the respondents may choose response 3 instead of 4 when he/she think to lie in between the scale on a five point Likert. It was also discussed that 7 point Likert scale usually perform better than a five point Likert scale.

So, a seven point Likert scale was used in this study to get responses from target population on BA and QMS practices elements. The scale values were ranging from 1 = Strongly disagree, 2= Disagree, 3= Somewhat disagree, 4= Neutral, 5= somewhat agree, 6= Agree and 7= Strongly agree. The validity of the survey instrument has been thoroughly described in the work of P. Trkman et al. (2010) and Parast, M. et al (2006). Senior, middle and junior management layer employees including supervisory staff members (senior non-management employees) were surveyed for the study on cluster random sample basis for Pakistan population.

Anita S Acharya et al. (2013) pointed out in their study that in cluster random sampling methods, target population is distributed into groups or clusters, this is usually done on

geographic area basis. Anita S Acharya et al. (2013) discussed that researcher will follow 2 steps process first by dividing population into groups and then take all or randomly selected individuals from the selected groups/clusters. Cluster sampling is helpful when target population is spread widely across the regions and the study is conducted on a wider national/provincial level. Cluster sampling will appropriately assures representation of all groups in the population. Etikan et al.(2017) portrayed that cluster sampling technique is very appropriate to use for population spread over a large area. In this way researcher can divide the geographic area in smaller portions of the large area and then randomly take sample from the smaller units. This will reduce the associated costs and help assure representation.

Summary number of organizations in each cluster (province). Under the economic survey report (2018), SMEDA (2019) Pakistan's major industries are divided into 41 different trades which are operating in all four provinces in the country. Under the provincial autonomy each province has divided following scheme was utilized to collect the data. Ashraf, M. I. (2016) briefed in his research work that each province in Pakistan has independent structure to manage and control industrial practices. So, each province based on language, management styles, rules and regulations may be treated as an independent mega industrial cluster.

3.6.2 Sample Size Justification

Professionals working across the Pakistan mainly in the fields of Quality Management, and Operation management (manufacturing/operation managers, improvement managers, TQM promotion managers, customer services, business intelligence & analytics, analysts, healthcare quality etc.) having at least one year experience in their disciplines were added. The aim of choosing this population/sample was to ensure a representative, accurate data analysis. Gaining useful data for this study involved a wide range of responses within each participating organisation using quantitative research methods. It was therefore agreed to include a smaller number of organisations (where QMS procedures are better implemented) in order to reduce the risk involved in the sampling method used, where certain respondents could not respond correctly and on time, which would result in a lower response rate. It may be questioned if the samples were representative of the total population of organisations and industries in Pakistan, but the researcher was willing to take that risk in order to ensure a high response rate for each company. (Creswell, 2009; Bryman, 2011).

3.7 Questionnaire Design

The study questionnaires were adapted from the following sources;

Table 3.1: Questionnaire Detail

Variable	Element	No. of Questions	Source
QMS	SML, HRD, POM, CSM	34	Parast, M. M., et al. (2006)
	RM	06	Chen, J. et al. (2013)
BA	PA, SA, POA,DA	19	P. Trkman et al. (2010)
	MA	05	Germann, F. et al. (2013)
PM	PM	16	Abu Hasan, Norhafizah (2016) Adeleke, O. M. et al. (2020) Al-Majali, F. (2013)

Table 3.2: Summary of the variables in this study

Independent Variables	Description	Number of Items
Management & Leadership	This is related to the professionals' ability to express organizational vision and manage staff accordingly	8
HR Development and Professionals' Career Growth	Development of HR competencies and growth opportunities in the organization	9
Process Management	Alignment of business processes with organizational goals	10
Risk Management	Extent of risks identification, evaluation, prioritization and mitigation practice	6
Customer Satisfaction Management	Monitoring and analyse activities the customer specific activities, gathering feedback and making arrangements to achieve customer specific goals	7

Plan Analytics	Analysis for planning function pertaining to products and services on the basis of business reports	5
Source Analytics	Analysis for procurement function pertaining to searching, negotiating and evaluating the suppliers to improve performance	4
Production/Operation Analytics	Manufacturing or processing each item/transaction with respect to time taken	5
Delivery Analytics	Analysis of dispatch function to bring products and services in market efficiently	4
Marketing Analytics	Analysis of marketing function, promotional schemes, customer focus, advertising	5
Dependent Variables		
Perceived Firm Performance	Organizational performance with respect to determined areas of firm outcomes which in this case is financial performance on the activities/objective achievement	16

In every research study the most important element considered while generalizing results always based on independent variables and study observation. Alireza Nazarian (2013) concluding their research pointed out a general rule that there should be 5-1 ratio of the cases attached to each independent variable. This can be further explained that each independent variable require at least 5 observations or responses. Schreiber et al. (2006) pointed out in their work that ten observations per free parameter need to be worked out will suffice as an agreed on value. In reference to above recommendation and under given independent variables of this study there need to be at least 150-200 respondents. In the current study, the number of respondents are above 400 which is above even good level of respondents.

As per the world fact book (2016-17) Pakistan's economy is divided into three broader categories i.e. services, manufacturing and agriculture. The organization selected and reached for the study are from industry and services sector, both constitutes 75.6% of our economy as per economic survey (2017-18). The senior, middle and junior management layer employees including supervisory staff members (senior non-management employees) were requested to participate in this study. Senior non-managerial staff members, junior managers, senior management teams and top management have been requested to take part in the study and

respond to the questionnaire. During the study and data collection, the researcher told the respondents that the data obtained would be confidential and would only be used for academic purposes. In the first stage of the analysis, the companies were divided according to their scale (micro, small, medium, or large). The study participants were also requested to provide detail of their demographics characteristics. Like type of organisation, department where respondent is serving, gender, age, education level, job titles/designation, and respondents total experience, city/province, years of QMS and BA practices implementation in the company, number of employees.

3.6.3 Pre-Testing the Questionnaire

Hair et al. (2007), discussed in their research that survey pre-testing is requirement before proceeding for actual study. The purpose of pre-testing has always been to make sure the consistency, accuracy of the responses as well as to ascertain are the questionnaire items clear, understandable and to make sure whether the study instrument moving as per planned procedure. The will also support to fine tune the instrument to prevent any critical complexities later on. In pre-testing a small sample of participants is chosen which have similar feature as that of actual target population. In their study, Hair et al. (2007) recommended to conduct the pre-test with 04 to 30 participants as the sample size larger than 30 will not result in additional benefits. Therefore, in the current quality analytics study, pre-test was arranged to found face validity of the selected items. The questionnaire was sent to 05 deputy/assistant managers, 05 managers and 05 divisional heads working in various sectors. Moreover, 05 questionnaires were sent to quality and analytics senior faculty members each of PIQC and PIM Institutes. The readability of the items, adequacy of the words and overall clarity was assessed by the researcher. The feedback received from participants was used to further fine tune the questionnaire.

3.6.4 Pilot Testing

The pilot testing was conducted for the study by receiving 06 completed questionnaires from quality experts (HODs and Managers) and 05 were received from PIQC Institute for Quality senior faculty members. The results were found satisfactory.

3.7 Methods of Statistical Data Analysis

The edition 22 of Statistical Package for Social Science (SPSS) and the Partial Least Squares Structural Equation Modeling (PLS-SEM) tools have been used to analyse the data collected in this report. SPSS was used to evaluate the characteristics of the sample data (Hair et al. 2007), while PLS-SEM was used to assess the hypothesised relationship as part of the proposed study model. (Hair, Hult, Ringle, & Sarstedt, 2014; Wong, 2013). Structural Equation Modeling (SEM) is known as the 2nd generation multivariate data analysis strategy used to control the constraint of the 1st generation tools. It is among the most impressive statistical tools in social and management sciences discipline equipped for testing the connections between numerous factors instantly (Hair, Hult et al. 2014).

This examined the "structure" of interrelationships communicated in equations that are practically identical to regression equations. SEM is frequently applied in studies to look at hypothetically direct and added underlying framework (Haenlein et al. 2004). The SEM technique is a blend comprised on variable analysis as well as different regression equations. Two unique variations of SEM analysis are indicated by Hair, Hult et al. (2014), which are, Covariance based (CB-SEM) and Variance based (VB-SEM) (known as PLS-SEM). The goal of CB-SEM is to repeat the hypothetical covariance grid or matrix, without concentrating on explained variance. It is principally used to affirm (or dismiss) speculations by deciding how much a suggested hypothetical framework will test the covariance matrix of the study sample. Conversely to this, PLS-SEM means extending the explained variance of the endogenous variable. For the most part, it is used to build theory in exploratory research by focusing on the clarification of fluctuations in regressors.

Past investigations have broadly centered on CB-SEM, despite the fact that the two methodologies (PLS-SEM and CB-SEM) share same types of foundations (Hair, Sarstedt, Ringle, and Mena, 2012). Though, the utilization of PLS–SEM has developed and will be progressively embraced as a key statistical technique in light of its particular methodological characteristics that make it an important and potential option to CB-SEM methodology from others (Hair et al. 2011, 2012, 2013; 2014). As per Hair et al. (2011), PLS-SEM is reasonably and essentially like multiple regression as the primary goal is to amplify the explained variance in the dependent variables and to examine the data quality as of measurement model features.

Subsequently, PLS-SEM was utilized to conduct data analysis in this investigation. As indicated by Hair, Hult et al. (2014) and Reinartz, Haenlein, and Henseler (2009), PLS-SEM stat software features include extremely efficient model predictions with normal data and extraordinarily non-normal distributional properties.

It has less severe presumptions of the error terms and variable distribution (Henseler, Ringle, and Sinkovics, 2009). The estimation error is dealt with inherently where it is available in the latent variable scores and is eventually revealed in the path coefficients that are assessed utilizing these scores. Whereas the error creates bias on the model assessments which is known as PLS-SEM bias, simulation researches demonstrated that the bias is mostly at exceptionally low levels and along these lines not meaningfully noteworthy (Reinartz et al. 2009). PLS-SEM likewise shows a higher level of statistical power in theory assessments as contrasted with CB-SEM (Hair, Hult et al. 2014; Reinartz et al. 2009). PLS-SEM path model will be an effective solution to complex issues if appropriately utilized, to gauge causal models in numerous hypothetical models and experimental assessment (Hair et al. 2011). Additionally, PLS-SEM results exceptionally approximate CB-SEM outcome. The following area talks about PLS-SEM procedure in detail.

3.7.1 Partial Least Squares Structural Equation Modeling (PLS-SEM)

In 2014 the Hair et al., discussed that PLS path model have two basic elements: first one is a measurement model (known as outer model in PLS-SEM) and secondly a structural model (this called inner model in PLS-SEM) (see Figure 4.1). Measurement model of the constructs is utilized to highlight the proposed relationship between the construct and its elements. Hair et al. (2017, 2016) and Ali F. et al (2018) has pointed out in their studies that PLS-SEM has edge over other methods like CB-SEM as it is free of distributional assumptions which create confusion and effect analysis quality which was the valid reason that PLS-SEM techniques was also followed in the present quality analytics study. Other methods are sensitive to distributional assumptions and need larger samples.

The application used to analyze the data was Smart PLS which was reported by prior researchers (Hair et al. 2017, 2016; Ali F. et al 2018) as very user friendly, quick data analysis and can be used with minimal training. Other applications like AMOS, Statitica, LISREL were

observed to be time consuming and provide satisfactory results in cases where sample sizes are large (Ali F. et al 2018).

Basically, there are two different measurement models. The reflective and formative indicators are two different models. As per Hair, Sarstedt et al. (2014), reflective indicators depict the directional arrows from the construct to its indicators. This highlight the theory that construct causes the covariation of the indicator variables. Meaning thereby, reflective items are exchangeable, very consistent and may be removed even without changing the construct meaning.

Secondly, formative model depicts directional arrows from the indicators to the construct, developing causal (predictive) relationship where indicators cause the construct. Removal of any item means deleting a part of the construct. That shows altering any indicator may cause change to the underlying construct. Structural model highlights the relationships (path) between constructs. PLS-SEM can only be used to depict the recursive relationships in structural model. So, structural paths can only lead in a single direction between constructs. Two constructs known as exogenous and endogenous are present in the structural model. Exogenous means independent variable that show the latent variables where arrows point out of such variables and no structural path relationship points toward such variables. On the other hand, 'endogenous' means a dependent variable that shows inherent data points in the conceptual framework that are controlled by several other variables through the structural model relationship (Hair et al. 2014). Chin (1998) and Henseler et al. (2009) described the two-stage process of the PLS I evaluation of the consistency and validity of the measures and (ii) evaluation of the structural equation model. Both are being described here as;

3.7.2 Assessing the Measurement Model (Outer Model)

The assessment of the measurement model included in the assessment of the validity and reliability of the items. During the evaluation of the model, its items are evaluated separately on the basis of established quality criteria such as reflective measurement and formative measurement models. As per Hair, Hult et al. (2014), study on assessment of reflective measurement model, researchers are required to confirm the reliability and validity. Firstly, through use of composite reliability (CR) that help in assessment of the internal

consistence reliability of the construct that was usually evaluated through Cronbach's alpha. Composite reliability (CR) values show the degree to which the build objects repeatedly illustrate the same latent structure. Composite reliability usually focuses on evaluating the reliability of the construction, which refers to the approximate internal accuracy of the construction.

This was important to mention here that composite reliability through PLS-SEM model is more effective way to conduct reliability measure as compared with Cronbach's alpha. As composite reliability (CR) is focused on the individual reliability of the approximate model of indicators that assume the concept that all indicators have different factor loads (Hair, Sarstedt et al. 2014; Henseler et al. 2009). On the other hand, Cronbach's alpha estimates the reliability, which consists of the inter-correlation of all the variables of the construct, taking into account the concept that all indicators have equal loading. Apart from this, Cronbach's alpha is very sensitive to the number of elements in the construction and is likely to understate the internal consistency of the implicit constructions (Hair, Hult et al. 2014). Due to the fact, CR values have been found providing a better estimate of variance as a result of respective indicators in the PLS-SEM model and it a limitation in Cronbach's alpha (Hair, Hult et al. 2014; Hair, Sarstedt et al. 2014).

Secondly, assessment of reflective variables effectively assesses validity. In addition, validity can be measured in two ways, one of which is convergent validity and the other is discriminatory validity. Convergent validity indicates the degree to which several research items have been established, evaluating the same definition in agreement with each other. This is fitting, as implied in the principle that objects should be connected to each other. Outer loadings of the derived variables and average variance (AVE) are used to determine convergent validity. It has been stated that the cutoff values recommended for outer loading must be greater than 05 (Hair, Hult et al. 2014). Loadings between 0.4 and 0.7 may be considered for removal if they increase the average variance extracted or the composite reliability by more than the recommended value. Variables with loads below 0.4 must be deleted from the measurement scale (Hair et al. 2011; Hair, Hult et al. 2014). AVE denotes the large mean value of the measured loads in the set of variables and is equal to the sum of the squared factor loads for the variables referred to as the commonality of the construct (Hair et al. 2014). AVE evaluate the degree to which a latent construct explains the variance of its objects" (Hair et al. 2014). If

the AVE values are more than 0.5, they point out that the latent constructs will describe more than half of its indicators on average (Hair et al. 2011; Henseler et al. 2009).

With AVE values less than 0.5, variance in the items show error and remain unclarified describing that construct describes less than half hald. Convergent validity is accepted only if items have outer loadings above 0.5 and AVE for each construct is 0.5 or higher. Discriminant validity quantifies how much the construct overall vary from different other constructs, as far as the amount it correlates with different constructs, along with how much indicators highlight a single contruct in a study" (Hair, Hult et al. 2014). This implies the construct estimates what is expected to quantify. A construct is seen as unique in relation to different other variables when the square root of AVE has been more than its association with some other latent variables. There are two main methods in place to determine the discriminatory validity of the major variables. First technique is cross loadings of the variables and second is through Fornell-Larcker model (Hair, Hult et al. 2014). The distinction between the two techniques were cross-loading is assessed at the level of indicator or variables, on the other hand Fornell-Larcker models is analyzed at the degree of constructs.

Conversely, to measure the reliability and validity of the formative model, the reflective scale's measurable statistical assessment rules can't be essentially replicated to formative scale. A formative construct mentions the variables that cause the latent variable and can't be exchanged among them as they are not usually interrelated. Besides, formative indicators are thought to be error free (Edwards Bagozzi, 2000). Moreover, there is no prerequisite for describing variable reliability, internal consistency reliability and discriminant validity. This is due to the reason that external loading, composite dependability, and square root of the average variance extracted (AVE) are not implied for a latent variable with uncorrelated measures. As another option, the evaluation of formative scale is increasingly founded on theoretical contemplations and professional opinion about the causal need between the indicator variable and the latent construct (Diamantopoulos and Winklhofer, 2001). However, PLS-SEM proposes certain factual rules for estimating the nature of formative estimation. In that regard, there are three stages associated with surveying formative measures: (a) evaluation of weight significance; (b) evaluation of collinearity; and (c) evaluation of the relationship of the indicators with the latent construct. In the first place, the significance of the weights is evaluated by utilizing a bootstrapping method to compute the significance of path coefficients.

The related coefficients for the formative connections are called outer weight in PLS-SEM (Hair, Hult et al. 2014). To confirm formative measures, collinearity between indicators is regarded as a major problem. To inspect collinearity, variance inflation factor (VIF) is measured and this evaluation is attempted in SPSS. Then, the relationship of the indicators with the latent construct measured to know the absolute contribution. The following table highlight the essential accepted values to assess the measurement model.

Table 3.3: Measurement Models assessment Criteria

Criterion	Description
Reflective measurement model	
Internal consistency reliability	Composite reliability is required to be more than the recommended value of 0.70.
Indicator Reliability	Indicator loadings are recommended to be more than a cutoff value of 0.50.
Convergent Validity	AVE must be more than 0.50.
Discriminant Validity	Square root of the AVE is computed that should be more than each of the construct correlations (Fornell-Larcker criterion). Indicator's loading is required to be greater than all of its cross loadings
Formative measurement model	
Outer weight	No minimum threshold values for indicator weights have been set up.
Variance Inflation Factor (VIF)	The VIF should not be greater than 5

Source: Hair et al. (2014; 2011)

3.7.3 Assessing the Structural Model (Inner Model)

When the internal consistency of the reflective constructs are seen a few measures should be considered to measure the hypothesised correlations of the inner model (structure model). Measurement of the structural model shall require an evaluation of the relation between latent constructs and other latent constructs where the hypothesis testing is performed. By performing the PLS-SEM algorithm and bootstrapping, the structural model is evaluated (Chin, 2010). The following approach was used to help the evaluation of the PLS structural model: coefficient of determination (R2), effect size (f2), value of the direction coefficient, where R2 indicates the predictive intensity of the endogenous structure of the structural model. It tests

the accuracy of the forecast model. We may argue that it shows the integrated impact of exogenous variables on the endogenous variables (Chin, 2010; Hair, Sarstedt et al. 2014; Henseler et al. 2009). R2 shows the variance in the endogenous that is clarified by the exogenous constructs. The key target construct level of R2 ought to be high, which goes from 0 to 1, with 1 demonstrating total predictive precision (Hair, Hult et al. 2014). As indicated by Cohen (1992, 2013), R2 estimations of 0.26, 0.13, or 0.02 may be a general guideline to portray significant, moderate and weak degree of predictive precision. For Chin (2010), estimates of R2 of 0.75, 0.50, or 0.25 for endogenous latent variables are considered to be substantial, moderate, and small.

Second, the indicator constructs can be evaluated by utilizing the effect size (f 2) of (Cohen, 2013). f 2 mentions the effect of exogenous latent constructs on endogenous latent constructs through the difference in R2 (Chin, 2010). f 2 can be estimated by taking a gander at the progressions in R2 when certain constructs are deleted from the model. To compute f 2, a researcher requires to assess two path models in PLS. The first path coefficient has been the entire model as determined in the hypothesis, precisely the R2 of the full model (R2 encompassed). The following path model should be a similar model, avoiding the exogenous design chosen to be omitted from the model, to be the same R2 of the shrunk model (R2 excluded). In view of the estimate of f 2, the effect size of the deleted constructs on a particular endogenous construct can be determined at 0.02, 0.15 and 0.35, respectively, in terms of small, medium and significant effects (Cohen, 2013). This suggests that, if the exogenous construct contributes substantially to the clarification of the endogenous structure, the contrast between the R2 included and the R2 prohibited will be strong in f 2. The equation to figure out the effect size is as underneath:

$$f^2 = \frac{R^2\text{included} - R^2\text{excluded}}{1 - R^2\text{included}}$$

An additional evaluation of the structural model is to look at the significance level of path coefficients. Because, PLS-SEM doesn't assume data distribution to be of normal nature, so, the researchers are required to utilize the bootstrapping method to decide the degree of significance of the model. A bootstrapping methodology ought to be done to prevent inflated or deflated t-values, which can prompt Type 1 error if the data is not normal. Bootstrapping is

a re-sampling technique which makes an enormous amount of sub-samples of the original data set (with substitution) and gauges the model for each sub-sample. Along these lines, the testing professional has several samples (usually at least 5000) of the model tested, which can be used to measure the standard error for each model parameter. By building on the standard error, t-worth can be used to determine the magnitude of each factor. In this examination, an enormous number of subsamples (e.g., 500) was taken from the original sample with substitution to give bootstrap standard error, which thus gives approx t-values to test the significance level of the structural path. As per Chin (1998), 500 re-tests are normal recommendations for utilizing bootstrapping to gauge a parameter. Bootstrapping results roughly equivalent to the normal data. PLS-SEM analysis additionally weighs on the explained variance to build up the significance of all path estimates (Hair, Sarstedt et al. 2014).

Table 3.4: Structural Models Assessment Criteria

Criterion	Description
R Square (R^2)	Cohen (1992; 2013), described a general rule of thumb to denote R^2 values of 0.26, 0.13, or 0.02 of endogenous latent variables known as substantial, moderate and weak respectively.
Effect size (f^2)	$f^2 = (R^2 \ included - R^2 excluded)/(1 - R^2 \ included)$. As per Cohen (2013), f^2 values of 0.35, 0.15, and 0.02 are reflected as large, medium, and small, respectively.
Estimates for path coefficients	Criteria *t*-value for one-tailed test is 2.33 ($p < 0.01$), and 1.645 ($p < 0.05$). Criteria *t*-value for two-tailed test is 2.58 ($p < 0.01$), and 1.96 ($p < 0.05$).

Source: Hair et al. (2014; 2011)

3.7.4 Testing the Direct Effect – The Two Stage Approach

The present research requires to assess reflective and formative in the model as need to use reflective-formative type of hierarchical component model, as the direct measurement of hypothesis testing is not adequate (Hair et al. 2013). As the usage of recurrence indicators will prompt all variations of the higher order variable that is explained by its lower order variable

component (R2 values approximately 1.0). Thus, the path relationship from the latent variable to the endogenous higher order part is in every case is very nearly to zero and non-significant. Along these lines, to examine the hypotheses, this examination utilized a blend of repeated indicator method and the utilization of latent variable score of the two-phase approach, which is also utilized by the two-phase approach in the mediator analysis in PLS-SEM (Henseler and Chin, 2010). Normally the 1st stage, latent variable scores for the lower order part should be adopted utilizing the repeated indicators strategy. Afterward, these scores are utilized as apparent factors in the estimation model of the higher order component, in the subsequent stage. In this way, the higher order segment is installed in the nomological net in a way that empowers other latent factors to clarify a portion of the past variations, which can bring about a significant path relationship (Becker et al. 2012; Chin, 2010; Ringle et.al 2012).

3.7.5 Testing the Mediating Effect – Bootstrapping the Indirect Effect

The importance of the relationship between variables must be measured in order to evaluate the results of mediation. As stated by Preacher and Hayes (2004), "mediation" is a specific case of "indirect effect". In recent time, Hair, Hult et al. (2014) stimulated the use of bootstrapping for mediation research by expressing that when checking the mediating effect,' the researcher ought to rather follow Preacher (2004, 2008) and bootstrap the sample distribution of the indirect effect, that adequately serve for simple and multiple mediator models". This methodology gives a progressively better strategy than the "causal technique" promoted by Baron and Kenny (1986) since SEM can test the relationship of factors instantly (Hair, Sarstedt, Ringle et al. 2012; Preacher and Hayes, 2008).

Noble and Kenny's (1986) methodology have gotten huge criticism because of low power and the several involved steps in the procedure which increases the existence of Type 1 error, which assumes that there is mediation when there really is no mediation effect. (Hayes 2004, 2008, 2009). Besides, a few professionals have likewise discussed that a significant complete effect of an indicator variable on the principle variable (which determined as c) isn't necessary for mediation to happen (Preacher and Hayes, 2008; Shrout and Bolger, 2002). In this way, inability to test the indirect effects without an absolute effect may make us overlook some of potential significant, important, or fascinating components through which the indicator factors may impose some effect on principle factors (Hayes, 2009).

The Minister (2004, 2008) argued that the path coefficient "a and the path coefficient "b" were normally distributed, while the consequence of "a*b" could not normally be distributed. As the online Sobel test relies on the normal distribution, the test should not be used as it may lead to improper results as the indirect effect is not normally distributed. This can influence "standard error". Subsequently, the system of "bootstrapping" ought to be applied to take care of the issue. In this regard, the current quality analytics research applied a new technique proposed by Hayes (2009) and Preacher and Hayes (2004, 2008) to quantify the mediating impact of the bootstrapping test called 'bootstrapping the indirect effect.' Bootstrapping, a nonparametric re-sampling approach, has been recognised as one of the more rigorous and robust methods (Shrout and Bolger, 2002; Zhao, Lynch Jr., and Chen, 2010). Furthermore this technique is genuinely suitable for PLS-SEM, because it has no assumption as to the distribution form of the variables or statistical sampling, and can therefore be used for small samples (Hair et al. 2014; Preacher et al. 2008).

As per Hayes (2009), there are a some phases recommended in measuring the mediating effects. In the first step, a model via SEM should be used to test the relation between the indicators and the mediator variable – path "a and the connection between the mediator and the key factors – path "b" for mediation decision. The bootstrapping is conducted to acquire the t-values in order to evaluate the direct association or relationships. Mediation test is proposed when the direct connections are significant. Second, when the bootstrapping is performed, at that point the 500 bootstrapped direct effects are created, for example path "a" and path "b. Since the indirect effects should be determined manually, for example the path coefficients for "a*b", the bootstrapping indirect effects for all the mediation hypotheses are made by taking the result of each indirect path.

Third, Standard Errors (SE) for every single indirect effect is determined. To figure SE, the fucntion "STDEV" in Excel spreadsheet is utilized due to the fact that data is now standardized in SmartPLS. At that point the SE is utilized to ascertain the t-values for every indirect effect. To ascertain t-values, the below given formula is used;

$$t = \frac{\text{Indirect Effect}}{\text{Standard Error}}$$

$$t = \frac{a*b}{Serror}$$

Then the last 4th point is to further confirm mediating effect, the 95 per cent bootstrapped confidence interval (95 per cent boot CI) for each indirect effect is calculated using the formula as given below:

Lower limit (LL)	=	a*b – Z (SE)
Upper Limit (UL)	=	a*b + Z (SE)

(Z value, for 0.05 level is 1.96)

Summary

This chapter has elaborated on the research framework, theoretical background of the study along with rational of the chosen method and research design. Moreover, study population, methods of statistical data analysis along with their justification were also highlighted.

CHAPTER FOUR: ANALYSIS AND RESULT

4.1 Introduction

The chapter describes the statistical data findings of the empirical investigation carried out in quality and analytics professions of industrial and service sector organizations in Pakistan. Findings present in the chapter were gathered from questionnaire distributed to the professionals. The data have also been used to triangulate the findings and approach facilitated to discuss unique issues that has been aroused as a result of data collection findings. The issues described were not predicted in the literature. The chapter comprised on three parts. Part one describes the outcome of descriptive statistics along with characteristics of study respondents. Then second part of the chapter explain the detail of measurement model assessment results. Third portion of the chapter deals with results of hypothesis testing.

4.2 Response Rate

To study the Quality Management & Analytics impact on firm performance 956 questionnaire were distributed to the senior executives, departmental heads, managers, deputy managers and junior staff members working in quality, production/operation, supply chain and business intelligence sections in three provinces (Punjab, Sindh, KPK) as well as Quetta city from Baluchistan province of Pakistan. Then the areas were selected from the provinces based on their dense industrial and corporate activities. The professionals working therein showed their interest to took part in the study. Table 4.1 highlight overall response rate of the sampled professionals in each province. Out of 956 sent questionnaires, 414 were returned back. Six cases were found incomplete and were omitted from the study. Remaining 408 questionnaires showing a valid response rate of 43% were utilized in the data analysis of study. The participants who couldn't returned duly filled questionnaires have not responded the subsequent their and onward fourth follow up calls/emails. Farouk et al. (2016) discussed in their study that response rate above 40% is termed as relatively high in case of self-administered questionnaire. Apart from this, Morton, S. M. et al. (2012) pointed out that although response rate above 10% is known as valid but response rate only is not the sufficient evidence to comment on quality or validity of a study.

Table 4.1: Response Rate

State/Province	Distributed Questionnaires	Returned Questionnaires
Punjab	413	195 (47.79%)
Sindh	391	166 (40.68%)
KPK	129	48 (11.76%)
Baluchistan	23	00
Total	956	408

4.3 Profile of Respondents

Table 4.2: Demographics

Demographic Variables	Categories	Frequency	Percentage
Gender	Male	378	92.65
	Female	30	7.35
Age	Under 30 Years	107	26.2
	30-39	138	33.8
	40-49	77	18.9
	50-59	57	14.0
	60 & Above	29	7.1
Qualification	Inter/Diploma	15	3.7
	Associate Degree	10	2.5
	Bachelors (BS)	112	27.5
	Master	262	64.2
	Ph.D	9	2.2
Designation	Supervisor/Technician/Ass	38	9.3
	Deputy/Asst. Manager	133	32.6
	Manager	109	26.7
	Head Of Dept./Division	72	17.6
	COO/General Manager	28	6.9
	Director/CEO	28	6.9
Employed at Dept.	Quality	259	63.5
	Production/Operation	87	21.3
	Services	36	8.8
	Supply Chain	26	6.4

Length of Service	1-2 years	18	4.4
	3-5 years	62	15.2
	6-8 years	56	13.7
	9-10 years	47	11.5
	11 & above years	225	55.1
(Total Employees at Respondents' Firm)	Less than 10	27	6.6
	10-49'	22	5.4
	50-249	65	15.9
	250-499	55	13.5
	500 & above	239	58.6
No. of Years QM Practices Implemented in Firm	1-2 years	14	3.4
	3-5 years	44	10.8
	6-8 years	16	3.9
	9-11 years	59	14.5
	12 & above years	275	67.4

In this part demographic profile of the respondents is being discussed briefly as also shown Table 4.2. This Table 4.2 highlight that more than 90% were the male respondents (92.65%) and just 07.35% were female who took part in the study. Low response of women is may be due to nature of the profession. Because in a related study Salas-Morera, L, at al. (2019) found the factor restricting women to enter the manufacturing/engineering related jobs. When age of respondents is discussed, it could be found that more than half were the young participants 245 (60%) under the age of 38 years, then 77 (almost 19%) participants were of 40-49 years old and 86 (21%) were above 50 years old. In terms of provincial relation, around half were from the province of Punjab (47.79%), from province of Sindh were (40.68%) and from KPK were only 11.76 % participants. On the educational qualification of the participants, it was found that 64.2 % were having master, 27.5 % had a bachelor's degree, 23.7% 49% secondary school, and 3.7 % were inter/diploma holders and 2.5%, 2.2% possessed associate and Ph.D degrees respectively.

In terms of participants' designations, study showed that 32.6 % were working as Deputy/Assistant managers, 26.7% were managers, 17.6 % were departmental heads, 6.9% each were COO/GM and Director/CEO whereas 9.3% working at Supervisor/Technician/Associate level. As far as the departmental affiliation of participants is concerned, it was known that 63.5% were employed at quality department, 21.3% were at production/operations and 8.8% were working in allied services departments (health safety environment, administration, marketing etc.) and 6.4% were appointed at supply chain and planning departments.

If we discuss the length of services of respondents it was found that more than half (55.1%) were having 11years & above experience, 15.2 % were possessing the 3-5 years' experience, 13.7 % were having 6-8 years' experience, 11.5% were working from the last 9-10 years and just 4.4% were having the 1-2 years' experience i.e. the minimum required experience in the study. While discussing the size of the organization where the participants were working it was known that 58.6% respondents were from the large enterprises i.e. having 500 & above employees, 13.7% were from organizations employing 250-499 employees, 15.9% were from medium size organizations that were having 50-249 employees, 5.4% were working at small size organizations having 10-49 employees and lastly 6.6% were from micro organizations with less than 10 employees. To know the quality management practices maturity level at participants' organizations, it was also surveyed, for how many years the organizations have implemented their selected quality management practices. The data may be required at some later stage to assess the maturity level and depth of quality analytics profession. It was healthy to know that more than half (67.4%) or the surveyed participants' organizations have implemented he quality management practice for he last 12& above years, the organizations where QM practices were implemented for the last 9-11 years were 14.5%, 6-8 years QM experience level were 3.9% firms, 3-5 years quality management practices experience were the 10.8% organizations whereas only 3.4% organizations were at the minimum required 1-2 years level quality management practices experience.

4.4 Non-response Bias

As the study data was arranged personally by the researcher i.e. from questionnaire distribution to filled questionnaire collection, so testing of nonresponse bias could not be

performed. Since all the professionals and senior executives were asked to return back the filled questionnaire in fourteen days. The respondents were adequately followed up during the period by the researcher himself. So, the difference between early and late respondents not a big issue.

4.5 Common Method Variance

Research studies come across with Common Method Variance (CMV) when variations are due to the instrument instead of real inclination of respondents that instrument tends to reveal. As per Podsakoff et al. (2003) CMV discusses the variance related to measurement method instead of the construct of interest. Research studies face the potential problem of variation when the assessment of dependent and independent variables are reported by a same single respondent (Podsakoff et al. 2003; Richardson, Simmering, & Sturman, 2009). In the case of this analysis, data for variables of the study was obtained from a single respondent and there is therefore a probability of common method variance. In accordance with the guidelines of Podsakoff et al. (2003) and Chang, Van Witteloostuijn and Eden (2010), it has been ensured that pre-and post-remedies are administered to mitigate the impact of CMV. As the pre remedial measure, different kinds of measuring scales were used and the labels of each section from start to end were removed in the questionnaire.

Researchers have administered pre-and post-remediation CMV to minimize (Chang, Van Witteloostuijn, & Eden, 2010; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). As more of a pre-remedial measure, all the labels in the questionnaire were eliminated and different types of scales were also used. Kock (2015) discussed the common method bias, especially in the field of structural equation modelling (SEM) via partial least squares (PLS-SEM approach. It was proposed that the typical method variance be tested by performing a complete collinearity test in the sense of structural equation modelling. So, under the recommendations of Kock (2015), existing research also deployed the same approach to identify common method bias through a technique known as variance inflation factors (VIF) prompted by mentioned full collinearity test. As a result of various studies' outcome, it was known that if the values of variance inflation factors (VIF) are higher than 3.3 this indicates that the model may involve common method bias (CMB). Contrary to this, if VIF values are lower than 3.3, model could be considered free of common method bias. The findings obtained in the current analysis showed that the VIF values for all constructs were lower than 3.3, which suggested that there

was no contamination of the traditional method bias in the present study. Therefore it is concluded that CMV was not a concern in the research.

4.6 Data Coding

After confirming the absence of non-response bias in the study, data coding process was performed by the researcher. Churchill (1999), highlighted that there are two major classifications of data coding. Firstly, we assign numbers or codes to each of construct for identification and problem free analysis. Then second category assumes that each construct has a unique pattern its own diverse section that asks questions about this particular construct. Therefore, this study arranged the questions in conformity with the constructs. All the variables used in this study were coded as shown in Table 4.3.

Table 4.3: Data Coding

Constructs		Code
Strategic Management & Leadership	IV	SML
Human Resource Development	IV	HRD
Customer Satisfaction Management	IV	CSM
Production/Operation Management	IV	POM
Risk Management	IV	RM
Business Analytics	Mediator	BA
Plan Analytics	Mediator	PA
Source Analytics	Mediator	SA
Delivery Analytics	Mediator	DA
Marketing Analytics	Mediator	MA
Performance Management	DV	PM

4.7 Preliminary Analysis

This section gives a brief discussion on the preliminary analysis using the SPSS before the assessments of the measurement model and structural model. The preliminary tests included

data screening, missing value analysis, outlier detection and fundamental statistical assumptions.

4.7.1 Data Screening

In order to move for various types of descriptive alongside inferential statistics, researchers are required to filter out their data. Main of objective of this step would to make sure that our collected data is accurate. It has been learnt through multiple studies that data screening or filtering out is of key importance (J. Hair et al. 2007). As the power of the implications extracted from inferential statistics outcome adequacy is mainly relying on if the key assumptions taken from multivariate analysis have been in compliance with rules or not ((Hoekstra, Kiers, & Johnson, 2012 and AlAnazi, A. A. et al. 2016). As the strength of the implications extracted from inferential statistics outcome adequacy is mainly relying on if the key assumptions taken from multivariate analysis have been in compliance with rules or not. But, the data screening literature points out that many studies were conducted where it has not been given if required assumptions are violated or followed (Hoekstra, Kiers, & Johnson, 2012). Moreover, the method verify that the information collected is in good state of accuracy. So, the researchers can proceed with all type of required tests of hypotheses. Given below measures were taken to ensure data screening:

4.7.1.1 Missing Values Treatment

Many tool and methods have been introduced in the previous researches to adequately solve the missing values. The experts in the field are of the view that any data with containing missing values would not be allowed to go for any of descriptive or advanced statistics tests. (J. Hair, Black, Babin, Anderson, & Tatham, 2010).In the work by J. Hair, Black, Babin, Anderson, & Tatham, 2010 it was recommended that researchers can deploy a very simple and basic technique of calculating “mean” and replacing the missing values with this provided the missing value not beyond 5% (Little & Rubin, 2014; Tabachnick & Fidell, 2007). As in the current quality analytics research, missing values were fewer than 5%. So, these were treated randomly through mean replacement measure as suggested above. On the other hand the researcher like Tabachnick and Fidell (2007) argued that the missing rate of 5% or less is non-significant. The table given below describe the missing values in the data sets. In current study,

it was found that only 18 values were missed by respondents (Table also provided in Appendix). Strategic management leadership and operation analytics each had 2 missing values whereas customer satisfaction management, human resource development each had 3 missing values and marketing analytics, performance management each had 4 missing values.

Table 4.4: Missing Values

Constructs	Missing Values
Strategic Management Leadership	2
Customer Satisfaction Management	3
Human Resource Development	3
Operation Analytics	2
Marketing Analytics	4
Performance Management	4
Total	18

4.7.1.2 Detection of Multivariate Outliers

Detecting outliers has always been a concern in management sciences. Barnett & Lewis (1994) has characterized outliers as an observation that is varying with the rest of the sample. In statistics, the outlier is known as it is an observation that exist at an abnormal distance from rest of observation in a collected sample. One may call this it is beyond the normal pattern of a distribution (Leys, C., Klein et al. 2018). As per above definition, it is now up to the researcher to choose the range of normal values. Prior to screen out the abnormal values, it is required to determine the normality of the data. The existence of outliers highlight that certain issues or problem may exist in the dataset. In accordance with above definition, outlier falls more than 1.5 times away the interquartile range below the 1st quartile or above third quartile.

The above description elaborate that presence of outliers in a study may bias the estimates of statistics analysis that cause unreliable findings (Verardi & Croux, 2009). To counter the impact of extreme observations of the items on mean, outliers in a study must be detected in an effective way (Sekaran, 2003). Many types of techniques and methods are in practice to detect and treat extreme end observations in a data. One of them is “Mahalanobis

distance statistical analysis" that has been employed in this research to identify the outliers. This is a preferred method used by many researchers for the detection of outliers Bulut, H. (2020). This useful technique has the power to identify values that are away from the data mean (J. F. J. Hair, Black, Babin, Anderson, & Tatham, 2006). Hence, the study has used "Mahalanobis distance statistical analysis" by using SPSS and no outlier was found for dataset. This study also deployed the modern Smart PLS3 (Qazi, A. et al. 2020 and (Ringle, Wende, & Becker, 2015) for the analysis of data as it is able to provide sensible outcome even with outlier values (J. F. Hair, Ringle, & Sarstedt, 2011).

4.7.2 Fundamental Statistical Assumptions

As discussed above the Smart PLS3 software has been used in this quality analytics study (Ringle et al. 2015) in order to effectively analyze data, as it is a non-parametric software that does not require to comply with statistical assumptions. But, it has always been vital to discuss some fundamental assumptions of normality and multicollinearity concerning the constructs to validate the results and to address occurrence of errors, if any (J. Hair et al. 2010; J. F. J. Hair et al. 2006).

4.7.2.1 Multicollinearity

When a high intercorrelations or inter-associations exists among the independent variables, this is called multicollinearity (Tabachnick et al. 2007). One also can call this disturbance in the study data, and if the issue exists in the study the statistical inferences drawn from the data may not be reliable. It was pointed out by Lavery, M. R. et al. (2019) and Tabachnick & Fidell, (2007) in their studies that multicollinearity issue among the study predictors may cause to escalate the standard errors of the coefficients and this also has an effect on the regression coefficients and statistical significance tests too (J. F. J. Hair et al. 2006). It is therefore often necessary to calculate multicollinearity before evaluating the proposed model in a sample. Table 4.5 indicates that the VIF values for all predictors in the sample were lower than 5, as indicated by J. F. Hair et al. (2011); thus the findings have shown that there is no multi-collinearity problem in the quality analytics study.

Table 4.5: Multicollinearity

Constructs	VIF	VIF
	Business Analytics	Performance Management
BA	-	4.375
CSM	2.972	2.973
HRD	3.029	3.056
POM	3.522	4.356
RM	2.835	3.646
SML	2.827	2.831

J. F. Hair et al. (2011) further informed about the causes of multicollinearity, some of the main reasons of multicollinearity in data may be due to use of dummy variables, adding such an variable which not computed directly but is computed from other variables, repetition of same type variable and study variables are found to be correlated with each other in the dataset. Lavery, M. R. et al. (2019) further discussed that partial regression coefficient of the study tend not to be estimated correctly due to the issue of multicollinearity and standard errors will tend to be high. Multicollinearity issue led to making it difficult to assess the relative importance of the independent variables in adding to variation in dependent variable. J. F. Hair et al. (2011) were of the view that if high multicollinearity is present in a study, the confidence intervals of the coefficients will likely to be very wide and relevant statistics measure will likely to be very small. This will lead to making it very tiresome to reject the null hypothesis when there is a multicollinearity issue in the study dataset.

4.7.2.2 Data Normality

As the data normality is of utmost importance for every study. Byrne (2016) discussed that the basic assumption required for (SEM) structural equation modeling is normality of data. However the strength of the problem is decreased if the least partial square-structural equation modelling approach is used in the analysis (J. Hair, Hult, Ringle, & Sarstedt, 2016). PLS-SEM uses the common bootstrapping technique to determine the significant interaction or relationship of non-normal data in the proposed model. One of the main advantages of using the PLS-SEM method is dealing with non-normal data situations and there is no obligation to

conform with its normality assumption in the PLS-SEM approach. (Bontis, Booker, & Serenko, 2007).

But beside this, J. Hair et al. (2016) made their suggestion and recommendations on the conditions when data is extremely non-normal that it need to excluded before the applying PLS-SEM. Though there is no such requirement of data being normally distributed on applying PLS-SEM, but it is of great importance to determine the data being normally distributed before applying inferential statistics (J. Hair et al. 2007). So, based on Munro (2005) recommendation, the data normality was determined for this study too with the help of Skewness, Kurtosis and histogram plots. The findings in Table 4.6 show that the data used in this quality analysis study were not usually distributed. But there were no signs of highly irregular data. J. Hair, Hult, Ringle, and Sarstedt (2017) pointed out in their study that PLS-SEM does not usually presume data normality as it is a non-parametric analysis methodology that does not require the data to be normally distributed. The subsequent research using PLS-SEM was also included in the study.

4.8 Descriptive Statistics

Table 4.6 about descriptive statistics highlight that mean value of plan analytics was 5.145, mean value of delivery analytics was 5.63 and mean value of performance management was 5.256, these were the highest mean values of all the variables for the quality analytics data respectively. On the other hand, Human resource development got lower mean values 4.89 and marketing analytics also comes out with lower mean value 4.70 for the data set. The mean values of all the other variables were ranged between 4.93 and 5.14. Moreover, the mean values for all quality management dimensions (strategic management leadership, HRD, production/operations management, customer satisfaction and risk management) ranged from 4.89 to 5.078. Likewise, all the dimensions of business analytics (plan analytics, source analytics, operation analytics, delivery analytics and marketing analytics) were ranged between 4.706 and 5.635. Table 4.6 also highlighted that mean values of all the elements of perceived performance management were 5.256.

Table 4.6: Descriptive Statistics

Constructs	Mean	Std. Deviation	Skewness	Kurtosis
Strategic Management Leadership	5.0780	.53648	-.026	1.539
Human Resource Development	4.8930	.69773	-.426	.441
Production/Operation Mgt.	4.9413	.65647	-.069	1.142
Customer Satisfaction Mgt.	4.9957	.57902	.197	1.824
Risk Management (Mgt.)	5.0456	.75670	-.603	1.105
Plan Analytics	5.1485	.98901	-.975	1.076
Source Analytics	4.9316	.91229	-1.055	2.503
Operation Analytics	5.0393	.78917	-.310	.661
Delivery Analytics	5.6356	1.15113	-.908	.570
Marketing Analytics	4.7060	.74607	.169	1.096
Performance Management	5.2561	.76088	-.628	.489

4.9 Assessment of Reflective Measurement Model

The reliability of all individual items/constructs is assessed in PLS by checking and inspecting the item loadings on their elated latent construct respectively (Hulland, 1999). The higher values of loadings show that the more variance is being shared among the related construct and measurement rather than an error variance, on other hand low loadings values highlight that the power of model description is very low that in turn minimizes the assessed parameters that help connect study constructs (Hulland, 1999). In the case of an endogenous constructs, the metrics are strongly linked and substitutable, and their validity and reliability must be checked and documented in depth. Therefore in this quality analysis report, both the reliability and the validity of the measurement model were checked by the researcher. This reliability was calculated by a composite reliability method and the validity was assessed by converging and discriminatory validity. The CFA test was then performed to determine the internal consistency (e.g. composite reliability), the convergent validity (e.g. average variance extracted) and the discriminant validity (e.g. cross-loading and Fornell-Larcker criterion) of the instruments. The goal here is to ensure that the measurements are accurate and true prior to the evaluation of the relationship in the structural model. The analysis and results of Reflective Measurement Model are given in tables 4.7, 4.8, 4.9 and figure 4.1.

4.9.1 Composite Reliability

Composite reliability (CR) has been calculated in order to assess the internal constructability. In this method, in compliance with the recommendation of Hair, Hult et al. (2014) most loadings for reflective substances were measured to exceed a cut-off value of 0.5. It is noted in Table 4.7 that all objects have been properly loaded onto their respective building object. Both item loads were well above the recommended cutoff value of 0.5. Loadings ranged from 0.579 to 0.932, which revealed that far more than half of the variation in the variable in the analysis is interpreted by the variables themselves. Items where loadings were below 0.5 (cutoff value) were deleted in a step by step sequence to achieve significant threshold value of internal consistency of the construct. For reflective scale, items that were deleted from the study may not be having any effect on the conceptual meaning of the particular construct as long as it retains adequate internal consistency. As this is due to direction of causality which flows from construct to items which demonstrating the items that represent the effects.

As recommended by Hair, Hult et al. (2014), MacKenzie, Podsakoff, & Jarvis (2005), these things are strongly correlated because they are triggered by the same underlying construct. In this analysis, the findings obtained underscore that the internal accuracy of all the constructions was within an appropriate range after the items were removed from the scale. The composite reliability (CR) values of the twelve reflective latent structures ranged from 0.884 to 0.965, which was higher than the suggested cutoff value of 07 (Hair, Black, Babin, & Anderson, 2010). As a result, it was understood that all constructions highlight a high degree of internal continuity of reliability.

4.9.2 Convergent Validity

The average extracted variance (AVE) was calculated in order to evaluate the converging validity. Table 5.4 demonstrates the converging validity, which illustrates that the AVE values of all latent structures were surpassed by the minimum reasonable value of 0.5 and that the values were found to be between 0.587 and 0.83. The AVE value of more than 0.5 points out that the latent construct clarified more than half of the variance of its indicators.

Table 4.7 displays the outcomes of the measurement model of study. In the table , it was shown that all eleven major constructs which are customer satisfaction management (CSM), Human Resource development (HRD), Production/operation management (POM), Risk management (RM), Strategic Management & Leadership (SML), Marketing analytics (MA), Operation analytics (OA), Plan analytics (PA), Source analytics (SA), Delivery analytics (DA) and Performance management (PM) are valid measurements of the respective constructs were focused on their estimations of parameter and statistical significance (Chow & Chan, 2008). Thus the model constructs had ample convergent validity. This highlight the validity of the study constructs therein.

Table 4.7: Convergent Validity

1st order Constructs	2nd order Constructs	Items	Loadings	CR	AVE
Customer Satisfaction Management (CSM)		CSM1	0.866	0.917	0.689
		CSM2	0.907		
		CSM3	0.851		
		CSM4	0.818		
		CSM7	0.693		
Human Resource Development (HRD)		HRD1	0.75	0.91	0.592
		HRD2	0.799		
		HRD3	0.776		
		HRD4	0.841		
		HRD6	0.68		
		HRD8	0.722		
		HRD9	0.806		
Production/Operation Management (POM)		POM1	0.843	0.926	0.641
		POM2	0.882		
		POM3	0.826		
		POM4	0.698		
		POM6	0.753		
		POM8	0.812		
		POM10	0.776		

Risk Management (RM)		RM1	0.835	0.884	0.607
		RM2	0.842		
		RM3	0.859		
		RM4	0.746		
		RM6	0.579		
Strategic Mgt. & Leadership (SML)		SML1	0.744	0.895	0.587
		SML2	0.749		
		SML3	0.771		
		SML4	0.821		
		SML6	0.776		
		SML7	0.735		
Marketing Analytics (MA)		MA1	0.932	0.936	0.83
		MA2	0.927		
		MA4	0.873		
Operation Analytics (OA)		OA1	0.875	0.898	0.688
		OA2	0.843		
		OA3	0.885		
		OA5	0.702		
Plan Analytics (PA)		PA1	0.897	0.955	0.809
		PA2	0.872		
		PA3	0.919		
		PA4	0.895		
		PA6	0.912		
Source Analytics (SA)		SA1	0.913	0.92	0.794
		SA2	0.855		
		SA4	0.904		
Delivery Analytics (DA)		DA1	0.727	0.898	0.688
		DA2	0.852		
		DA3	0.873		
		DA4	0.858		
	Business Analytics	MA	0.862	0.956	0.813
		OA	0.912		
		PA	0.928		
		SA	0.905		
		DA	0.901		

Performance Management (PM)	PM1	0.739	0.965	0.678
	PM2	0.692		
	PM3	0.878		
	PM4	0.844		
	PM5	0.815		
	PM8	0.797		
	PM9	0.847		
	PM10	0.704		
	PM11	0.852		
	PM13	0.874		
	PM14	0.907		
	PM15	0.837		
	PM16	0.887		

4.9.3 Discriminant Validity

The discriminatory validity of the analysis was evaluated with the aid of two cross-loading tests and the Heterotrait-monotrait (HTMT) criterion. The researcher carried out the study on cross-loading of the products. Standardized load estimates should be 0.5 or higher and, preferably, 0.7 or greater. as per the Hair et al. (2010) and Chin (1998) recommendation and it was further recommended that the items possessing very low loadings (below 0.4) need to be deleted (Hair, Hult et al. 2014; Hair et al. 2011).

Moreover, it was pointed out that all measures of the construct should be significantly loaded onto their respective construct. Fornell & Larcker, test, indicates that more variance is shared by a latent construct with its own indicators than by another latent construct in the structural model (Fornell & Larcker, 1981). In compliance with this criterion, the square root of the AVE (represented by the values in the diagonal) calculated should be greater than each of the build correlations (represented by the values in the off-diagonal) calculated (Hair, Hult et al. 2014). Heenseler et al. (2015) proposed another approach for the Heterotrait-Monotrait Correlation Ratio (HTMT) which is considered to be superior to the previous methods used to determine the discriminatory validity. Table 4.10(a) illustrates the discriminatory validity of

1st ranked constructs, while Table 4.10(b) reveals the discriminatory validity of 2nd ranked constructs. Both of these tables show that all the square root of the AVE values is greater than the other correlation values between the latent variables, which means that a number of the constructs used in the study model are applied to various individuals.

4.9.3.1 Heterotrait-Monotrait Ratio

Henseler et al. (2015) performed an advanced analysis to implement a new criterion for the calculation of discriminant validity for variance-based structural equation modelling tasks. In their research, Henseler et al. (2015) also confirmed that the Fornell-Larcker criterion and cross-loading are one of the main approaches to determining the discriminatory validity of structural equation modelling based on variance. Apart from this, Henseler et al. (2015) and Yusoff, A. S. M., et al. (2020) discussed that the existing approaches and methods had not adequately detected the lack of discriminant validity therein at various research situations. Consequently, Henseler et al. (2015) and Yusoff, A. S. M., et al. (2020) recommended the use of an alternative approach, "the heterotrait-monotrait ratio of correlations" commonly known as HTMT ratio. This HTMT ratio is based on the "multitrait-multimethod matrix" to assess the discriminant validity. To date there are numerous studies that also deployed the HTMT ratio to assess the discriminant validity and therefore recommended the use of the new approach to assess the discriminant validity (Ab Hamid, Sami, & Sidek, 2017; Ali, Rasoolimanesh, Sarstedt, Ringle, & Ryu, 2018; Haider, Jabeen, & Ahmad, 2018; Henseler et al. 2015; Hussein & Baharudin, 2017; Janadari, Sri Ramalu, & Wei, 2016). The two ways are deployed to assess and evaluate the discriminant validity with the help of HTMT ratio; the first approach deploy the criterion and the second approach is as a statistical test (Henseler et al. 2015). In the first approach, the HTMT ratio is recommended to be less than 0.85 (Clark & Watson, 1995; Kline, 2011) or at most it should be less than 0.90 (Gold, Malhotra, & Segars, 2001). If the HTMT ratio goes higher than the above-mentioned minimum limits, then it identify an issue of discriminant validity. The second approach is deployed in order to test the null hypothesis (H0: HTMT $\geq$ 1) versus the alternative hypothesis (H1: HTMT < 1) and if the confidence interval includes value one, this highlights that there is lack of discriminant validity (Henseler et al. 2015). In the quality analytics study researcher deployed the first criterion approach to assess the discriminant validity using the HTMT ratio.

Table 4.8 displayed the values of the HTMT ratio for 1st order constructs. As shown in Table 4.8, all values of the HTMT ratio for 1st order constructs were found to be less than 0.90. It therefore qualified on the basis of the HTMT criterion<090 (Gold et al. 2001). Therefore the above results underscored that the discriminatory validity of all 1st order systems had been well defined. Table 4.9 also provided the values of the HTMT ratio for the 2nd order constructs. As suggested in Table 4.9, all values of the HTMT ratio for 2nd order constructs were found to be below the threshold of 0.90. This also qualified on the basis of the criterion of HTMT<090 (Gold et al. 2001). The results therefore underscored that the unequal validity of all 2nd order systems had been well defined.

Table 4.8: HTMT Ratio 1st Order Constructs

	CSM	DA	HRD	MA	OA	PA	PM	POM	RM	SA	SML
CSM											
DA	0.739										
HRD	0.717	0.735									
MA	0.644	0.841	0.68								
OA	0.747	0.875	0.756	0.873							
PA	0.651	0.844	0.777	0.81	0.865						
PM	0.738	0.811	0.727	0.875	0.834	0.775					
POM	0.832	0.811	0.826	0.787	0.884	0.813	0.864				
RM	0.807	0.805	0.84	0.729	0.808	0.891	0.838	0.84			
SA	0.718	0.825	0.709	0.779	0.845	0.884	0.807	0.84	0.884		
SML	0.823	0.679	0.797	0.592	0.741	0.647	0.672	0.804	0.733	0.687	

Table 4.9: HTMT Ratio 2nd Order Constructs

	BA	CSM	HRD	PM	POM	RM	SML
BA							
CSM	0.737						
HRD	0.78	0.717					
PM	0.883	0.738	0.727				
POM	0.874	0.832	0.826	0.864			
RM	0.889	0.807	0.84	0.838	0.84		
SML	0.708	0.823	0.797	0.672	0.804	0.733	

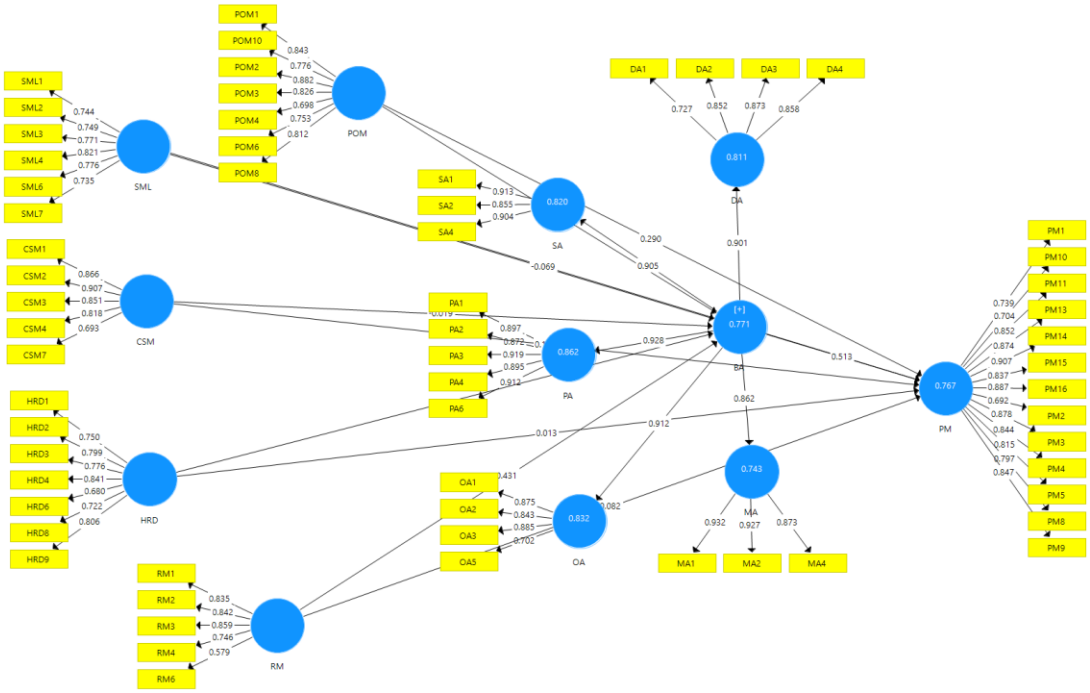

Figure 4.1: Measurement Model Assessment

4.10 Assessment of Structural Model (SEM)

After establishing the goodness of the measurement model, then comes in the second step to test the hypotheses. As per Chin (2010) guidance, the assessment of the structural model was performed by conducting PLS-SEM algorithm and bootstrapping. The research carried out an evaluation of the predictive power of the structural model using the coefficient of determination (R2 values) of the endogenous design (Chin, 2010; Henseler et al. 2009) and also calculated the degree and importance of the path coefficient. (Hair, Hult et al. 2014). Table 4.10 demonstrates R2 for each of endogenous latent variables present in this study. Cohen (1992; 2013) described a rule of thumb for obtained R2 values. As per the rule the values 0.26, 0.13, or 0.02 for endogenous latent constructs can be termed as substantial, moderate and weak respectively. Table 4.10 indicates that exogenous constructs such as customer satisfaction management (CSM), Human Resource development (HRD), Production/operation management (POM), Risk management (RM), Strategic Management & Leadership (SML) contributed 77.1 % of the variance in Business Analytics and 76.7 % of the variance in performance management respectively. According to Henseler et al. (2009), the R2 of dependent constructs with three or more exogenous latent variables should be at least substantial, the condition was eligible for this research.

Table 4.10: Coefficient of Determination

	R Square	Effect Size
Business Analytics	0.771	Substantial
Performance Management	0.767	Substantial

Moreover, Cohen, 2013 in his study found out that predictor constructs are also be assessed with the help of effect size of Cohen (f 2). Since business analytics and performance involve more than one exogenous design, the relative effect sizes (f 2) of the exogenous designs were calculated using the Smart PLS 3. Cohen (2013) is driven by appropriate limits for f 2 values which are as; 0.35 is considered Big Effect Size; 0.15 is known as MEDIUM Effect Size; and 0.02 is considered as SMALL Effect Size.

Table 4.11 shows that f 2 of Production/Operation management, Risk management highlight a relatively small to medium effect size and Business Analytics had a large effect sizes (Cohen, 2013). This shows that the identified range of effect sizes was reasonable since there were many factors that affect organizational performance (Luket al. 2008). This highlight that the estimated model fitted the data very well.

Table 4.11: Effect Size

	F2	Effect
CSM -> BA	0.001	No
CSM -> PM	0.015	No
HRD -> BA	0.009	No
HRD -> PM	0	No
POM -> BA	0.237	Medium
POM -> PM	0.083	Small
RM -> BA	0.286	Medium
RM -> PM	0.085	Small
SML -> BA	0.001	No
SML -> PM	0.007	No
BA -> PM	0.443	Large

4.10.1 Direct Relationship-Path Analysis

Nitzl, C et al. (2016) discussed that path analysis is known as an extension of a regression model. The path analysis model with the help of its correlation matrix support comparing two or more casual models in a study. Nitzl, C et al. (2016) further discussed that path model contains two kinds of effects one is the direct effect and other one is the indirect effect. So, both were applied in the quality analytics study. As per Hair et al. (2013), the non-significant pathways or pathways displaying signals in the opposite direction to the hypothesised condition do not endorse prior theories, whereas the proposed causal association is empirically confirmed by significant pathways. Until evaluating the mediating effect in the sample, a re-sampling of 5000 was carried out to obtain a t-value in order to determine if direct relationships were significant. The path coefficients were produced as highlight in the Structural Model Assessment Figure 4.2 and the bootstrapping results are given in Table 4.13. Detailed results obtained are given here as under;

Hypothesis 1: There is a positive relationship between Strategic Management Leadership (SML) and Business Analytics (BA) Practices.

The result obtained, while the performance of the algorithm and the bootstrapping PLS-SEM are given as; a t-value of 0.629 was lower to the threshold level of 1.645, indicating a statistically negligible association between strategic management activities and market analytics ($\beta = 0.028$, $t = 0.629$, $p = 0.265$). On the basis of these observations, Hypothesis 1 did not obtain empirical support and was thus dismissed. Therefore no inference can be made (Lane, 2011;Rainey, 2012). Since all necessary measures in the methodology relating to sampling and measurement error have taken into consideration and the strength of measurement (G*power) exceeded 0.80, the negligible relationship can be assumed not to be linked to methodological issues.

Hypothesis 2: There is a positive relationship between HR Development and Business Analytics Practices.

The second hypothesis was also not confirmed as the t-value 1.412 was found less than the cutoff value of 1.645, showing statistically insignificant relationship between the human resource development practices and business analytics ($\beta = 0.079$, $t = 1.412$, $p = 0.079$). Based on the results, Hypothesis 2 failed to receive empirical support, therefore was rejected.

Hypothesis 3: There is a positive relationship between Production/Operation Management (POM) and Business Analytics Practices.

A significant and positive relationship was found between the practice of production/operation management and business analytics ($\beta = 0.437$, $t = 6.808$, $P < 0$). Therefore, Hypothesis 3 is supported.

Hypothesis 4: There is a positive relationship between Risk Management and Business Analytics Practices.

A significant and positive relationship was found between the practice of risk management and business analytics ($\beta = 0.431$, $t = 9.457$, $P < 0$). Therefore, Hypothesis 4 is supported

Hypothesis 5: There is a positive relationship between Customer Satisfaction Management and Business Analytics Practices.

Fifth hypothesis was not confirmed as the t-value 0.392 was found less than the cutoff value of 1.645, showing statistically insignificant relationship between the customer satisfaction management practice and business analytics ($\beta = -0.019$, $t = 0.392$, $p = 0.347$). Based on the results, Hypothesis 5 failed to receive empirical support, therefore was rejected.

Hypothesis 6: There is a direct positive association among Business Analytics Practices and Firm Performance.

A strong positive and significant association among the business analytics practices and firm performance was found (β = 0.513, t = 7.369, LL= 0.406 UL= 0.632, P < 0), supporting the Hypothesis 6.

Hypothesis 12: There is a positive relationship between Strategic Management Leadership and Firm Performance Management.

The result showed that this hypothesis was supported as the path coefficient from strategic management leadership to firm performance management was obtained as strong positive and statistically significant (β = 0.069, t = 1.682, p < 0.043).

Hypothesis 13: There is a positive relationship between HR Development and Firm Performance Management.

Thirteenth hypothesis was not confirmed as the t-value 0.275 was found less than the cutoff value of 1.645, showing statistically insignificant relationship between the human resource development and firm performance management (β = 0.013, t = 0.275, p = 0.392). Based on the results, Hypothesis 13 failed to receive empirical support, therefore was rejected.

Hypothesis 14: There is a direct positive association among Production/Operation Management and Firm Performance

A significant and positive association was found among the production/operation management and firm performance management (β = 0.29, t = 4.119, P < 0). So, it can be concluded that Hypothesis 14 is supported based on the study results

Hypothesis 15: There is a direct positive association among Risk Management and Firm Performance

The statistically significant and strong positive connection was found among the practice of risk management and firm performance management ($\beta = 0.082$, $t = 1.673$, $P < 0.042$). Therefore, Hypothesis 15 is supported by the study findings.

Hypothesis 16: There is a positive relationship between Customer Satisfaction Management and Firm Performance

A significant and positive relationship was found between the practice of customer satisfaction management and firm performance ($\beta = 0.101$, $t = 2.214$, $P < 0.013$). Therefore, Hypothesis 16 was found as supported by study data.

Table 4.12: Results of Direct Relationship

		Beta	SE	t	P	LL	UL	Decision
H1	SML -> BA	0.028	0.045	0.629	0.265	-0.044	0.102	Not-Supported
H2	HRD -> BA	0.079	0.056	1.412	0.079	-0.008	0.177	Not-Supported
H3	POM -> BA	0.437	0.064	6.808	0	0.331	0.539	Supported
H4	RM -> BA	0.431	0.046	9.457	0	0.352	0.504	Supported
H5	CSM -> BA	-0.019	0.048	0.392	0.347	-0.096	0.061	Not-Supported
H6	BA -> PM	0.513	0.07	7.369	0	0.406	0.632	Supported
H12	SML -> PM	0.069	0.041	1.682	0.043	0.041	0.011	Supported
H13	HRD -> PM	0.013	0.047	0.275	0.392	-0.064	0.09	Not-Supported
H14	POM -> PM	0.29	0.07	4.119	0	0.167	0.398	Supported
H15	RM -> PM	0.082	0.049	1.673	0.042	0.007	0.172	Supported
H16	CSM -> PM	0.101	0.046	2.214	0.013	0.028	0.177	Supported

4.10.2 Testing the Mediating Effect of Business Analytics Practices

Upon testing the direct relationships, the test of the mediation effect was conducted by the researcher (Table 4.13 and Fig. 4.2). Under the Hayes (2009) study, there are numerous methodological steps in measuring the mediation relationship. First of all, a model must be implemented by SEM to determine the relationship between the predictor variable and the

mediator variable. This has been achieved by doing a bootstrapping. As shown in Table 4.14, it was determined that four of the five indirect effects at the 0.05 stage were significant.

Hypothesis 7: Business Analytics Practices mediates the relationship between Strategic Management Leadership and Firm Performance.

This was illustrated in Table 4.14 and Figure 4.2, the bootstrapping analysis showed that the indirect effect (β = 0.054) was important with a t-value of 2.347 (P <0.016). This was also addressed by Preacher and Hayes (2008), the indirect result of 95 percent of Boot CI: [LL = 0.153, UL = 0.239], did not have a 0 between the two limits, i.e. lower and upper limits. So this means that mediation is taking place. It is therefore clear from the result obtained that the mediation effect of business analytics on the relationship between strategic management and firm performance was statistically significant (β = 0.054, t = 2.347, p < 0.016). Hypothesis 7 was sponsored under this condition.

Hypothesis 8: Business Analytics Practices mediates the relationship between HR development and firm performance.

This was illustrated in Table 4.14 and Figure 4.2, the bootstrapping analysis showed that the indirect effect (β=0.066) was important with a t-value of 2.068 (P <0.023). This was also addressed by Preacher and Hayes (2008), the indirect result of 95 percent of Boot CI: [LL = 0.134, UL = 0.292], did not have a 0 between the two limits, i.e. Lower and upper boundaries. So this means that mediation is taking place. It is also evident from the result obtained that the mediation impact of business analytics on the relationship between human resource growth and firm results was statistically important (β = 0.06, t = 2.068, p < 0.023). Hypothesis 8 was endorsed under this condition.

Hypothesis 9: Business analytics practices mediates the relationship between production / operation management and firm performance.

This was illustrated in Table 4.14, Figure 4.2 and the bootstrapping result analysis showed that the indirect effect (β = 0.224) was important with a t-value of 4.216 (P < 0). This was also addressed by Preacher and Hayes (2008), the indirect result of 95 percent of Boot CI: [LL = 0.148, UL = 0.321], did not have a 0 between the two limits, i.e. Lower and upper boundaries. So this means that mediation is taking place. It is also clear from the result obtained that the mediation impact of business analytics on the association between production/operation management and firm output was significantly important (β = 0.224, t = 4.216, p < 0). Hypothesis 9 was endorsed under this condition.

Hypothesis 10: Business analytics practices mediates the association among risk management and firm performance.

This was illustrated in Table 4.14, Figure 4.2 and an analysis of the bootstrapping result showed that the indirect effect (β = 0.221) was important with a t-value of 6.058 (P < 0). This was also addressed by Preacher and Hayes (2008), the indirect result of 95 percent of Boot CI: [LL = 0.167, UL = 0.286], did not have a 0 between the two limits, i.e. Lower and upper boundaries. So this means that mediation is taking place. It is also evident from the result obtained that the mediation effect of business analytics on the association among risk management and firm results was significantly important (β = 0.221, t = 6.058, p < 0). Hypothesis 10 was endorsed under this condition.

Hypothesis 11: Business analytics practices mediates the association among customer satisfaction management and firm performance.

This has been highlighted in Table 4.14, Figure 4.2 and the bootstrapping result analysis revealed that indirect effect (β = -0.01) was insignificant with t-value of 0.386 (P < 0.35). As discussed by Preacher and Hayes (2008), the indirect effect 95% Boot CI: [LL = -0.049, UL = 0.032], as a 0 lye in between the lower and upper limits. This indicates that no mediation exist. It is explained by given result that the mediation effect of business analytics on the relationship between customer satisfaction management and firm performance was statistically insignificant (β = -0.01, t =0.386, p < 0.35). Under the condition, Hypothesis 11 failed to receive empirical support, therefore was rejected.

Table 4.13: Indirect Effects

		Beta	SE	T	P	LL	UL	Decision
H7	SML -> BA -> PM	0.054	0.023	2.347	0.016	0.153	0.239	Supported
H8	HRD -> BA -> PM	0.06	0.029	2.068	0.023	0.134	0.292	Supported
H9	POM -> BA -> PM	0.224	0.053	4.216	0	0.148	0.321	Supported
H10	RM -> BA -> PM	0.221	0.036	6.058	0	0.167	0.286	Supported
H11	CSM -> BA -> PM	-0.01	0.025	0.386	0.35	-0.049	0.032	Not-Supported

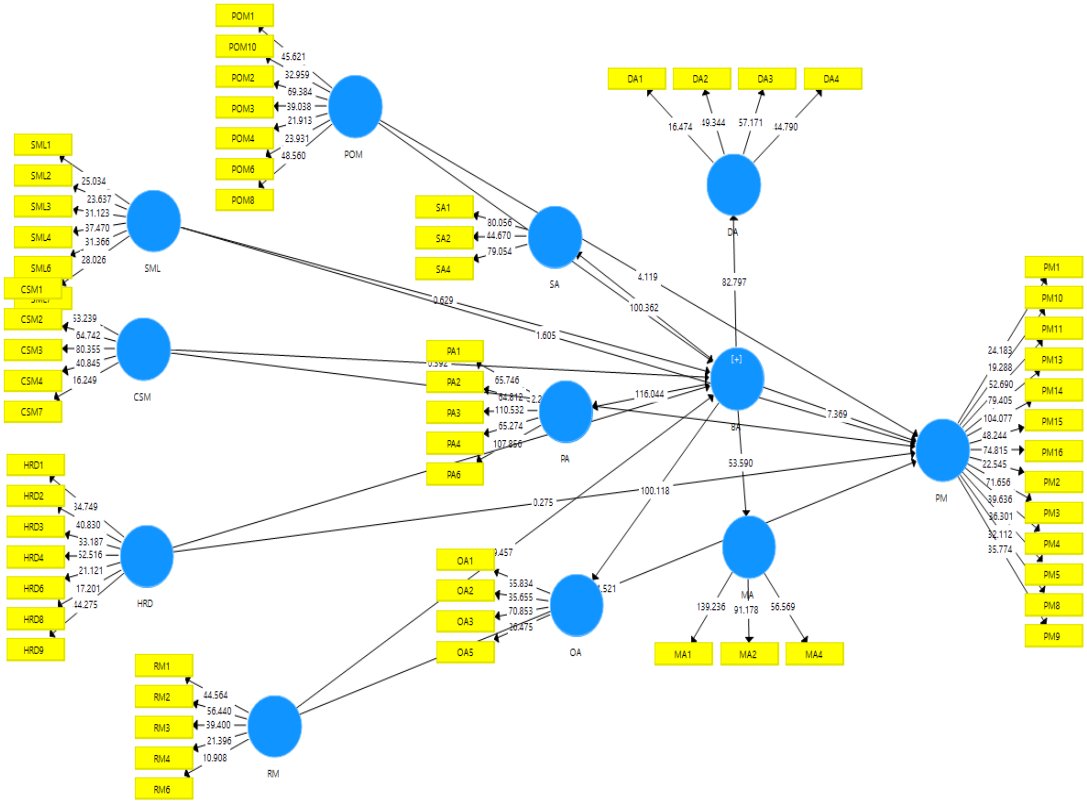

Figure 4.2: Structural Model Assessment

Table 4.14: Summary of the Hypothesis Results

H	Hypothesized Relationship	Result
H1	There is a positive relationship between Strategic Management Leadership and Business Analytics Practices	Not-Supported
H2	There is a positive relationship between HR Development and Business Analytics Practices	Not-Supported
H3	There is a positive relationship between Production/Operation Management and Business Analytics Practices	Supported
H4	There is a positive relationship between Risk Management and Business Analytics Practices	Supported
H5	There is a positive relationship between Customer Satisfaction Management and Business Analytics Practices	Not-Supported
H6	There is a positive relationship between Business Analytics Practices and Firm Performance	Supported
H12	There is a direct positive association among Strategic Management Leadership and Firm Performance	Supported
H13	There is a direct positive association among HR Development and Firm Performance	Not-Supported
H14	There is a direct positive association among Production/Operation Management and Firm Performance	Supported
H15	There is a direct positive association among Risk Management and Firm Performance	Supported
H16	There is a direct positive association among Customer Satisfaction Management and Firm Performance	Supported
H7	Business Analytics Practices mediates the association among Strategic Management Leadership and Firm Performance	Supported
H8	Business Analytics Practices mediates the association among HR Development and Firm Performance	Supported
H9	Business Analytics Practices mediates the association among Production/operation Management and Firm Performance	Supported

H10	Business Analytics Practices mediates the association among Risk Management and Firm Performance	Supported
H11	Business Analytics Practices mediates the association among Customer Satisfaction Management and Firm Performance	Not-Supported

4.11 Summary of the Chapter

The findings of the study were discussed in this chapter. The Respondents profile was represented using SPSS. But in the other side, the PLS-SEM study was used correctly to assess the reliability and validity of the results. Bootstrapping technique was used in the PLS-SEM study to evaluate the research hypotheses. In summary, the findings of the study showed that the measurement model was considered to be appropriate on the basis of adequate statistical evidence of reliability, convergent validity and discriminatory validity. The structural model was tested after testing the measurement model. The next chapter addresses the results of the study as well as the consequences for practise and future studies, and the limitations of research.

CHAPTER FIVE: DISCUSSION

5.1 Introduction

The purpose of this chapter is to review and discuss the results of data analysis phase as given in chapter 4. The implications of the above findings were also discussed. The discussion is solely based on quality analytics research objective and its related research questions as given in chapter one and four. Under the below pages, discussion on the study findings is elaborated along with adequately supported justifications for the significant results. Then, the contributions made by the existing study to the theoretical aspects of literature including empirical, contextual and managerial contributions which may will help senior management, decision-makers on providing guidance in their specific areas have been included in next chapter along with study limitations and direction for future studies.

The present quality analytics research work uses resource based theory (RBV) to build up the multidimensional QMS and BA model. RBV is established in Wernerfelt's (1984) conceptual work to break down a firm by means of its resources as opposed to its products and services, which Wernerfelt's (1984) thought gives a superior focal point on potential strategic alternatives. As per RBV, an organization's competency relies heavily upon quality to deal with its key resources (human and other) successfully and accrue market advantage, which can be converted into improved firm performance (Grant 2002, Newbert 2007). RBV is elaborated by accomplishing prevalent firm performance by setting up significant, uncommon, matchless, and non-substitutable resources of advanced quality (Barney, Wright et al. 2001). In RBV, the value (V) measurement of research permits firms to make extra potential financial profits.

5.2 Summary of the Study

Purpose of the quality analytics study is to examine the relationship between the quality management practices, business analytics practices and firm performance under resource-based view (RBV) (Barney, 1991; Wernerfelt, 1984). The mediating effect of business analytics practices

was also investigated between strategic management leadership, human resource development, customer satisfaction management, production operation management, risk management and firm performance. To meet study's set objective requirements data was collected senior executives, departmental heads, managers, deputy managers and junior staff members working in quality, production/operation, supply chain and business intelligence sections in three provinces (Punjab, Sindh, KPK) as well as Quetta city from Baluchistan province of Pakistan. Out of 956 distributed questionnaires, just 408 (43%) were analyzed through the PLS-SEM technique and SPSS. Level of significance with 0.01 and 0.05 have been used as an essential threshold for hypothesised decision-making.

Eleven hypotheses depicted the direct association between quality control determinants and business analytics activities in the surveyed organisations. Four hypotheses were failed to get experimental support. There were five hypotheses on mediation effect, just one hypothesis was rejected. Study findings strongly supported resource based view (RBV) theory when the main effect of quality management practices and mediating effects of business analytics practices highlighted the significant change in the relationship. The findings are discussed in much detail under the following lines. The discussion was comprised on two sections, first section discussed the direct relationship between the determinants of quality management practices, business analytics practices and firm performance, whereas the second section elaborating the mediation results. Only the significant results obtained from data analysis were discussed here. As in case of insignificant results conclusion cannot be drawn due to insufficient data support, that has not provided any evidence for existence or nonexistence of the relationship between the constructs (Lane, 2011; Rainey, 2012).

5.3 Discussion on Direct Relationship

5.3.1 Relationship between Strategic Management Leadership and Business Analytics

Hypothesis (H_1): *There is a positive relationship between strategic management leadership and business analytics practices*

This quality analytics study did not show a positive relationship between elements of Strategic Management Leadership and Business Analytics Practices (BA). As this could not get the empirical support. In 2007, Lupu, A et al. found the varied impact of strategic changes on business intelligence projects success. Gunasekaran, A. et al. (2017) highlight the impact of strategic management engagement on business analytics project success and Zoumpatianos, K., (2012) found the direct impact of management's initiatives on the success or failure on BA project. Moreover, studies in healthcare setting by Foshay, N., & Kuziemsky, C. (2014), identified that work information, personnel, leadership and process maturity level directly impact the implementation of business intelligence systems at organizations and their relative strength need to be further evaluated. The findings suggest to further analyze the relation particularly for south Asian regions.

5.3.2 Relationship between Human Resource Development and Business Analytics

Hypothesis (H_2): *There is a positive relationship between HRD and business analytics practices*

This quality analytics study did not show a positive relationship between elements of Human resource development (HRD) and Business Analytics Practices (BA). As this could not get the empirical support. Muscalu, E., & Şerban, A. (2014) found the positive impact of human resource development on business analytics' projects success. Similar feedback was reported by Martin-Rios, C et al. (2017) and Zoumpatianos, K., (2012) that management's development initiatives highly impact the success or failure on BA project. Study by Foshay, N., & Kuziemsky, C. (2014), identified that work information, personnel training, leadership and process maturity level directly impact the implementation of business intelligence systems at organizations and their relative strength need to be further evaluated. The findings suggest to further analyze the relation particularly for south Asian regions.

5.3.3 Relationship between Production Operation Management and Business Analytics

Hypothesis (H_3): *There is a positive association among production/operation management and business analytics practices*

The current quality analytics study revealed a positive association among production operation management (POM) and business analytics (BA) practices. POM got the experimental support and bring in a positive relationship between the two variables. Thanks to the advancements of new technologies and equipment, that use of big data has been exhibited in various functions of production operations, encompassing manufacturing, engineering services, supply chain and fault detection, quality enhancement and energy consumption (O'Donovan et al. 2015). Product lifecycle management (PLM) have become successful methodologies for enterprises to build on their competitive advantage with the advancement of organization-wide information management. Liu (2013) builds up a hypothetical model to investigate the center components which decide SCA of firms. Liu and Liang (2015) set forward the arrangement of working technique with asset prioritization, and introduced changes of asset based system for product lifecycle by breaking down the information set from a study of multiple organizations which can prompt usages of supply chain analytics (SCA, (Ren, S. et al. 2020)

In order to deal with issues of data accessibility for PLM, Auto-ID and sensor innovation have been generally in practice by production entities to check and track their item continuously from start to end. Such an age of programmed data and data gathering technique introduced emerging era, for instance, how to detect and replace the multi-source heterogeneous big data during the complete production cycle of a product, and how to utilize the ongoing and multi-source lifecycle big data to find and transmit concealed information to improve all phases of PLM. To tackle such issues, another methodology is recommended to give another worldview to production companies to upgrade the productivity of PLM. The new worldview can give a hypothetical and professional approach for the maintainable advancement of other production companies (O'Donovan et al. 2015). The research by Dai, H. N. et al. (2019) supported quality analytics research findings by describing effective deployment and sustainability of analytics work on identified issues of cleaner production methodology.

The findings further supported capability of analytics at plan, then capability of analytics at manufacturing/operation analytics along with their key segments. As supported the data analytics based product lifecycle management plans, operation and dispatch analytics and product marketing analytics were thoroughly supported with manufacturing capabilities role on analytics. In connection with above experimental discussion, it is being hypothesized that production operation management (POM) is positively related with business analytics.

5.3.4 Relationship between Risk Management and Business Analytic Practices

Hypothesis (H_4): *There is a positive relationship between risk management and business analytics practices*

The current quality analytics study revealed a positive relationship between risk management (RM) and business analytics (BA) practices. Risk management secures the experimental support and bring in a positive relationship between the two variables. One aspect of current research was to partially assess implementation status of selected innovative advancements in the fields of Industry 4.0 and digitalization which found impacting the growth of new business models, concepts, tools and paradigms across all business spheres especially the supply chain management (SCM). The emerging Internet of Things (IoT) encompassing advancements such as cyber-physical systems and smart products, enabled organizations to build digital supply chains as well launched smart operations (Ivanov, D. et al. 2019). The technologies are not free of problems and issues. Risk management practices implemented at organization have been found positively impacting the mentioned advancements (Gunasekaran, A. et al. 2018).

In today's world supply chains are strengthening organization and success of supply chains are largely built on digital capabilities therein. A practical case is being discussed here, one of world's leading logistics and courier firm join hands with a technology giant offering business intelligence services. The logistics firm gathered the technology risks realized and built up a joint digital innovation which permits logistics firm to produce things utilizing 3D printing in distribution sites (Ayyagari, R. 2019, UPS 2018). Risk control mechanism at supply chain need two basic abilities: confrontation and recover (Dolgui et al. 2018; Scheibe et al. 2018). As of confrontation which is related with supply chain's capacity to safeguard against disruptions and

lessen the effect when disruption happens, some work on managing alternate sources, risk reduction avenues, or flexible capabilities must be looked out in the relaxed periods. To recover, the idleness must be initiated together with receptive emergency plan of action as to risk reduction measure, flexible limits and standby supply sources.

So as to evaluate the effect of the disruption on the SC, and both the expenses and impacts of material stream transferal, organizations require gadgets coupled with joint effort and visible supply chain performance to execute these back up arrangements. Ivanov et al. (2017) broke down the progress effects of requesting and production control approaches within capacity disruptions for the live case of a retail SC with item perishability deliberations by utilizing AnyLogic. The exchange among perishability and disruption risks is taken care of. It has been seen that a production limits disruption causes both item level shortfalls and lack of risk cover. In connection with above empirical discussion, it is being hypothesized that risk management (RM) is positively related to business analytics (BA).

5.3.5 Relationship between Customer Satisfaction Management and Business Analytics

Hypothesis (H_5): *There is a positive relationship between CSM and business analytics practices*

This quality analytics study did not show a positive relationship between elements of Customer Satisfaction Management (CSM) and Business Analytics Practices (BA). As this could not get the empirical support. However the studies like Bijmolt, T. H et al. (2010) highlight the impact of customer engagement on business intelligence projects. Verma, V. et al. (2016), F. Lilien, (2013) and P. Trkman, et al. (2010) also found the direct impact customer's feedback on the success or failure on BA project. Moreover, studies in healthcare setting by Foshay, N., & Kuziemsky, C. (2014), identified that work information, personnel, leadership and process maturity level directly impact the implementation of business intelligence systems at organizations and their relative strength need to be further evaluated. The findings suggest to further analyze the relation particularly for south Asian regions.

5.3.6 The Relationship between Quality Management Practices and Firm Performance

Hypothesis (H_9): *There is a positive association among production/operation management and firm performance*

This study revealed a positive association among elements of quality management practices and firm performance. First of all production operation management (POM) is and firm performance management is presented that got empirical support and yielded a positive relationship. Meaning thereby, better the processes and operations including expert reviews of new product or service development from proposal to launch; establishing work procedures, specifications, key performance indicators as well as getting staff understood the same; regular evaluation of products/services against set specifications and KPIs by concerning staff. Understanding of mentioned process operation elements is a key component of process operation management that encompasses different functions at different stages in a firm (Kohlbacher et al. 2011). Above points are commonly known as process orientation, which ensures to keep focus on the business process operations, the purpose of all this is to create satisfied customers.

Van Assen, M. (2018) identified in their research that employees of a process operation oriented firm are customer conscious, know which part of their job add to internal or external customer. High level of process orientation is necessary to develop process specifications, operational procedures and improve it further. This also keep process operations updated against emerging market requirements (Shukla et al. 2015). The study finding is also consistent with Kohlbacher et al. (2011) findings that the combination of process ownership, process measurement and continuous process improvement methods must be added together in order to lead for higher financial performance of a firm.

Danilova, K. B. (2019) developed business process management framework is also consistent with study findings that the process knowledge accrued and experts guidance on process ownership orientation provides a tools to senior professionals who are looking to implement or further improve process ownership in their organization. Danilova K. B. (2019) framework identified key role of senior management as they should empower process owners. They further informed that process operation management serves as a method to develop, review and alter

process related roles (Shukla et al. 2015). Likewise, the findings of Danilova K. B. (2019) and Van Assen M. (2018) highlighted some of the possible issues to operational ownership that the firms may face that needed specific thoughtfulness from concerning senior professionals. Another study also found in line with current study that benchmarking the internal and external performance conditions of a firm help employees to be more innovative with emerging ideas and companies take competitive advantage (O'Dwyer, M., & Gilmore, A. 2019).

Then the next POM element is benchmarking best in class processes; vendor quality management initiatives and reporting the production operation management performance to executives. On benchmarking or market orientation the study by O'Dwyer, M., & Gilmore, A. (2019) found consistent with quality analytics study that in the market orientation components, just competitor performance evaluation was found significant on adding to overall firm performance. It was further described that small and large organisations have comparable levels of functional management styles as well as competitor focus but small organizations are at knowingly lower levels of competition focus than that of big size organizations.

The study by Ali K.A.M., (2020), also found consistent as it was elaborated that supplier quality initiatives are of key significance having potential to impact firm performance in a positive way. This highlight that if supplier quality initiatives are strong at an organization, the firm tend to take more competitive advantage in market place. The study by Adeleke, O. M et al. (2020) revealed that suppliers' participation in matters relating to production operation management activities support improving firm performance. As per the study recommendation, supplier relationship management activities like supplier involvement, supplier appraisal and supplier development activities significantly improves firm performance. It was shown in Mahbobkhah, F. (2019) Iran's study that as the experts', senior professionals' and referents' authority has significant and positive effect on staffs' entrepreneurial abilities, similarly impact of regular process performance reporting by employees to executives found positive on firm performance. Moreover, Del Gesso, C. (2019) found that the performance reporting systems support corporate growth through outcome achievement of planned goals as when the results of process activities are measured and reported altogether this help improve daily reporting systems. The reporting trends highlighted by above studies were in line with quality analytics study finding on production

operation management. Based on above discussion, it is being hypothesized that process operation management (POM) is positively related to firm performance.

Hypothesis (H_{10}): *There is a positive relationship between risk management and firm performance*

This part of discussion elaborate the relationship between risk management (RM) and firm performance management. RM was also successful in getting empirical support and bring in a positive relationship between the two variables. In the present quality analytics research, risk management entails practices like senior managements' encouragement on identification and reporting of risk events. Tse Y.K. et al. (2019) study results were supporting above findings by discussing that the two practices namely supplier development risk and product quality risk are found to impact the financial performance and quality planning of a firm. Agency theory was chosen by Tse Y.K. et al. (2019) as the essential theory to give a unique perspective on in-firm participation in risk management activities. The two types of control component formal control (FC) and social control (SC) were found to positively impact the two kinds of risk management activities (Tse, Y. K., et al. 2019). FC found consistent with quality analytics study objectives, Li et al. (2010) described FC as deploying set rules, instructions and specified procedures whereas SC explains mutual benefits and norms in an organization. Another study found in line with current study results, risk management study by Urbański, M., Haque (2019) elaborate statistically significant relation between adequate risk planning and accomplishment of a project, this empowered project owners to sufficiently accomplish their projects being under limits of financial budget.

Then on risk management comes in the risk review and risk evaluation measures in the company. The results obtained in another study by Imran, M., et al (2019) have confirmed positive impacts of design related risks, technical, cash flow related and human resources/labor related risk on the successful accomplishment of projects under the set schedules and costs. It was further discussed that design technical, financial and labor related factors have been found playing pivotal role in industry and positively impact projects gains. Michalak (2017) introduced the idea of operational activities' risk evaluation and found that the functional or operational risks are closely associated with business processes performance and elaborated the point though multiple ways.

Other research findings (Dionne, 2013; Boholm, 2016; Lexin 2016) showed the advantages of adequately communicating risk in firms related through risk management frameworks, researchers gave empirical data on the benefits of risk review and assessment classifications. Tse, Y.K. et al. (2019) study results validated the present study that stated it is useful for the organizations to embrace formal control to reinforce the impact of product/service quality risks on the financial performance and quality planning. This might facilitate concerning managers to adopt formal controls to mitigate quality planning and performance risks. The results of a study by Nawaz, A. (2019) in construction industry, provided a chance to project owners, directors, managers, administrators, and senior professionals to monitor progress of their current and future projects of their vendor firms by adopting the best possible risk management strategies featured in this investigation. Describing the outcomes of a core element given in this work is that the degree of "risk identification" measures deployed in the construction industry of Pakistan is lower than the required extent. This causing accidents and delay in projects. So, it suggests to consider deploying customized risk management and control practices.

Another research work by FARID, W et al. (2020) elaborated a key risk factor where significant number of the projects in Pakistan need to deploy appropriate planning and management that were found among the key reasons for delaying construction industry projects. Project delays are extremely basic kind of risk since its impact isn't just restricted to project schedules and project costs but also stimulates low quality of work and different technical issues. Later are the risk transfer measures adoption mechanism by the firms, this could be insurance or the alternate measures. Edwards, I., Griffith, et al. (2019) pointed out in their research that in the short-term, deployment of an insurance pool has accumulated advantages which was supported by extensive literature review and has discovered that insurance pools give constant and practical premiums to their registered clients.

The applicability of insurance as a practical risk management method and the results of lost access due to the absence of same got little consideration by managers and entrepreneurs. Edwards, I., Griffith, et al. (2019) and Salve, P., Simpson, D., (2011) found the evidence of risk transfer measures through insurance or other alternate risk transfer measures. FARID, W et al. (2020) pointed out in their work that majority of the projects in Pakistan, projects risks are moved to the contracting parties which consequently adding the cost to project baselines and lower quality.

Pertaining to above empirical discussion, it is being hypothesized that risk management (RM) is positively related to firm performance.

Hypothesis (H_{11}): *There is a positive relationship between customer satisfaction management and firm performance*

This section highlights the relationship between customer satisfaction management (CSM) and firm performance management. CSM got the empirical support and bring in a positive relationship between the two variables. Present quality analytics study findings were consistent with the meta-analysis study conducted by Otto, A. S.,et al. (2019) on 251 studies of satisfaction performance correlations that revealed, the mean correlation found both statistically significant and positive among customer satisfaction management measures in a company and its performance. Likewise, Sarra Berraies, Manel Hamouda, (2018) found the presence of a significant relationship between the customer experience and financial performance of organizations. They highlighted the positive impact of customer experience on two forms of innovation, which are called exploitative innovation and exploratory innovation. Furthermore, Sarra Berraies et al. (2018) presented a model in their research work which created the positive links among customer experience management, customer satisfaction, exploitative and exploratory innovation and firm performance. Beside this Chew Ging Lee & Shi-Min How (2019) study also confirmed the positive and statistically significant relationship between the customer satisfaction ratings and hotel industry performance.

Another study which supported the findings of current quality analytics work by Raguseo, E. et al (2018) was conducted with a purpose to assess the Effect of the corporate value of the facets of Big Data Analytics on the financial results of a business through direct and indirect initiatives, through customer loyalty and market performance variables. The findings show that the business benefit of the Big Data investigation includes more than the necessary variation in the customer satisfaction, market performance and financial performance of the company. Thus only business value and customer satisfaction influence the financial performance of companies, the direct effect of business value and the indirect impact of customer satisfaction. It was clear that consumer loyalty, being statistically important, had a positive effect on financial results than marketability and an indirect influence on corporate valuation (Ji-fan Ren et al. 2016).

Ernest, Yaw et al. (2016) have demonstrated a statistically significant relationship between the satisfaction and loyalty exhibited by staff working in a company, the customers aspects like satisfaction, value creation, trustworthiness, loyalty and financial performance of an organization. Research Choi Sang Lang, et al (2013), assessed customer relationship management, consumer relationship building measures, satisfaction, customer co-collaboration arrangements. The outcomes of the investigation found that CRM is the most effective methodology in keeping up and making relationships with various kind of customers which in turn ensure firm grown across good will , word of mouth and financial gains in the longer term.

Another study by Stelzer, A., et al. (2016) was conducted on the impact of customer feedback mechanism and transportation company performance. The discussed methodology gave the chance by deploying emerging communication advancements to improve the quality of public transport system. Stelzer, A., et al. (2016) found the methodology supporting to retain current public transport users and secure new customers. So, public transport organizations are required to adjust their data collection frameworks as per new technological advancements along with improvements at feedback system in order to enhance every day experiences of their customers. Satisfaction with public transport activities, travelers experience and data quality found of statistical significance and positively contributing to financial target achievements of the transportation company. Ongoing research in the literature related to customer services perceives that the company's and the customers' circles are firmly interconnected, and the association among customers and the firm is key to the joint value creation process (Grönroos and Voima 2013)

The current investigation adds to this part of research by giving an improved knowledge of the organization’s components that help customer collaboration. The same was consistent with Foss et al. (2011) and Van Doorn et al. (2010) work. The study go above the function of individual staff members to analyze extensive organizational tools required for customer co-creation. The discoveries help see how firms may incorporate customer innovation with their inner actions (West and Bogers 2014) and recommend the need to join the company's and the customers' points of view to comprehend the interconnectedness between the two circles. In an experimental investigation, Harrison-Walker (2011) found a positive relationship between "market focus " of an organization and "customer maintenance", "customer readiness to go for higher price or pay premium", "customer tend to spread positive word of mouth communication" and "customer

inclination to not-substitute among brands or choose items of other company, resulting enhancing financial performance".

As indicated by Kotler and Keller (2009) that customer satisfaction and loyalty provided chances to acquire new customers. Keeping up every current customer has been normally found to be more beneficial than customer changes as the expense of pulling in new customers can be multiple times the expense of holding on current customers. The finding is also in accordance with the research led by Choi sang Lang (2013) Customer satisfaction has been found a key component that enhances loyalty. Customer satisfaction is characterized as the degree of customer inner feelings and emotions when one look at what he got in terms of product features and what was needed (Umar, 2005), other than satisfaction, customer loyalty is created by practicing customer relations and perceived value (Hasan, 2008). In connection with above empirical discussion, it is being hypothesized that customer satisfaction management (CSM) is positively related to firm performance.

Hypothesis (H_{12}): *There is a positive relationship between strategic management leadership and firm performance*

Next section of discussion is relationship between strategic management leadership (SML) and firm performance management. SML got experimental evidence and bring in a positive relationship between the two variables. Mui, H. K. Y. t al. (2018) elaborated strategic management leadership as the company's top head with the obligation of planning such management activities that incorporate the development, execution and evaluation of the business tactics consistently, the ability to be compatible with changing attributes of external environment, all type of resources of the organization and the mindsets of the managerial group. Hoskisson, Hitt, Ireland and Harrison (2012) characterize strategic leadership as the ability to foresee, to imagine, to keep up adaptability and nimbleness by engaging its subordinates for the required strategic change and to form an achievable goal for the firm.

SML yielded positive relations with its included elements like top executives and departmental heads assumes responsibility for quality and participate in improvement activities. The output of the research (Serfontein, 2010) exhibited that strategic leadership has good effect on

the organization performance and its operating technique. Likewise a study done in South Africa (Nthini 2013) on looking at the effect of strategic leadership on performance. In this research were included, to decide strategic leadership corporate strategic course, adequately oversaw corporate asset portfolio, successful organizational culture, moral practices and adjusted organizational controls in deciding the connection between the strategic leadership and organizational performance (Nthini, 2013). The positive connection was found (Predrag Djordjevic 2018) between strategic leadership and elements of quality planning in a study that elaborated on a contribution to the examination with respect to the association of these components under transitional states.

Another SML element pointing out, management ensures that improvement goals are established and monitored at all levels and function in the company. The outcomes from the study conducted by Agha, Alrubaiee, and Jamhour (2012) found consistent with above and called attention to that major skill elements of SML which have critical effect on the accomplishment of economy of scales through improvement targets setting and reviewing for each activity. Such key skills connect different technological advancements related objectives together and found significantly affect the organizational performance (Agha, Alrubaiee and Jamhour, 2012). The research work by Haque, TitiAmayah, and Liu (2016) also verified that there is a positive critical effect of the strategic management leadership's vision on firm performance, accordingly the research highlight that key organizational improvement objectives, targets, future condition, value and mission found major components of leadership vision indicating positive effect of strategic leadership on organizational performance (Kantabutra and Avery 2010).

The effect of leadership on the organization's performance has been evidently distinguished in the Malcolm Baldridge (MB) and the European Federation Quality Management (EFQM) excellence models (Savic et al. 2013). Other than the leadership aspect, quality management tools like executive coaching and SML conduct toward quality elements, consumer centricity, staff development, management of vendor/supplier agreements, and so forth have demonstrated in many studies to be of success in ensuring firm performance positively particularly enhancing quality and innovation performance in delivered products and services (Auer-Rizzi and Reber, 2013; Shanmugapriya and Subramanian, 2015; Waqas Raja and Wei, 2015). The above results were in line with existing study.

SML also discussed he importance of customer satisfaction and stressed upon the need to include customer satisfaction measures in operational plans. The results of the research work by Samad (2012) was in line with the point while demonstrating that a positive impact found of customer specific innovation on firm performance (Samad, 2012). Strategic leadership makes an advantage to know the attitude of the customers by concentrating and taking advantage of innovation at manufactured goods or delivered services in line with consumer requirements (Mui, H. K. Y et al. 2018). The work by McCauley and Wakefield (2006) also found consistent with quality analytic research while focusing on that it is the obligation of the top management leadership to guarantee that related staff members are prepared and advanced onto a vibrant and self-driven workforce team in the firm. In this way, building up the staff adequately as per process needs empowered the organization to flourish in the emerging markets (McCauley and Wakefield, 2006). Employees are the most significant asset of a company and strategic leadership must stressed on the need in creating and organizing the key resource under customer specific environment (Mui, H. K. Y et al. 2018).

As the above discussion elaborated, it is being hypothesized that strategic management leadership (SML) is positively related to firm performance.

Hypothesis (H_{13}): *There is a positive relationship between human resource development and firm performance*

This quality analytics study did not show a positive relationship between elements of human resource development (HRD) and firm performance. As this could not get the experimental support. The studies like Otoo, F. et al. (2019) show a partial impact of HRD practices on firm performance through mediation of employee performance and Li, R. et al (2019), Waiganjo, E. et al. (2013) showed impact of HRD practices on innovative and financial performance of the organizations respectively. Some studies show weak to medium level relation between the two (Guest, D. E. et al 2003) and Katou, A. A. (2014) found a context based impact between the two in developing and under developed economies the relation was suggested as no to weak and in at developed one the relation was positive. The findings suggest to further analyze the relation for south Asian regions.

5.3.7 Relationship between Business Analytic Practices and Firm Performance

Hypothesis (H_6): *There is a positive relationship between business analytics practices and firm performance*

The current quality analytics study revealed a positive relationship between elements of business analytics (BA) practices and firm performance. Business analytics got the empirical support and bring in a positive relationship between the two variables. The study by Aydiner, A. S. et al. (2019) found in line with current research findings, the direct relationship between business analytic practices and business process performance by demonstrating that the business analytics algorithms and technologies are coordinated with firm procedures (Tan et al. 2016). The combination enhances company's capacity to detect and react to circumstances in the market, and it does brings such information to business processes (Chen, Wang, Nevo, Benitez-Amado, and Kou, 2015). A more practical utilization of business analytics enhances customer positioning and supports in accomplishing better firm performance. Simultaneously, integration with different other business areas assists in getting improved firm performance.

The current investigation has given a helpful point of view and Found in line with research carried out by Raguseo, E. Et al (2018) analysed the perception of corporate value as regards the transactional, strategic and transformational value of a company's monetary success under a big data analytics condition. The main goal of Raguseo, E. Et al (18) and Tian, X. Et al.(2015) research was conducted to determine the effect of the corporate benefit of big data analytics aspects on the financial performance of an organisation through direct and indirect interventions, through customer loyalty and business market performance. The findings show that the business benefit of the Big Data investigation includes more than the necessary variation in customer satisfaction, market performance and financial performance. Thus only business value and customer satisfaction influence the financial performance of companies, the direct effect of business value and the indirect impact of customer satisfaction. It is clear that customer loyalty has more impact on financial results than on the marketability and indirect effect of business value (Ji-fan Ren et al. 2016). Quality analytics study findings indicate that organizations should recognize customer satisfaction here as significant strategic goal for achieving corporate performance of their companies. as also supported with Raguseo, E. et al (2018) work. Consequently, leaders should be

conscious that there might be variations depending on the specific IT objects they choose to invest in. In addition, the results emphasized the significance of market value of big data analytics solutions and customer satisfaction as decision variables in evaluating the financial performance of the company (Raguseo, E. et al 2018).

Akter, S et al (2016) work highlight the similar condition as narrated in current quality analytics study that big data analytics tools enable the company's entrance into foreign markets, the introduction of revolutionary products and the opportunity to beat rivals. Big data analysis tools allow an organisation to attract its customers with better goods and services than competition. Finally, Big Data Analytics tools improve the company's financial results in terms of customer retention, revenue growth and profitability (Raguseo, E. et al 2018). Duan, Y. et al. (2020) point was also consistent with current study findings that quality insights from big data discovered affecting business performance though adequately dealing with the supply chain, improving technological applications, making new items, and maintaining healthy relationships with customers. For instance, companies have found changing their processes, tasks and performance measures utilizing live sensor data and making analysis from advanced industrial equipment.

Every one of the quality research dimension indicated in our hypothesized model execute a key task in developing quality at analytics. "Getting business value from analytics tools depends in significant manners on building solid [internal capabilities] that connect insights with business results". The study establishes "internal capabilities" such as the quality of trained capabilities that can upgrade and improve competitive advantage through deploying procedures such as knowledge visualisation and presenting predictive prescriptive data appropriately. Better analytics features have been recognised to boost efficiency when they are related to the strategies of organisations (Aslan et al. 2015). For example, one retailer could not meet set performance goals that had to be realised by deploying broad data insights because it needed to reconstruct its supply chain, which was not reinforced by a firm-level process. While organisations spend huge money on developing analytical insights, they are often disengaged from a firm-level strategy. (Duan, Y. et al. 2020). Despite the fact that organizations put huge money in improving analytics driven insights but these are mostly disengaged from firm level strategy. In connection with above empirical discussion, it is being hypothesized that business analytics (BA) is positively related to firm performance.

5.4 The Mediation Effects of Business Analytics

5.4.1 The Mediation Effects of Business Analytics on QMS practices and Firm Performance

In the current quality analytics study, out of five selected QMS practices hypothesized to have an effect on firm performance through business analytics only customer satisfaction management (CSM) had not revealed significant result whereas rest of dimensions (i.e. strategic management leadership, production operation management, human resource development and risk management) were found to positively improve firm performance through business analytics. The mediation role of the business analytics can be explained theoretically through resource based view (RBV) theory. As per RBV theory, organizations can strategize their vital resources in order to take competitive advantage as well as enhance firm performance (Runyan et al. 2007).

Hypothesis (H_7): *Business analytics practices mediates the association among strategic management leadership and firm performance*

One of research by Wieder, B. et al (2015) give new insights into how elements of business intelligence (BI) or analytics reasonably direct or indirect way impact the value of strategic dynamic of managerial decision making and vice versa. The outcome of PLS and mediating role investigation affirm that business intelligence management quality has positive direct as well as indirect impacts on information management quality, data quality and the extent of business intelligence applications. The study was found consistent with current quality analytics work by depicting that business intelligence management had no direct impact on managerial strategic aspects but its impact as such through indirect way i.e. the two-way mediator way by means of operational data quality and risk evaluation activities was confirmed (Boulesnane, S. et al. 2013). There has been a significant mediation impact of business intelligence management quality on the nature of managerial development and strategic aspects.

Hypothesis (H_8): *Business analytics practices mediates the relationship between human resource development and firm performance*

The mediation role of analytics on human resource development and firm performance was further supported by the Chernetska, D. (2017) study which revealed insight for the firm staff to properly knowing the particularity of customer specific information, produced through business analytics model and then using to enhance customer experience through innovative offering. The uniqueness of the investigation lies in the business viewpoint on the subject, ground in analytics literature (Waseem-Ul-Hameed et al. 2018). The subject of data use for information processing, knowledge creation is communicated and used against the idea of resource stocks gathering. In this manner, the investigation broadens the discussion on overseeing customer information in the extent of innovative advances, by combining this idea with elaborations from the data analytics subject.

One of the earlier study highlight a positive relationship of information technology usages on supply chain contribution and firm performance (Huber et al. 2007). Naway, F., & Rahmat, A. (2019) conducted a technological integration study to verify the mediation role of information technology integration across supply chain operation including its dimensions like supply chain planning, supplier operation management, plant manufacturing and delivery operations on firm overall supply chain financial performance. The study yielded statistically significant relations. So, it runs with current study where mediation role of a similar set of tools business analytics was assessed on QMS practices and firm performance.

Hypothesis (H_9): *Business analytics practices mediates the association among production operation management and firm performance*

Hypothesis (H_{10}): *Business analytics practices mediates the association among risk management and firm performance*

Another research was found supporting the current research was conducted by Waseem-Ul-Hameed et al. (2018) that describes, information communication technology (ICT) namely information systems have been found mediating the relationship between digital purchase payments, e-traceability, overall operation management and e-coordination customers. Information communication technology (ICT) facilitated to deliver payments digitally instantly, greater security with adequate protection level and confidentially by enhancing customer

satisfaction, trust and firm performance. Demir, R. et al. (2017) literature review confirmed direct positive relationship between human capital risk and firm high development under the moderation of information systems like business intelligence and ERP. A few investigations identified with strategic HRM risk additionally lead Demir, R. et al. (2017) to recommend the moderation relationship of information systems on human capital risk and high development of organizations (Barringer et al. 2005).

Hypothesis (H_{11}): *Business analytics practices mediates the association among customer satisfaction management and firm performance*

Findings of current research did not support, mediation role of analytics on customer satisfaction management and firm performance as this could not get the empirical support. However the studies like Foss, N. J. et al. (2011) highlight the mediating role of advanced knowledge incentives technologies customer relationship and innovation performance of the firm. The findings suggest to further analyze the relation particularly for south Asian regions. Based on above experimental discussion it its being hypothesized that business analytics found mediating between QMS practices (SML, HRD, POM and RM except CSM) and firm performance.

CHAPTER SIX: CONCLUSION

Purpose of the final chapter of the thesis is to summarize the research reported in quality analytics study. The chapter has been divided into following four parts:

1. Reveal in what ways research objectives have been fulfilled and way to comprehend research questions.
2. Briefly describe theoretic, methodological and managerial contributions of this research
3. Discuss the limitations of the research.
4. Explain directions for future research.

The final chapter starts with a brief description of the thesis along with key findings of the quality analytics study. Findings has led to a number of recommendations and limitations of the study that may provide help to conduct future studies.

6.1 Thesis Summary

Current study focused on the relationship of quality management system (QMS) practices with business analytics (BA) and firm performance. It has been found through the extensive literature that multiple grounds and significances exists that highlight impact of quality management system (strategic management leadership, human resource development, customer satisfaction management, risk management, production operation management) and business analytics (Plan, Source, Make, Dispatch, Market) effects firm performance.

Quality Analytics thesis suggested a conceptual framework of selected quality management system and business analytics elements into one relationship model to elaborate the relationship between these constructs and firm performance, the model further show the mediating effect of business analytics on quality management system practices and firm performance. To elaborate the relationship between given constructs and business analytics and firm performance the research

model has proposed sixteen hypotheses (as given in chapter 1). Context of the study is the Pakistan's business sector organizations across the four provinces of the country, sample was drawn from more than 400 professionals. Quality management system practices (strategic management leadership, human resource development, customer satisfaction management, risk management, production operation management) were the exogenous constructs as these are known as drivers of change in organizations. The components of business analytics and performance management were treated as endogenous constructs. The study examined the relationship of a few demographic variables on business analytics and firm performance.

The chapter also comprised on the brief description of the QMS and BA implementation status in Pakistan, rational selecting the field, problem statements, study objectives, and the significance of the thesis as highlighted in chapter-1. Previous studies have been discussed in the literature review part of chapter-2 that was arranged in connection with the developed conceptual model of the study. Methodology of the research which guided to conduct the study has been thoroughly discussed in chapter-3. Data analysis, study findings were discussed in chapter 4 while overall discussion on findings in relation with set hypotheses were arranged in chapter-5.

6.2 Key Findings of the Study

In order to know the relationship between business analytics led quality management system on firm performance, a conceptual model was developed with eleven constructs (strategic management leadership, human resource development, customer satisfaction management, production operation management, risk management, plan analytics, operation analytics, source analytics, dispatch analytics, marketing analytics and firm performance). In total sixteen hypotheses were developed to depict the relationship of mentioned constructs. Before testing the hypotheses, the assessment of the structural model was performed by conducting PLS-SEM algorithm and bootstrapping under Chin (2010) guidance. It was done by evaluating the predictive power of the structural model through coefficient of determination (R2 values) of the endogenous construct and the respective level of significance for each path coefficient was also determined. As per Henseler et al. (2009), the R2 of dependent variable with three or more endogenous latent construct should be at least substantial, the condition was eligible for this analysis.

The hypothesis was evaluated on the basis of a path analysis, that is an extended version of the regression model. The path analysis model, with the aid of its correlation matrix, allows researcher compare two or more casual models in a study (Nitzl, C et al (2016). The path model includes two forms of effects: one is a direct effect and the other is an indirect effect. Both were used in the quality analysis report. The non-significant pathways or pathways displaying signals in the opposite direction to the suspected condition do not support theories, whereas the suggested causal association is empirically confirmed by significant pathways. Then bootstrapping with a resample of 5000 was run to obtain t-values and p-values so as to determine if direct relationships were important.

6.2.1 Findings of the Study in Relation with Research Objectives

Table 6.1: Findings of the study with respect to research objectives

Research Objectives	Research Outcome
To assess the Impact of Quality Management System (QMS) practices on firm performance.	To validate the impact of quality management system practices (strategic management leadership, human resource development, customer satisfaction management, production operation management, risk management) on firm performance a total of five hypotheses were developed. Result of the direct effect of path model for QMS practices and firm performance reveal following outcome; **H_{12}**. A positive relationship was found between Strategic Management Leadership and Firm Performance **H_{13}**. No evidence found for a positive association among HR Development and Firm Performance. The **H_{14}**. A Positive association was found among Production/Operation Management and Firm Performance **H_{15}**. A positive relationship was found between Risk Management and Firm Performance **H_{16}**. A positive relationship was found between Customer Satisfaction Management and Firm Performance

	From above discussion, it was confirmed that research objective was almost met as the QMS practices (excluding HRD) have a positive impact on the firm performance.
To assess the Impact of Quality Management System (QMS) practices on business analytics practices	To validate the impact of quality management system practices (strategic management leadership, human resource development, customer satisfaction management, production operation management, risk management) on integrated business analytics practices a total of five hypotheses were developed. Result of the direct effect of path model for QMS practices and business analytics draw following conclusion; **H_1**: No evidence found, if a positive relationship exist between Strategic Management Leadership (SML) and Business Analytics Practices **H_2**. No evidence found, if a positive relationship exist between HR Development (HRD) and Business Analytics Practices **H_3**. A positive association exist among Production/Operation Management and Business Analytics Practices **H_4**. A positive association was confirmed among Risk Management and Business Analytics Practices **H_5**. No evidence found, if a positive association exist among Customer Satisfaction Management (CSM) and Business Analytics Practices From above discussion, it was confirmed that research objective was partially met as the QMS practices (excluding SML, HRD, and CSM) have revealed the positive effect on the firm performance.
To assess the Impact of Business Analytics (BA) practices on firms' perceived performance	To confirm the integrated impact of business analytics practices on firm performance one hypothesis was developed. Result of this direct effect of path model for BA practices and firm performance reveal following outcome; **H_6**: a positive relationship exists between Business Analytics Practices and Firm Performance

	From above discussion, it was confirmed that research objective was fully met as the business analytics practices have a substantial positive impact on the firm performance.
To assess the mediation effect of Business Analytics (BA) practices between QMS practices and firms' perceived performance	To know the mediation effect of integrated business analytics practices between quality management system practices (strategic management leadership, human resource development, customer satisfaction management, production operation management, risk management) and firm performance overall five hypotheses were developed. To know the mediation effect, It was necessary to adjust the model via SEM in order to determine the relationship between the predictor variable and the mediator factors. This was done by performing the bootstrapping. The purpose was to know if the in-direct relationships are significant. Result of the in-direct effect of path model for QMS practices and business analytics draw following conclusion; **H_7**. Business Analytics Practices positively mediates the relationship between Strategic Management Leadership and Firm Performance **H_8**. Business Analytics Practices positively mediates the relationship between HR Development and Firm Performance **H_9**. Business Analytics Practices positively mediates the relationship between Production/operation Management and Firm Performance **H_{10}**. Business Analytics Practices positively mediates the relationship between Risk Management and Firm Performance **H_{11}**. No evidence was found, if Business Analytics Practices mediates the relationship between Customer Satisfaction Management and Firm Performance From above discussion, it was confirmed that research objective was almost met as the business analytics practices

	positively mediates the relationship between quality management practices (excluding CSM) and firm performance.

6.2.2 Findings of the Study in Relation with Research Questions

The result of t-values and p-values obtained through path analysis model both for direct and indirect effects running a resample of 5000 through bootstrapping was known in order to assess if all of the direct and indirect relationships were significant. Following discussion reveal the status of set research questions in comparison with study findings:

Table 6.2: Findings of the study with respect to research questions

Research Questions	Study Outcome
RQ-1: Do all of the selected quality management system practices supported with information analysis are equally linked with business analytics practices.	The research findings elaborate that under the asked research question's scenario, it was found that only Production Operation Management and Risk management practices of QMS were found having significant impact on business analytics practices. No evidence was found for significant impact of other selected QMS practices like strategic management leadership (SML), human resource development (HRD) and customer satisfaction management (CSM) have revealed a positive impact on the firm performance in Pakistan context.
RQ-2: Do Business Analytics Practices help propose a model or structure for integrating information analysis into decision making to nurture firm performance?	The study findings highlight that business analytics practices (integrated as plan analytics, source analytics, operation analytics, delivery/dispatch analytics and marketing analytics) has a substantial effect on firm performance. So, this reveal that firm need to consider implementing business analytics applications and practices to significantly impact their final outcome.
RQ-2-1:	It was confirmed though the indirect effect that business analytic practices support in fine tuning the QMS practices

Does business analytics is reshaping the business firms' value creation through improved QMS?	and the result reveal that firm where business analytics practices were deployed in addition to QMS practices yield better results. So, it may be concluded that business analytics will support in re-shaping existing QMS practices.
RQ-3: Do all of quality management system (QMS) practices through Business Analytics practices have similar effect on firm performance?	The research findings discuss that under the asked research question's scenario, it was found that almost all QMS practices from strategic management leadership, human resource development, Production Operation Management and Risk management practices were found having significant impact through business analytics on firm performance. However, no evidence was found for significant impact of customer satisfaction management (CSM) through business analytics on the firm performance in Pakistan context. So, it may be concluded that almost all QMS practices through business analytics significantly impact firm performance.
RQ-4: Do all of selected quality management system (QMS) practices have a similar type of effect on firm performance?	The research findings discuss that under the asked research question's status, it was found that almost all QMS practices (including strategic management leadership, Production Operation Management, customer satisfaction management and Risk management) were found having significant positive impact on firm performance. However, no evidence was found for significant impact of human resource development on the firm performance in Pakistan context. So, it may be concluded that almost all QMS practices through business analytics significantly impact firm performance.

6.3 Study Contributions

Implementation of quality management system practices was initiated in Pakistan from around mid-1990s with the introduction of ISO 9000:1994 standard version under government

patronage and initiatives of automotive OEMs. The application was found somewhat mature in medium to large enterprises but small and micro industries are still struggling to find the way in QMS application. Contrary to this application of analytics or business intelligence is still in its infancy stage in Pakistan. However, there is only the evidence of large organizations where such systems were implemented.

6.3.1 Theoretical Contributions

The study has provided a unique contribution to the production operation management body of knowledge by identifying a major theoretical gap which hinders organizations to improve upon performance (especially innovative). Although process parameters and specifications are set in every industry and service sector and those have become regulatory requirements. As per quality management system requirements these need to be revised based on emerging trends and technology advancements. But these have been neglected and operation standard changes are owe to customer complaints only. 1st major gap identified is process orientation focus i.e. process theory understanding in early years of work commencement. The standard for process orientation need to be developed following which staff can smoothly move through their transitionary stages of knowledge acquisition. The world is changing fast, so the business operations are. Existing process/operation benchmarking guidelines failed to attract leaders and professionals to adopt benchmarking as an improvement tool. Benchmarking a very effective tools has become useless due to lack of recognized body of knowledge that provide adoptability and flexibility across the industries. A gap was existed that need to be bridged by refining daily work systems framework for respective industry. The present study has revealed the importance of production operation management, as POM was emerged as the second constructs impacting the firms' direct and indirect performance through mediation of business analytics as well as has significant impact on analytics project success.

2nd theoretical gap was identified as literature has not identified any set body of knowledge/guidelines to be followed for strategic management role in inculcating innovative work on the basis of daily work system reporting. What criteria exist which can be followed to ensure smooth functioning at SMEs and large local organizations. 3rd theoretical gap was identified as the need to develop separate body of knowledge for risk management or add to newly developed

Agency Theory by Tse Y.K. et al. (2019) by incorporating more unique perspective on in-firm participation in risk management activities beside existing formal and social control to other like information control, strategic control and most importantly behavioral control. 4th theoretical gap was found an absence of body of knowledge (BoK) on customer co-creation or joint value creation framework. Although literature has discussed this point extensively but a comprehensive co-creation framework still found absent in all known studies. The 5th theoretical gap exist no evidence from known studies was found to integrate and develop quality management systems (QMS) and business analytics (BA) combined body of knowledge that can explain how the both disciplines are interconnected, how quality or management professionals can add business analytics to their skill set and how analytics professionals can equip them with QMS knowledge to be successful in their production operation analytics endeavors. The gap has emerged a new discipline of knowledge by combining the two (QMS & BA).

6.3.2 Practical/Managerial Contributions

Onto the practical contribution suggested by this study, the 1st contribution was provided as a more process orientation result in more innovative team that will be better equipped to establish and review workable process KPIs. The gap exist in current settings where managers are required to develop their own customized process/operation benchmarking SOPs. More process orientation will provide managers more knowledge that supports internal innovation. Managers can improve their daily process reporting system based on their process orientation capability and maturity. The process orientation will also support in inculcating entrepreneurial abilities in skilled professionals providing them more avenues. The study highlighted a 2nd practical contribution which is a need for key strategic management skill where the study pointed out that improvement goals are established, reviewed and monitored at all levels and function in the company. The top executives' capability also connect different technological advancements related objectives together and found significantly affecting organizational performance.

3rd practical gap that was identified is managers are required to adopt daily formal, social and functional control measures to reinforce the impact of product/service quality risks on the financial performance and quality planning. This might facilitate concerning managers to adopt formal controls to mitigate quality planning and performance risks. So, it suggests to consider

deploying customized risk management and control practices in respective organizations. 4th practical implications found for managers and leaders was to know which attributes of the staff job description/roles concerning products/ services are highly valuable both for internal and external customers. Known past literature has failed to identify a customized approach which need to be developed for each separate function and level.

The 5th practical implication of the quality analytics research in Pakistan context was found as, the study highlight that to fetch business values from analytics depends on building strong competencies related to core process activities and technology. The internal capabilities will help in yielding a better competitive advantage. The gap is also elaborated if core competence are not available the organizations' huge money invested in improving analytics driven insights will be a complete waste as it will be dragged from firm level strategy. So, as pointed out connection between firm level strategy, human resource development and analytics success is a must. Strategic management role on business analytics success was not confirmed in the Pakistan context but it impact on firm performance through business analytics was confirmed. So, managers and executives are required to consider adopting the applications to get better insights and improve their decision making processes. The mediation of business analytics on operation management as well as human resource management was found critical to enhance organization performance. This has been found to better manage time spent on daily problems solving and innovation. This further led to identify 6th practical implication, which was recommend by the study as the mediation of business analytics has been proved to be controlling problem solving at a certain extent which allowed to provide improvement insights spend more time to enhance innovativeness competencies.

The study has further provided key practical implications in Pakistan context even after the implementation and launch of risk based QSM version of ISO 9001:2015, risk management activities are regarded as waste of time and resources (Nawaz A. 2019). This has not gone even beyond low level consideration. The current study identified the major gap that risk management has emerged as the single major construct found impacting the direct firm performance, and in-direct firm performance via mediation as well as found impacting business analytics project success. The 7th gap has not been previously identified in any known study of QMS, BA or mediation.

6.4 Limitations of the Research

Among the major strengths of any good research studies is to have an eye on the limitation. Although the quality analytics study has contributed to existing body of knowledge in the quality management system as well as provided methodological and practical implications but it is not without weaknesses. So, the limitations are given here as under so that direction to future research can be provided.

The major limitations of the research are as follows:

The business analytics led quality management system implementation is relatively a new phenomenon. A thorough review of literatures was conducted based on work published in South Asia and rest of the world. Thus information on the topic is very scare, a very few studies were conducted which found covering even a few elements of a dimensions of QMS and analytics in separate studies with different objectives not the current model.

The study was limited to the major studies of the Pakistan which were included in the set provincial cluster. The response from Baluchistan was very poor and low response was received from KPK too. The study was limited to the organizations who responded from those areas. So, the results may be generalized with caution in these and few other settings.

Another limitation of the current study is that cross-cultural dimension of analytics led quality management implementation has not been considered. So, the generalizability of the study to other parts of the world is very limited as the study was conducted in Pakistan settings.

One limitation was questionnaire length. Current questionnaire contained 80 items. This could have been observed as time-consuming for some participants and may have resulted in losing concentration when answering the end questions.

The study has not touched upon the organizations providing consulting services in both QMS and BA fields. The data was collected from practitioners only.

The present quality analytics study uses a cross-sectional approach to collect scattered information. It is recommended to conduct future researches using a longitudinal study approach to assess strength of proposed model and know its stability across time in different regions.

The study was confined to one country only. Future studies may extend by including more regions or countries with different cultures in order to address cultural factors or compare various cultural settings.

The study was conducted employing a seven point Likert scale. The future researchers may consider adopting the better nine-point scale fast-form items as suggested by Wamba S.F., et al (2019).

6.5 Direction for Future Research

From the current quality analytics study, following recommendations can be drawn regarding further research:

As discussed above the present study, has not incorporated cultural dimensions. Thus, a cross-cultural examination in future will put more value. Impact of cultural reflections may be investigated on various other dimensions of quality management and business analytics.

In the present study impact of selected quality management and business analytics practices was assessed on perceived firm performance (financial aspects). The impact on other performance parameters like market innovation, customer services enhancement and customer satisfaction index may be investigated.

Quality analytics is 1st study of its kind that has employed quality management and business analytics in a joint manner. So, a comparative study may be more useful to understand the significance of the conceptual framework in different settings, regions and across industries. Apart from this emergent and developed country comparative perspectives need to be investigated in some future studies.

The application of the quality analytics conceptual model can be empirically tested in several other particular sectors like service, education, healthcare or technological services etc.

The comparative study of provinces (Punjab, Sindh, KPK, Baluchistan) included in this study may considered, this will support not only compare different quality management tools, but also to compare findings from the tool but in different locations, to see its application level and benefits gained.

It is recommended to conduct future researches using a longitudinal study approach to assess strength of proposed model and know its stability over the period of last five or ten years' time, as the quality management owing to analytics integration is expected to witness rapid changes that need to be examined.

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Appendix A

Quality Analytics Study Questionnaire

Dear Sir,

You are expected to take part there in "Quality Analytics Performance" research. The goal of the study is to learn about the best quality/analytics practices that contribute to the firm's success. You are chosen as a potential participant in this study because of your professional background in manufacturing/operation/quality/analytics.

Please complete the attached survey questionnaire for our study. The completion of the questionnaire will not include any personally identifiable information/document and will not result in any risk or damage to the respondent, its organisation or industry.
The details given in this study will remain confidential and will not be revealed to other practitioners or the general public in a manner that can be traced back to you or your organisation. No individual other than the researcher will be identifiable for aggregate reports/publications such as thesis, and only aggregate anonymous data will be presented.

Likert Scale 1-7 has been used to capture your responses where;
1- Strongly Disagree (least level), 2-Disagree, 3-Fairly Disagree, 4-Neutral, 5-Fairly Agree, 6-Agree, 7-Strongly Agree (highlight the maximum level)

You can provide your answers (marking x) at specified boxes below / in front of each question. This will take 20-25 minutes of your precious time to adequately fill the form. If you have any questions, please contact undersigned at; imranrana.qa@gmail.com;

If you have any additional questions later, I will be happy to answer them.
Your response will be highly appreciated and will support developing Quality Analytics implementation model for our region.

regards,

Research Scholar
Legends:
1- Strongly Disagree (SD), 2-Disagree (D), 3-Fairly Disagree (FD), 4-Neutral (N), 5-Fairly Agree (FA), 6-Agree (A) 7-Strongly Agree (SA)

Demographics:

Gender;

Male
Female
Prefer not to say
Age Group;

Under 30 Years
30-39
40-49
50-59
60 & Above

Your city / province / state (mention);
……..

Your Dept. (Serving at):

Production / Operation
Quality
Supply Chain (Purchase, Logistics etc.)
Sales/Marketing
Services
Other…

Total number of employees in your company;

Less than 10
10-49
50-249
250-499
500 & above

This organization is practicing Quality Management since (Years);

1-2
3-5
6-8
9-11
12 & above years

Organization is practicing Business Intelligence / ERP / Analytics /KPIs since (Years);

1-2
3-5
6-8
9-11
12 & above years

Your Total work experience (in Years);

1-2
3-5
6-8
9-10
11 & above

Your Highest Qualification;

Inter/Diploma
Associate Degree
Bachelors
Master
Ph.D
Other

Your Position in the Organization (Designation);

Director / CEO
COO / General Manager
Head Of Dept. / Div
Manager
Deputy / Asst. Manager
Supervisor/Technician/Associate

How many Hierarchy levels are between your position and CEO /MD;

Direct Report
1
2
3
Other

Your Operation / Quality / Analytics Professional certification (if any)

No Certification
Job Specific (Operation, Supply Chain etc.)
Quality Specific
Other

Your gross salary per month (in Rs. / US$) OPTIONAL

Quality Analytics Study Questionnaire

Business Analytics Led Quality Management System and Its Impact on Firm Performance: Pakistan Perspective

Sr#	Strategic Management & Leadership (SML)	SD	D	FD	N	FA	A	SA
		1	2	3	4	5	6	7
1	The top executive of the company accepts responsibility for quality tasks							
2	Major departmental heads in our company accept responsibility for quality management activities							
3	Top executives participate in the quality improvement activities							
4	Management regularly set objectives/targets for quality performance enhancement at all levels and functions							
5	Quality issues and improvement opportunities are not reviewed in the top management meetings							
6	Quality management system (QMS) activities are part of company/division strategic plan							
7	Customer satisfaction (Internal/External) is considered in the operational plan (1-2 years)							
8	Quality objectives/goals and policy are not clearly understood within the company/division							
	Human Resource Development (HRD)							
1	Work related training is given to employees throughout the company/division							
2	Training in the decision making / statistical techniques (graph, charts, analytics) is provided in the company / division.							
3	Employees are involved in their career growth programs in the company/division							
4	Effectiveness of employee growth plans is measured / monitored							
5	Employees are not recognized for superior performance							

6	Employees are advancing their knowledge through professional work engagements							
7	Employees here does not feel the need to acquire advance professional trainings / certifications							
8	Employees are given opportunities to apply related operation analysis techniques and technologies							
9	Employees know the interconnection of their field with other disciplines (e.g. information systems, ISO 9001)							
	Production / Operation Management (POM)							
1	New product/service design is reviewed before the product/service is produced							
2	Product/service specifications / KPIs are understood in our division/company							
3	Product/service procedures/SOPs are understood by all in our division/company							
4	Inspection, review, or checking for quality of products/services is done at our division/company							
5	Work or process instructions/job description are not properly understood by employees							
6	Our company/division study the best practices of other companies to get ideas about how to do things better							
7	Company/division does not compare current quality level of products / services' features with those of competitors							
8	Suppliers/vendors are selected based on quality rather than price							
9	Company relies on few dependable suppliers							
10	Company provides performance feedback and related awareness / technical assistance to suppliers							
	Customer Satisfaction Management (CSM)							
1	Our company/division is totally committed to create satisfied customers							
2	Top executives demonstrate with their actions that customer satisfaction is important							
3	Employees know which attributes of the products/ services are highly valuable for our customers							

4	Our company/division asks customers to give feedback about product/services' (company) performance							
5	Information from customers is not used in designing company's products and services							
6	Customers' complaint resolution takes longer time in our company / division							
7	Our company's goals exceed customers' expectations							
	Risk Management (RM)							
1	The existence of risks and senior management's recognition of this is appropriately communicated to employees.							
2	Management encourages the reporting of events in order to identify risks							
3	Company review risks after implementation of risk reduction measures and controls							
4	Company has established satisfactory risk transfer arrangements with other organizations (e.g. insurance)							
5	Company does not evaluate and record risks while making key decisions for important projects, investments							
6	Company evaluates risk (changes in laws / regulations or litigation claims) that result in lowering company's ability to smoothly conduct business							
B	**(**Supply Chain) **Business Analytics (BA)**							
B1	**Indicators of analytics capabilities in plan**							
1	Our company has set supply chain performance measures							
2	Company use proper analysis tools to assess the effect before making decisions							
3	We use Statistics methods to forecast demand							
4	A forecast is developed for each product / service							
5	Products/service forecast have not proved beneficial							
6	We measure and evaluate forecast accuracy							
	Source Analytics (SA)							
1	Supplier inter-relationships (KPIs, metrics) are understood and documented							
2	We share planning and scheduling information with our suppliers/vendors							
3	Supplier performance measures are not contributing to our products/services quality and delivery improvement							

4	We measure internal / external suppliers performance and provide feedback							
	Operation Analytics (OA)							
1	Our operation planning processes are integrated and coordinated across the departments							
2	Our suppliers lead times updated as required /monthly							
3	We measure adherence to our operational plan							
4	Sales, operation/production & distribution department do not collaborate in the planning & scheduling process							
5	Our plans are developed at the "item" level of detail							
	Delivery / Dispatch Analytics (DA)							
1	We track the percentage of customer orders completed / delivered on time							
2	We measure "out of stock" situations							
3	Our distribution management process measures are in place							
4	We use our process measures to recognize and reward the process participants							
	Marketing Analytics (MA)							
1	Our management expects quantitative analysis to support important marketing decisions.							
2	We are confident that the use of marketing analytics improves our ability to satisfy our customers.							
3	If we reduce our analytics (marketing) activities, our UNIT's profits/performance will not suffer							
4	We regularly use analytics to support decisions in the below areas [pricing, promotion and discount management, sales-force planning, segmentation, targeting, product positioning, developing annual budgets, advertising, new product development, long-term strategic planning, sales forecasting							
5	Marketing analysis has not provided us any information on overall market trend							
C	**Performance Management**							
1	Scrap /Re-work levels have been gradually reduced in our company / division							
2	Internal / External customer complaints have been gradually reduced in our company / division							
3	Key Performance Indicators / Job Descriptions have resulted in employees performance enhancement							

4	Internal communication (section to section) in our company/division has improved in the last few years							
5	Risk identification & reduction processes have been improved in the last few years							
6	We have not observed any difference in our activities before and after improvement activities implementation							
7	Cost of our company/division products'/services has not been reduced in the last few years							
8	Data analysis activities has improved planning process in our company/division							
9	Operation / Production analysis acitivities has improved our company / divison's staff decision making skills							
10	Product / services delivery time has been reduced by data analysis and corrective action measures							
11	Quality management activities has contributed to improve our company's performance both internally and externally							
12	Marketing Analysis has not provided insight on competitors' activities in market							
13	Better Analysis has made our company / division performance reporting faster							
14	Smooth processes' performance has contributed toward innovative products and processes							
15	Stakeholders' (investor, employee, customer, supplier) are satisfied with company / division performance							
16	Data analysis has provided insights to make our employees innovative in their respective field							