STUDY OF SELECT ISSUES OF TOTAL QUALITY MANAGEMENT IN INDIAN FMCGs INDUSTRY

Thesis submitted in fulfillment of the requirements for the Degree of

DOCTOR OF PHILOSOPHY

by

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JULY, 2021

Contents

DECLARATION BY THE SCHOLAR

I hereby declare that the work reported in the Ph.D. thesis entitled **"Study of Select Issues of Total Quality Management in Indian FMCGs Industry"** submitted at **Delhi Technological University, Delhi** is an authentic record of my work carried out under the supervision of Dr. R. S. Mishra. I have not submitted this work elsewhere for any other degree or diploma.

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SUPERVISOR'S CERTIFICATE

This is to certify that the work reported in the Ph.D. thesis entitled **"Study of Select Issues of Total Quality Management in Indian FMCGs Industry"**, submitted by **Mr. Rakesh Kumar** at **Delhi Technological University, Delhi, India** is a bonafide record of his original work carried out under my supervision. This work has not been submitted elsewhere for any other degree or diploma.

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Dedicated

to

Almighty god and my parents

Acknowledgement

Though it will not be enough to express my gratitude in words to all those people who helped me during my Ph.D. tenure, I would still like to give my thanks to all these people. My first debt of gratitude must go to my supervisor **Dr. R. S. Mishra**, Professor, Department of Mechanical Engineering, DTU, Delhi. He offered me so much advice, patiently supervising me, and always guiding me in the right direction. His understanding, encouraging and personal guidance have provided a good basis for the present thesis. His wide knowledge and his logical way of thinking have been of great value for me. I am deeply grateful to **Dr. S. K. Garg**, Head, Department of Mechanical Engineering, DTU, Delhi for his detailed and constructive comments and for his important supports throughout this work. I have learned a lot from him. I also thank **Prof. Yogesh Singh**, Vice Chancllor, DTU, Delhi for the cooperative spirit and providing an excellent working environment. I wish to express my warm and sincere thanks to **Prof. S. C. Sharma**, Dean-PG, DTU, Delhi, for his supports. I would also like to thank **Dr. Saurabh Agrawal** and **Dr. Quasim Mutza**, DTU, Delhi for their valuable advice and friendly help. I express my special thanks to **Management of Britennia Industries Ltd.**, New Delhi, for providing the experimental support.

My special gratitude is due to my father **Mr. R.Y.P. Singh**, my mother **Late Mrs. Prabhawati Devi** and my wife **Mrs. Divya Singh** and my younger brother **Mr. Rajesh Kumar** and my childs **Miss. Mansa Yashraj** and **Master Raunak Singh** and my friend **Ajay Solanki** for their unending support in the bad phase of my life. Their love provided me inspiration and was my driving force. Last but not least, i express my heartily thanks to my friend **Dr. Girish Dutt Gautam**, for his continuous advice, help and moral support.

(Rakesh Kumar)

List of Figures

List of Tables

Abstract

The 21st century seems to have practically adopted performance measurement as a tool for continuous improvement; hence a productive change in the world of business is quite noticeable. Measuring performance continuously has become essential for masses of organizations as this is the only way that organizations can compete with global challenges. Performance measurement is often confused with performance management and mostly misunderstood as synonyms. Performance measurement is a solo activity that is employed to access performance for a predetermined goal on a set of parameters. As opposed to this, performance management is an integrated activity that aims to nurture and institutionalize performance management as a fundamental system of an organization. In this parlance, performance measurement is considered as one of the tools that are used in measuring the actual performance of the system to achieve the goal. Similarly, performance management is viewed as an activity of goal setting and monitoring the achievement of goals. Performance management in this sense is viewed as another form of management by objectives (MBO). In De-facto, management by objectives is one of the important features of performance management. The performance of an organizational system is the aggregate output of performance of its subsystems, which are directly linked with the goal of the organization. The strategies of the organization are interpreted as Systems of the System (SoS) viz Total Quality Management (TQM), Just-In-Time Management (JIT), Lean Manufacturing (LM), Logistics Management, assembly system, facility management, Supply Chain Management (SCM) system etc. This strategy of a subsystem is dynamic in nature and acts to achieve their individual goal with enablers and drivers called critical success factors (CSFs) which ultimately converges with the organizational goal. The name/title or levels of these CSFs may appear the same, but their approach differs from one other as per the system requirement.

In recent decades, Total Quality Management (TQM) has become the approach

of confidence for those organizations who have still been struggling to implement it without any barrier in their organizational system. Moreover, it is a benchmark level of dominance for those organizations who are using it as a tool in their various continuous improvement programs such as lean production, six-sigma approach, Just-in-Time manufacturing and Total Productivity Management (TPM). Thereby, the TQM implementation seems to be determined to hone their performance level so as to attain a benchmark that would lead them to get a sustainable status. The critical success factors (CSFs) certainly in this context have been playing a pivotal role. They have been contributing to making the industries more competitive and sustainable by introducing new technologies and bringing forth new perspectives into the organization. It is a well-known fact that an organization's performance is largely determined by its employees. A TQM aware employee understands and manages quality in their daily activities. These factors lead a successful company to consistently measure and improve its quality-related functions.

At present, the FMCGs industries operate on the basis of consumer demand for variety and change which leads to continuous improvement with innovative products. Simultaneously customer wants that they must take for granted that the items and services they consume should work well as soon as they purchase them. There are also residual losses when customers abandon products and brands for quality reasons. To achieve success with a total quality management program or any other improvement methodology, managers must understand the quality goals for their product or company. FMCGs consumers choose their daily need products according to their hygienic compatibility, taste and thus change their purchasing decisions according to their lifestyle.

However, back here in developing countries such as India, many industries do not bother with the performance measurement of their subsystems or strategies. Corporations do not share the correct information about the performance of their business nor do they have the facility to measure the impact of implemented strategies. TQM performance heavily depends on how well the TQM system is designed for the organization. In other words, it is quite difficult to improve overall TQM performance if decisions criteria (attributes, i.e critical success factors) are not embedded or considered at the phase of TQM system design. The study of the connection between the CSFs and total quality management (TQM) is essential for effective TQM. Many authors suggest that the CSFs for any objective should be SMART and an acronym for: Specific, Measurable, Attainable, Realistic and Timely. Stating or defining CSFs are top management's responsibility and the quality of their statement reflects the quality of their strategic planning. Many FMCGs industries are successful and they achieve their success because of their effective TQM system design and management of quality-related activities.

This information paves the way for the present thesis which is aimed to examine different issues related to TQM performance measurement in the Indian FMCGs industry. To overcome this problem, in this study, barriers have been decided on the basis of the ranking of the CSFs. Firstly, a set of questionnaires has been developed to identify the issues related to TQM performance measurement practices in Indian FMCGs industries. Then, the issues related to the TQM performance in the industry have been identified through survey. Then, hypotheses concerning have been formulated and tested. Moreover, a case study has been performed and analyzed using the SAP-LAP framework in a particular FMCG company domain. In the last phase, a Knowledge-Based Performance Measurement (KBPM) framework has been developed to rank the CSFs of TQM system using fuzzy-logic approach to evaluate the effectiveness. From the results, it has been revealed that the performance of TQM can be improved remarkably if it applies properly. Moreover, the author believes that the outcome of this thesis could be used for reference analysis to improve the effectiveness of existing TQM practices in the FMCG industries.

Chapter 1

Introduction

1.1 Introduction

Measuring performance is one of the most important tasks in the course of any organizational system. The term "Performance Measurement (PM)" used by various disciplines as per their own concern. In the context of industrial and system engineering, a prominent study was conducted of organizational systems with respect to performance measurement by practitioners and researchers in the last four decades. This performance measurement determines the success of any system or rather, of any organization with respect to the goal. In the mid-20th century, General Electric started tradition of performance measurement that included about exterior the current scope of common records. In Beginning performance measurement were book keeping centric and in reverse pointers with minimal information accessibility. Further, In 1970s, General Motors started measuring non-financial performances associated with production and operations. Evolution takes palce and after that performance measurement is characterized by a huge stream of information. performance measurement has been talked about in profundity since the 1990s, when Eccles (1991) highlighted the significance of a more comprehensive system for performance measurement system frameworks (PMS). From this moment, the hypothesis of PM started to be solidified, and vital commitments were made, including performance measurement, performance measures and PMS (Neely et al., 1995), contrasts between performance management and performance measurement (Lebasso , 1995; Bititsi et al., 1997). Now the measurement was data and technology-driven, considered a precursor of the Balanced Scorecard (introduced by Kaplan and Norton), KPI as measurement tool as introduced in 1992. Some organizations regard the inherent development delay as a marketing key performance indicator (KPI) catalog with the promise of providing thousands of off-the-shelf measurements to their customers. These solutions incorrectly assumed that all organizations had the same performance measurement needs. No two organizations are alike; They all have different strategies and take on unique challenges according to their desired goal, so the critical success factors also differ from organization to organization. Furthermore, the data collected in support of key business processes is never the same. For these reasons, the organization's strategic team abandoned one-size-fits-all solutions. In the 1990s, the use of performance measures grew in popularity in a variety of manufacturing and service sectors.

It observed that performance measurement tool users were often more focused on "chasing their numbers" rather than addressing improvements in underlying processes. The current approach to performance measurement is characterized by a transformational focus on objective-driven performance management that is the foundation of operational excellence. Performance measurement is a process-focused approach that aligns the performance of critical processes to strategic goals by measuring and improving what is most important to an organization.

Fassoula, (2006) reported that manufacturing organizations try to adopt and implement a set of successfully tested operations management practices that enable them to identify changes in their environment and respond proactively through continuous improvement. Kaplan and Norton (1992) stated that If organizations cannot measure performance, they cannot manage their business. Bolwijn and Kumpe (1990) argued, in a competitive environment today organizations need to pursue more complex dimensions of performance. A book authored by Daft, R. I., and Marcic, D., (2009), Understanding management, business performance defined as the measurable result of the level of achievement of the organization's goals or the measurable outcome of the organization's management of its aspects (ISO 1999).

1.2 Total Quality Management (TQM)

To be a good performer in operations, organizations need sophisticated approaches which can be implemented to improve productivity, efficiency, effectiveness, flexibility and competitiveness, such as TQM, SCM, JIT, LM and Enterprise Resource Planning (ERP) including information technology (IT). Many authors endorsed it previously like, Oakland (1989), Wilkinson, 1998, Hakes, 1991, focusing on JIT, Mentzer et al., 2001; Kaufmann & Carter 2006 on SCM, Bhasin, S. (2008); Maskell, B. and Baggaley, B. (2004), Shah, R. and Ward, P. (2003) on Lean, Hassab Elnaby et al. (2012) on ERP.

Implementation of such organizational measures would increase efficiency, effectiveness and competitiveness of the organizational operations that will lead to higher performance and more customer satisfaction.

Implementation of organizational functions is a complex process that requires in-depth understanding. Implementation of success factors play an important role in ensuring implementation Achievement. These factors demonstrate the organization's ability to implement and derive the value added from its implementation. Successful companies use a variety of strategies and technologies such as JIT, TQM and SCM represent alternative approaches to improve the effectiveness and efficiency of an organization's operation stated Kannan & Tan (2005).

Vanichchinchai and Igel (2009) found that TQM and SCM have differences in primary goal, but both share their philosophical perspective, ultimate goal (i.e customer satisfaction) and ultimate integration (from internal functions and external business partners) . All the strategies come in scene after TQM as artifice. But none of them approaches will perform in an effective way without TQM, although satisfying and filling the need of customers and well organizational performance is the main aim of any strategy. Colledani & Tolio (2011) in their work on evaluation of the performance of production systems, jointly considering quality and production logistics performance measures, stated that production system architecture affects the performance of the quality control system.

Snell and Dean (1992) actually found it difficult to differentiate between JIT and TQM as both have similar elements. Flynn and Flynn (2005) provide clear support for the idea that organizations with strong quality management practices achieve better supply chain performance. Customer satisfaction and organizational performance have significantly improved by implementing TQM (Faisal et al., 2011; Hasan and Kerr, 2003). TQM strategy one of them is widely used in manufacturing as-well-as industry and has shown very good result for the improved performance of the organizations. TQM is a tame dynamic system Pirsig (1991) and its dynamism is governed and controlled by its key success factors or critical success factors (CSFs) which attributed as a combination of their drivers and enablers. The drivers and enablers of TQM vary from organization to organization as per the desired goal. The drivers are the constructs that will determine the performance level of the TQM and organization as well. The empirical drivers Top-level management, employee involvement, supplier's management, customer focus, employee awareness, training and education, etc. and accordingly TQM drivers were enabled by enablers. The enablers are for reinforcing the system's drivers to remain dynamic for continuous improvement. Enablers are considered to be variable which gives the ability to maintain consistency. TQM is the integration of all functions of a business to achieve high quality of products through continuous improvement by the participation and efforts of all employees. It includes every aspect of the company: processes, environment and people. The entire workforce, from top level management to line workers, must be involved in a shared commitment to quality improvement. Therefore, in a nutshell, quality and total quality management (TQM) can be specifically defined as directing (managing) the entire (total) production process to produce an excellent (quality) product or service.

According to Sashkin and Kiser (1993), 'TQM means the organization's culture is defined and supports the consistent attainment of customer satisfaction through an integrated system of tools, techniques, and training. This involves the continuous improvement of organizational processes, resulting in high-quality products and services' (Partlow 1996). TQM is an approach to managing organizations which emphasizes the continuous improvement of quality and customer satisfaction, entails the application of systematic tools and approaches for managing organizational processes with these ends in mind, and involves the establishment of structures such as quality improvement teams and councils for maintaining focus on these ends and enacting organizational improvement processes' (Mohrman et al. 1995). Ho, S.K. (1997) defines the term TQM as: Total - everyone associated with the company is involved in continuous improvement (including its customers and suppliers if feasible). Quality - customers' expressed and implied requirements are met fully. Management - executives are fully committed. An analysis of these definitions shows that, after all, they are not much different. For example, there is a strong emphasis on concepts including continuous improvement, customer focus, human resource management and process management.

The basic philosophy of TQM is not a new idea of the 2021s but rather stems seventy years back from W. Edwards Deming in the 1950s. It was in 1950 that Deming introduced statistical methods to US executives, making an attempt to instruct American engineers on continuous improvement through statistical thinking.

Steven E. Brigham (1993) recommended about TQM has its roots in statistical procedure control (SPC); It was originally a manufacturing management model. When W. Edwards Deming and Joseph J.M. traveled to Japan after World War II to help rebuild that country's infrastructure, what they taught did not look like what we now call TQM. Like any enduring species, TQM has evolved, matured and redefined itself.

When TQM is applied to educational institutions, and particularly to learning, it will further diverge even from its original manufacturing form states Steven E. Brigham (1993). TQM recognizes the value of full participation of the workforce and extols the virtues of behavioral and cultural change with 'empowerment' as a key objective, but the gap between using the term 'empowerment' and giving real power prevents recognition, Page and Curry, (2000). The International Organization for Standardization's (ISO) defines a 'quality management system' as "a management system to direct and control an organization with regard to quality" (BS EN ISO 9000, 2000, Dale, B.G. et al., 2007, p. 280).

Therefore, observing the views of various authors it is concluded about TQM as a set of processes and practices used to align and control the quality of an organization as a whole. TQM systems include processes for quality planning strategy and operations, setting capital and operating budgets, measuring and rewarding performance, and reporting progress and conducting meetings. On the other side performance of an organization is based upon the implemented strategies like TQM, SCM, JIT, Lean Manufacturing, Six-Sigma, TPS etc, although they share common ultimate goals customer satisfaction, but their primary goal is different and converges to the organizational goal. These all strategies play a role to achieve the objective of the organization in an organized manner by following their own principles, tools and techniques. Sahoo (2020) observed that the operational practices like lean, TQM and SCM are widely adopted by manufacturers in developed countries, and share a common theme consistent with sustainable creation of customer value and continuous improvement. TQM's victory depends on integration of diverse sub-systems of management effectively advised Nahyan and Abdel, (2017). Many authors investigated the impact of these practices and strategies on organizational performance which is reviewed extensively in chapter two. All these strategies have a post-implementation impact on the performance of the organization. Very rare work is found in context to TQM. Most available work is found related to the SCM performance.

The thing which previous authors mixed is critical success factors of TQM implementation with critical success factors of TQM. Both give a different meaning. If we talk about the latter one, then CSFs of TQM can be listed keeping in view the goal of TQM, but CSF of TQM implementation will be identified on the basis of organizational structure. It may be the text of the label or factors may appear the same, but functionalities differ because the goal differs. As the goal of TQM is customer satisfaction, zero defect, waste elimination etc., in that manner now the quality manager will decide that what to do to achieve the goal, and what is critical to success factors of the TQM goal.

1.3 Performance measurement principles

Measuring performance is an essential part of organizational systems, since it provides information on the performance of those systems, with the aim of supporting decision-making on various issues. There are different theories and models that can underlie performance measurement systems. Most of the traditional approaches to measuring performance are based on accounting centric and lagging indicators with minimal data availability. In recent years, emphasis has shifted to system approaches driving the focus on the strategy specific.

The principles of performance measurement are everchanging as per the characteristics of the system and evolution. As in the present case, the performance measurement of TQM is the requirement of the organization to identify those factors which hinder to achieve organizational goal. Those elements should be targeted to measure on which the output depends and those elements which were responsible for the best result. Measuring the performance of the system is a want to find performance bottlenecks (barriers) in the system.

The performance of any system is measured by proposing a set of principles. The principles proposed complement criteria that any performance measurement system should meet (e.g. the need for indicators to have goals or targets; develop indicators simple and easy to use) (Kaplan and Norton, 1992; Neely, 1999; Lantelme and Formoso, 2000; Bourne and Neely 2003). The performance measurement framework is created in order to effectively transfer performance measurement principles, thereby it is necessary to establish the balanced links between the strategic goal(s) and the CSFs (Cross & Lynch, 1990; Kaplan & Norton, 1992; Medori & Steeple, 2000). Another key principle that has been strongly emphasised is that performance measurement should be clearly grounded in strategy (Cross & Lynch, 1990, Dixon et al. 1990). The significant challenge of incorporating more leading indicators into performance measurement systems can be tackled more effectively if greater emphasis is placed on identifying the factors.

1.4 Performance measurement of TQM and challenges

In today's competitive scenario, it is necessary for improvement in the implemented operations strategies performance that, it would result in more effective, consistent, and efficient performance to the organizations and improve the entire functional areas of operations. TQM performance addresses the TQM capability to integrate and improve all organizational activities. The performance of TQM mediates the organizational performance about this chapter 2 is dedicated. Performance of TQM means the effectiveness of TQM which needs a robust tracking system to measure. The three components of TQM- human (stakeholders), technical and business components must be examined for effective TQM, suggests Oakland (2003). The Common Quality Agenda (CQA) is a set of measures or indicators that tracks the long-term performance of the quality system. Developed with experts across the organization, it shows how the quality deployed for the system is changing in the organization, how boundary across the organization is performing, and how the organization compares with the other organizations. These indicators are the foundation of an organization's report, measuring up and inform the organization's specialized reports that delve into specific topics. As quality improves of entire organization's employees or says internal customer reporting on TQM system performance, the CQA will evolve and serve as a cornerstone for all. In an organization, the TQM approach and its performance depend upon the critical success factors established at the inter or intra- organizational levels. At the inter-organizational level there are top-level management, employee training and education, employee empowerment, Customer involvement, at the intra-organizational level there are supplier's relationships, customer's feedback, stakeholders. In an organization, under quality planning, plans are formulated at the grass-root level with the help of dedicated representatives of organizations of all levels. In order to have successful quality planning, the planning machinery in the organization must be suitably developed both at the inter-organizational and intra-organizational level.

To start, identifying critical success factors of TQM to achieve the TQM goal makes clear is that such detection capabilities should include the ability to monitor performance. Further capability development efforts should anticipate similar scenarios in which the first signs of CSFs variables appear as hindrances (barriers). Either way, identifying and interpreting performance variation among processes may be the difference between success and failure in combating a future quality threat. While advanced tools and techniques (e.g., balanced scorecard) have begun to close this capability gap, work remains in lowering barriers for end-users and delivering such capabilities to each of the performance measurements. Measuring the performance of any management system is the best way to align strategy and structure.

It is important to emphasize that although the ultimate goal is achieving the organizational objectives, for this its constituent systems or approaches possesses relevant goal also viz. JIT, SCM, facility management system, TPM, TQM etc. and these have impacted positively on organization functioning. TQM has been

Imperative for the proactive functioning of the organization as its totality characteristics. Moreover, TQM uses to take a proactive role in the organizational function as well. Dow et al. (1999) developed nine constructs using factor analysis: workforce commitment, shared vision, customer focus, teams, personnel training, cooperative supplier relations, benchmarking, advanced manufacturing systems, and just-in-time principles to examine two issues in the context of TQM, first the identification of the main dimensions of quality management practices and how these practices interact to produce superior quality outcomes. In survey-based research by Wilson, D. D., & Collier, D. A. (2000) by using Structural equation modelling (SEM) measured the content, philosophy, and intent of Malcolm Baldrige National Quality Award (MBNQA) considering seven Baldrige categories as constructs (leadership, information and analysis, strategic planning, human resource management, process management, business results and customer focus and satisfaction) and its subareas to tests the MBNQA performance. The research is to test the theory and causal performance linkages implied by the MBNQA and concludes that leadership is the most important driver of system performance then comes Information and Analysis and leadership no direct effect on financial results but must influence overall performance through the system. Sila, I. (2007), presented the study on the effects of contextual factors on TQM and TQM–performance relationships. Five contextual factors are considered by Sila, I. (2007) which includes three institutional factors (TQM implementation, ISO 9000 registration, and country of origin) and two contingency factors (company size and scope of operations). On the basis of two organizational theories, institutional theory and contingency theory propositions are formulated to show the effects of contextual factors on TQM practices and TQM–performance relationships with the help of Structural Equation Modeling (SEM). Huang, C.-T. et al. (2009), considered 10 factors and 24 subfactors of the Statistical Process Control (SPC) system and evaluated its performance using fuzzy-AHP. The proposed study by Huang, C.-T. et al. (2009) has drawn on the work of Vander Wiel et al. (1992), Rungtusantham et al. (1997, 1999), and Montgomery (2001), together with business information, to introduce a Statistical Process Control (SPC) system into a Taiwanese LCD business. Huang, C.-T. et al. (2009) referred Ham and Lee (2002), Parasuraman et al. (1985, 1991), Lin et al. (2004, 2005) for each step of the paper, like Define, measure, analyze, improve and control (DMAIC) the Six-Sigma methodology is used as the basis for performance-appraisal models and questionnaires to assess the various factors in the implementation of the SPC system, developing indices of importance, action, and performance for each factor. The factors which do not lie within the appropriate performance zone be identified as the critical success factors.

Shun-Hsing Chen (2013), measured the performance of TQM on the basis of thirty-two (32) tools and techniques of TQM. The study was conducted in a Taiwanese motor industry to choose the right tools at the right time and to implement them in the right way if have to achieve customer satisfaction. With an integrated approach, the failure mode and effects analysis (FMEA) and a modified performance–evaluation matrix, the study has provided usefulness for assessing TQM tools and techniques that could be successfully applied in a variety of other industries also. As the importance-performance matrix developed by Hung et al. (2003) plots the level of importance of various attributes against the level of satisfaction with the performance of those attributes.

A company needs to understand that in what way performance measures can guide and drive an organization's execution towards superior results in their chosen area. In an ideal world, any performance measurement system would provide an early warning detection system indicating what has happened; diagnose reasons for the current situation and proceed to indicate what remedial action should be taken. The objective of any organization should be to install a system that endeavours to meet the above criteria. Many have learned that succeeding with certain elements of TQM is achievable. Experience shows that sustained TQM success doesn't come from targeting opportunities in a haphazard manner using a few of the TQM tools.

To build a sustainable and effective TQM foundation that yield dramatic company-wide improvements on a global basis necessitates a robust roadmap.

Performance measures should be chosen so that an organization can know whether progress is being made against targets and check points. Performance is also considered in the context of inter-organizational relations. The concern here is the way different organizations collaborate to create new entities or meet new challenges, for example supply chain partner organizations or vendors. When entering into such alliances, organizations need to consider the extent to which each contributes value while striving to meet its objectives. The extent to which each organization's strategic objectives are met can be assessed in terms of the value added by the alliance in accomplishing those objectives. These include the efficiency of joint or integrated operations, the conformity or fit of the structures and cultures of the merged organizations, changes of the impact on the sectors in which the combined organizations operate, the longevity of the relationship, and-in the case of multilateral operations-mission success.

Correspondingly, it is critical for TQM enterprises to deploy early warning systems. These milestones can either reinforce that progress is being made or signal that problems need to be solved. TQM is universally accepted as one of the most understood change management programs and is one of the strategies for confronting the global competitive challenge facing both manufacturing and service industries (Wali et. al, 2003).

To monitor the quality management system and initiate steps for preventing error organization needs to implement the principles of total quality management (TQM) with other business strategies (if implemented) to achieve the organizational goals. Execution of TQM plays a key part in enhancing the effectiveness of an organization, Zhang et al.(2000; Sanger, 1998; Marshall and Heffes, 2004; Tangen, 2005; Harvey and Green, 1993; Reeves and Bednar, 1994; van Kemenade et al., 2008.

1.5 An overview of TQM practice in Indian FMCGs industries

The growth of GDP has accelerated the growth of the FMCG industry in India over the years or can say that the growth of the FMCG industry is directly proportional to the GDP of India. A structured measurement framework that can be used to quantify performance is required to understand the opportunities for improving the performance of TQM. In other words, a detailed analysis of TQM metrics is needed. However, only a small step forward has been made in the measurement of TQM system efficiency in recent years. Therefore, the measurement of TQM performance, through a set of globally accepted metrics, is an ongoing challenge. Fast-moving consumer goods (FMCGs) or consumer packaged goods (CPG) are products that are manufactured and sold in less time and at a relatively low cost. They include not only processed food and beverages, toiletries, cosmetics, and household cleaning products, but also home appliances, and electronic goods.

Process manufacturing is common in the FMCGs industries. In process manufacturing, the relevant factors are the components (not the parts); formulas (not bills of materials); and bulk materials instead of individual units. Although there is always cross-over between the two branches of manufacturing, the major ingredients of the finished product and the majority of the resource intensity of the production process generally allow manufacturing systems to be classified as one or the other and with discrete manufacturing, which deals with the discrete units, bills of materials, and assembly of components.

Manufacturer of FMCGs products has attracted considerable interest from consumers because this sector provides essential goods for daily provision and consumers wants these essential products at high quality and low cost.

India represents the world's 12th largest consumer market and the FMCG Industry in India is worth more than USD$ 13.1 Billion making it the fourth largest sector in the economy. Mckinsey Global Institute (MGI) in their report "The Bird of Gold: The rise of India's Consumer Market" predicts that by 2025 India will become the world's fifth-largest consumer market. Booz & Company reported that by 2020, the Indian FMCG sector is expected to grow between 12% to 17% and market size elevate from 4,000 to 6,200 billion. The volatility in the market share indicates that companies like Nestle India Limited and Marico Limited, with dominance in their key categories, have improved their market shares and outperformed in the FMCG sector. This is also aided by the lack of competition in the respective categories. Single product leaders such as Colgate Palmolive India Limited and Britannia Industries Limited have also observed that although the patented features provide powerful differentiation, it is a very time-consuming and costly process and in the case of FMCG products.

The FMCGs sector in India is in the process of a drastic transformation. At the cost of traditional setups (grocery shops) the new, "modern" retail formats, like chain stores and hyper/supermarkets, have rapidly diffused in almost all major urban areas, and increased their market share in the last couple of decades. This rapid change has raised concerns about the competitive conditions in the FMCGs sector. Quality comparisons could be helpful in identifying if some FMCGs manufacturers enjoy a certain degree of market power. However, it is notoriously difficult to make a quality comparison across manufacturer because each manufacturer manufactures a different basket of products and the number of products manufactured is very large. To mitigate the effects of differences in product mix, the relative prices calculated for baskets of products sold by each retailer/retail. FMCGs are products that have to be replaced/used up within a relatively short period, ranging from days to a year depending on the product. They are usually quickly replaced when not available, and they are usually produced in large quantities. Because of these large volumes, they are generally profitable in spite of low profit margins. Therefore, the characteristic of FMCGs industry is quite different than the other industry. It is characterized by high turnover consumer packaged goods, i.e., goods that are produced, distributed, marketed and consumed within a short span of time. Since the sector encompasses a diverse range of products, different companies dominate the market in various sub-sectors.

FMCGs manufacturers manufacture almost identical products, so the competition is too high among them. However, high competition among major market players and retail execution is expected to hamper the global FMCG market growth. Therefore, price competition, as well as quality competition, is likely to be very important. FMCG is the fourth largest sector of the Indian economy. Household and personal care product is the major segment of FMCG, accounting for 50 per cent of the total market. Health care (32 percent) and food and beverages (18 percent) are second in terms of market share. Increasing awareness, easy accessibility and changing lifestyle have been the key growth drivers for the FMCG sector. The retail market in India is projected to reach USD 1 trillion by 2022 from USD 600 billion in 2015, the modern business is expected to grow at 20 per cent per annum. This is expected to increase the revenues of FMCG companies. However, some of the top FMCG companies in India are-Dabur (60%), Colgate (54.7%), Hindustan Unilever (54%). Unlike other emerging economies, the FMCGs industry in India is still very traditional in nature and is largely controlled by cooperatives and independent FMCG companies.

Quality comparisons could be helpful in identifying if some FMCGs manufacturers enjoy a certain degree of market power. However, it is notoriously difficult to make a quality comparison across manufacturer because each manufacturer manufactures a different basket of products and the number of products manufactured is very large. To mitigate the effects of differences in product mix, the relative prices calculated for baskets of products sold by each retailer/retail type as follows: In order to develop a framework that is applicable and suitable for FMCGs as small businesses, certain characteristics must be considered. These could be used as a guide. They are (i) systematic and easily understood (ii) simple structure (iii) clear links between elements which are presented (iv) general enough to suit different contexts (v) represent a road map and a planning tool for implementation (vi) answers 'how to?', and not 'what is?' TQM (vii) Implementable.

FMCGs businesses need a much simpler approach than other businesses. Some form of gradual progression of quality initiatives adoption could be the key, rather than a 'fully blown' approach to TQM implementation, which will favour FMCGs businesses. The characteristics of an organization can also affect the implementation of TQM at various sites within the company. This was emphasized by Van Der Akker (1989), who described how TQM needed to be implemented differently within Aery Materials Group Europe because of the cultural differences between the company's eight manufacturing plants and 15 sales offices. The culture, management practices, and processes vary organization to organization which play great role to create and deliver its products and services. The TQM strategy will then differ from one organization to another. Ngowi, (2000) strongly recommend that implementation of TQM requires changes to the shared assumptions, frames of reference, and understandings that most organizations have developed through interaction with their environment. These changes will impact basic beliefs and values that employees hold about work.

The following are the typical characteristics of FMCGs: From the marketers' perspective: High volumes, Low margins, Extensive distribution networks and High stock turnover. From the consumers' perspective: Frequent purchase, Low involvement and Low price a) Analyzing these characteristics, it can be suggested that as FMCG products are low involvement products, quality product should be used which should have a very attractive functional appeal, which can create a pull effect for the customer towards the final product. b) Since products are generally low priced, the quality used to develop value into the final product must be cost-effective so that the consumer can get value for money and in some cases where premium pricing occurs, the consumer Must be rest assured that the high price is justified. c) FMCG companies mainly focus on brand building and product development for growth. d) Competition is very intense in the FMCG sector; the market is filled with lots of unbranded and branded products. The quality helps to differentiate a product against similar competitive products. e) Distribution networks or channel management plays a very significant role in the FMCG industry. f) It helps the FMCG industry to create in demand consumer quality products at low cost which are easily available. This means that the types of products in this industry are around consumers every day. Everyone is a consumer, so it gives something to identify with. g) The companies involved in the FMCG industry are some of the biggest brand names known across the globe. Therefore, maintaining quality is the primary responsibility of these companies. h) Innovation is a consistent process in the FMCG industry. They continually need to come up with new product development ideas aimed at the consumers. i) The FMCG industry is dynamic and diverse.

Some basic quality principles and modern quality management methods have not been widely used by Indian FMCG sectors. A number of quality management problems still remain unsolved. After reviewing the literature relating to FMCG quality management, it became very clear that little empirical research has been conducted in these areas in the area of TQM implementation. Therefore, the current status of TQM implementation in FMCG companies is still unclear. Due to the lack of empirical studies in the field of TQM, it is difficult for the FMCG sector to obtain sufficient information to support its TQM implementation practices. As a result, many FMCG industries have experienced difficulties or failures in implementing TQM. And when it comes to implementing Total Quality Management for FMCGs sector, this is exponentially vital.

FMCGs industries often have limitations on finances, personnel and equipment while suffering under the added burden of vulnerability related to unpredictable shifts in consumer behavior. FMCGs industries would still be preoccupied with the Acceptable Quality Level (AQL) concept. This concept has been based on the premise that improving quality beyond an economic conformance level is economically suboptimal. AQL systems, therefore, are philosophically inconsistent with "quality is free" and "zero defects" notions (Crosby, 1979; Juran and Gryna, 1988). In order to bridge the gap and provide FMCGs companies with practical assistance in the area of TQM this research will be aimed at identifying TQM drivers and enablers (combinedly called success factors) and developing a model for measuring performance of TQM, and practically validating the model using data from Indian FMCGs company. Practitioners will be thus able to use this model for developing quality management theory related to FMCGs companies. Indian FMCGs industrial practitioners will be able to use this model to evaluate the effectiveness of their TQM system so as to target improvement areas. In FMCGs companies, the quality management would be very important, and the possible effects of TQM can be monitored by evaluating various dimensions of performance with the help of critical success factors which decided on the basis of the TQM goal. Rapid technological changes taking place in the world have forced businesses to try to keep pace with the changing demands of customers. This requires continuous excellence in improving internal processes. The implementation of TQM encourages organizations to identify the measures that answer the question of what internal processes should be improved and the correct implementation of TQM in FMCGs companies can improve internal processes, or modify the existing organizational operations. In context of FMCGs industries Conca et al. (2004) states that TQM allows firms, on the one hand, to achieve a high degree of differentiation, meet customer needs and strengthen brand image, and on the other, reduce costs by preventing mistakes and wasting time and improving corporation processes.

In FMCGs industries, TQM emphasizes the ability of management more is that the ability of follow-up operation and management of supply chain determines the development scale of quality and the overall revenue. Suppliers are a crucial part of TQM system in FMCGs industries. Companies must vet new suppliers and regularly audit existing suppliers to guarantee that materials meet standards. Communication with suppliers about TQM goals is also essential. According to Inmon et al. (2019), TQM consists of organization-wide efforts to install and make permanent a climate in which an organization continuously improves its ability to deliver high-quality products and services to customers. As FMCGs market grows, continued capacity discipline among quality and the shift of manufacturing from conventional to automation could push more quality management to smarter one. FMCGs industries could also benefit from worsening imbalances in subsystems whereby TQM fill capacity in multiple direction, but top management commitment incentivize organization to quickly return productivity to profitable origin points. TQM system have the flexibility to mitigate this directional imbalance, and help organizational system, through more flexible and directional approach. Eventually, faster technology adoption could lead to increased demand in traditional FMCGs sectors. Benefits of TQM in FMCGs Sector are: Enhance working relationship, Improved quality product, Employee satisfaction, Teamwork, Communication, Productivity, Employee participation and Customer satisfaction.

India has trend to awards to the industries for their excellence performance and for their promotions. Zink, (1995) emphasizes that employee empowerment is an important area of assessment of major quality awards around the world. Empowered employees go by many labels: self-managing teams, self-directing teams, autonomous groups. The Confederation of Indian Industries (CII) use to announce various awards to industries based on their performance in different fields, Frost & Sullivan gives India Manufacturing Excellence Awards (IMEA) yearly, Golden Peacock Awards (GPA), instituted by the Institute of Directors (IOD), since 1991 in India, are now regarded as a benchmark of Corporate Excellence worldwide. Golden Peacock Award is designed to encourage systemic innovation in an organization to develop products and services that are aligned with the current market demands. Golden Peacock National Quality Awards is to encourage Total Quality improvements in both manufacturing as well as service organizations in India. Federation of Indian Chambers of Commerce & Industry (FICCI) Quality Systems Excellence Award, this award is institutionalized for excellence in quality systems in industry, assess the robustness of 'Quality Systems' in organizations unlike most other award that focus on product quality. Santos et al. (2007) advocates that Quality awards provide a useful evaluation framework against which organizations can evaluate their quality management practices and their ultimate business results, and may constitute a common benchmark or standard criterion for firms operating under their sphere of influence. The Associated Chambers of Commerce and Industry of India (ASSOCHAM) gives awards to industries for various functions including TQM. ASSOCHAM is one of the apex trade associations of India. The organisation represents the interests of trade and commerce in India, and acts as an interface between issues and initiatives. Assocham initiated its endeavour of value creation for Indian industry in 1920. Synnex Business Media Pvt. Ltd. annually arrange India Logistics Summit & Awards to provide a platform for industry to show their true potential of the Business. Besides all these awards there are Rolta Corporate Award, National Quality Excellence Awards (by Parix media group), IMC Ramkrishna Bajaj National Quality Award, Pride of India' Award.

Chemical and Allied Export Promotion Council of India (CAPEXIL) a trade promotion body as a non-profit making organization was setup in march 1958 by the ministry of commerce, Govt. of India to promote export of chemicals and allied product from India. Global Logistics Excellence Awards by Infinity Expo Private Limited. The significance of these Quality Award competitions to promote and popularise the TQM philosophy among industries, especially Indian FMCGs industries. The changes taking place in the manufacturing sector have now become a stimulus for the implementation of the principles of quality management and management by quality as-well-as in the service sector. Organizations around the globe use various TQM based frameworks such as the national quality awards or business excellence frameworks to improve the organizational performance (Miguel, 2015). Among several reasons for considering the award as a proxy for effective TQM implementation York and Miree (2004) mentioned are, first, the criteria for conferring the awards measure the level of implementation of this kind of system, and, second, the quality awarding involves enquiries at several firm levels, to ensure that the winner effectively succeeds in implementing TQM.

1.6 Motivation for the present research

It is realized by the organizations that measurement of performance of the post implementation tools is essential to monitor accordingly to make change and being competitive in global market. For this, they focused on improving their service level, reducing operating expenses and increasing revenue growth by effectively managing total quality management (TQM) system. Studies have revealed that strategic approach is usually abstract and vague, and deals with human phenomena that are difficult to quantify. Therefore, it is difficult to point to a link between improved data collection and improved strategic approach, more than to the impact of improved collection on the quality of tactical approach. And since this is the case, leaders are apparently more and more "addicted" to operational and tactical approach, but not necessarily more dependent on strategic approach. However, performance measurement that depend on tactical approach also require high quality strategic approach for their formulation and implementation.

TQM is a complex adaptive system to achieve targeted performance level and meet the organizational goal. TQM system consists of diverse, interacting adaptive entities (factors) whose aggregated behaviors result in emergent, organization-level patterns and functionalities. A complex adaptive system of systems consists of multiple, connected complex systems. The connections can be hierarchical, horizontal, or a mixture of the two. The authors provide basic definitions, describe common tools of analysis, and introduce illustrative case. For example, undesired quality levels have no single cause, nor do they arise from a single system. Instead, they arise from the interactions of multiple systems that operate at various levels of scale. Supply chain management and lean manufacturing play roles, as do top level management, customer focus, supplier's involvement, training and education, employee involvement, benchmarking, and, as recent evidence suggests, the information and communication technology. Each of these contributors can be modeled as a complex adaptive element and the whole as a system of organization. Similarly, organizational system can be decomposed into separate systems, each with unique dynamics. Next is about who Performs the Performance measurement? One of the challenges facing companies is whether the Performance measurement should be conducted by internal personnel or by external consultants. The risk of using internal personnel is that they may have loyalties or relationships with people on the project team and therefore may not be completely honest in determining the true state of performance or deciding who is at fault. Using external consultants or facilitators is often the better choice. External facilitators can bring to the table:

- A multitude of forms, guidelines, templates, and checklists used in other companies and similar projects
- A promise of impartiality and confidentiality
- A focus on only the facts, hopefully, free of politics
- An environment where people can speak freely and vent their personal feelings
- An environment that is relatively free from other day-to-day issues
- New ideas for project metrics

Implementing a complete performance measurement program allows the company to define and identify the fastest path to business value. It does so by providing clear performance expectations and ongoing feedback on results. TQM performance measurement path is shown in Fig.1.1.

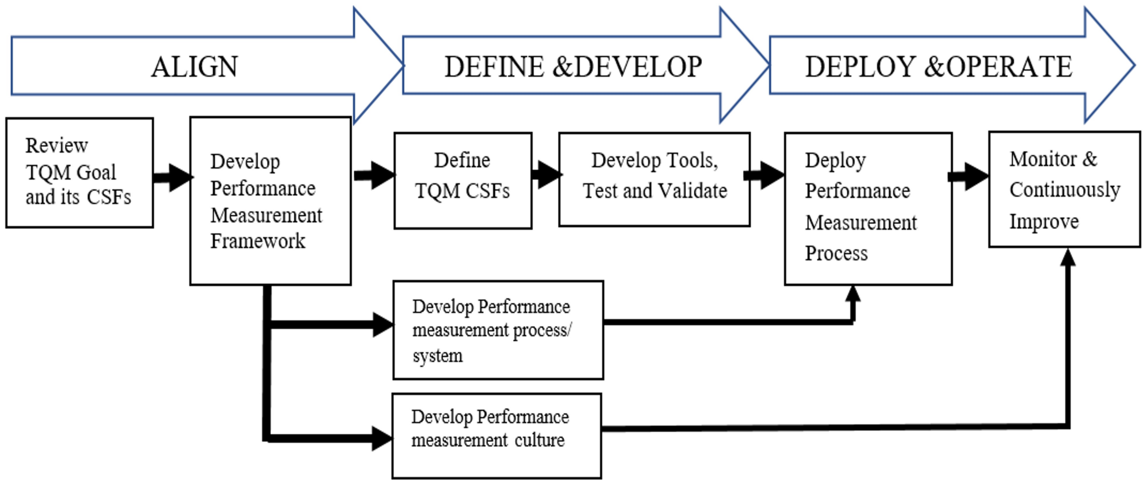

Figure 1.1: TQM performance measurement path

1.7 Objectives of the present research

The major objectives of this research are as follows:

- To conduct a comprehensive literature review related to TQM and to find the research gap
- To study the case company and analyze the TQM awareness and implementation
- To identify and prioritize drivers and barriers to TQM implementation in the FMCG industry
- To develop a TQM performance measurement model for a FMCG organization
- To validate the findings of the research through a case study
- To develop models and frameworks for improving the performance of TQM

1.8 Research Methodology

The tools used in this research are:

1. Questionnaire-based survey: This is used to gain a broad insight into the performance of total quality management and its practices in the Indian FMCGs industry context.

2. Case development and analysis- The purpose of case development is to understand the total quality management practices followed in an Indian FMCGs industry. The case has been discussed using SAP-LAP (Situation, Actor, Process- Learning, Action, Performance) methodology (Sushil,2000). Further to understand the mutual interaction of the identified TQM CSFs (drivers and enablers) interpretive structural modelling (ISM) approach has been utilized and to recognize the driving and dependence power of these CSFs variables, MICMAC analysis is done.

3. Fuzzy Logic: It is used for establishing relationships among the drivers and enablers and result variables of TQM performance measurement system implementation. It is also used to find the key variables which are strategic in nature and require the management to focus on them carefully to improve the other dependent variables of the system. It provides an opportunity for the researcher to consider simultaneously the impact of criteria, sub-criteria and their interrelationships in order to select the appropriate alternative under consideration.

1.9 Research overview

An extensive literature was undertaken to find the gaps in the area of TQM performance measurement and its system. Based on the literature review and discussion with the quality experts, a questionnaire was developed to conduct a survey in Indian FMCGs industry. A five-point Likert scale was used in the questionnaire. However, some of the questions in the questionnaire were of a yes/no type also. Validation of the questionnaire was done through a pilot survey. Subsequently, modifications to the questionnaire were incorporated to make it more lucid and appealing to the respondents. The questionnaire was then floated to the in-job employees of XYZ FMCGs Ltd. Questionnaire survey is followed by hypothesis development and then a case study. The TQM awareness among the employees is also statistically analyzed through a questionnaire (research objective-2). These provide an in-depth and relatively unstructured approach to develop theories and frameworks. The survey methodology, followed by case studies, provides a foundation to understand various issues related to the TQM performance measurement system before developing frameworks and analytical models.

To understand the relationships among different drivers, and enablers and result variables of implementation of TQM performance measurement system, a hierarchy-based framework is proposed on Interpretive Structural Modeling (ISM) approach. This framework helps to understand the relative importance of the variables in the implementation of the TQM performance measurement system. It also helps to outline the most important variables related to the implementation of the TQM performance measurement system which requires more attention from quality professionals.

1.10 Thesis disposition

A brief description of all the chapters is as follows.

Chapter 1 contains an introduction to Total Quality Management (TQM) and performance measurement. The growing importance and relevance of TQM in today's context have been discussed in this chapter. Further, this chapter deals with the performance measurement of TQM. Also, a separate section has been devoted to an overview of TQM practice in Indian FMCGs industries. The motivation of research and objectives of this research have been presented. Finally, an overview of the characterization scheme of the thesis has been reported in this chapter.

Chapter 2 contains a classification of literature related to TQM, TQM as a dynamic system, performance measurement of TQM, quantitative models in TQM performance, case studies, surveys on TQM practices etc. Through literature review, gaps in contemporary research in this area have been identified. These gaps are the major driver for the current research. This chapter also includes a selection of research methodologies used in this research such as questionnaire survey, Fuzzy Logic.

Chapter 3 is about the research methodology adopted to conduct this research work. The instruments and methodology adopted to accomplish the work is briefed in this chapter. This introduces and informs about the synchronicity of the research journey to result.

Chapter 4 presents the survey methodology used in this research. Justification of the methodology used and formulation of hypothesis are also presented in this chapter. It also covers the development of the questionnaire, its structure, source and content validation. The questionnaire was administered to the prospective respondents in the FMCGs manufacturing industry. A sample size of 400 employees was selected for administering the questionnaire on the basis of TQM awareness. In all, 365 filled in responses were received giving a response rate of 91.25%. The descriptive statistics and results of the survey are also presented in this chapter. First, the non-response bias, reliability analysis and descriptive statistics are presented. It then presents the current status of TQM in the Indian FMCGs industries.

Chapter 5 presented the testing of two sets of hypotheses. These hypotheses are concerned with the general TQM issues as well as the impact of various drivers and enablers (called critical success factors) on the TQM performance. The statistical tool Anderson-darling test and t-test is used for the testing of the hypothesis. In the end, a discussion of the results is presented.

Chapter 6 presents a case study of the Indian FMCGs industry to further understand the TQM performance practice in Indian FMCGs industries. The focus of these cases is to understand the TQM performance measurement practices in Indian FMCGs industries. SAP-LAP methodology (Sushil, 2000) has been used for analyzing these case studies. Then Interpretive Structural Modeling is applied to establish contextual relationships among the variables, and then after MICMAC Analysis is done to understand the TQM CSFs in terms of their interdependence.

In **Chapter 7**, first, the existing TQM performance measurement system is discussed. Then proposed model for the measurement of performance of TQM is presented and validated with implementation. To measure the performance of TQM, the Knowledge-Based Performance Measurement Model (KBPM) is implemented (using Fuzzy Logic). Lastly, the result obtained are interpreted, then concluded.

Chapter 8 is the last chapter of the thesis is about the result and discussion delt the work carried out for measuring TQM performance. This chapter is devoted to the synthesis of overall findings. It provides linkage among different methodologies adopted in this research. Findings from the survey, case study and quantitative modelling are presented in the collective form.

1.11 Conclusion

In this chapter, an overview of the context related to this research has been presented. Performance measurement in TQM, as a field of research, is introduced as the prime focus for the present work. The motivation and objectives of this research have been presented in this chapter. A brief description of the research methodology to be used in this research has also been presented. In the research overview, a brief summary of the entire research reported in this thesis has been presented. The organization scheme of the chapters in this thesis is also presented.

Chapter 2

Literature Review

2.1 Introduction

Various researchers and engineers have made attempts to study TQM systems empirically in order to describe and understand their structure, dynamics and performance. Practical implementation of quality management is arousing more and more concern, and there are numerous studies related to TQM (Aquilani et al., 2017). Some legend gurus in quality management, like, Crosby (1979), Ishikawa (1976, 1985), Deming (1982, 1986), Feigenbaum (1983, 1991), Juran (1986, 1989) and Garvin (1988), have studied TQM from different perspectives but they all share the common basic things that how to manage quality to gain a competitive advantage through customer satisfaction and excellent performance. The effective TQM improves the performance of organisations in several ways, like as defects reduction of product, enhancing design of product, prompt service delivery, higher productivity and cost reduction.

According to Rosenzweig et al. (2003), integration is confirmed to directly relate to business performance. This also holds true for internal cooperation, which has a direct effect on an organization's performance (Stock et al.,1998 Gimenez & Ventura, 2005), while other authors use supplier, customer and internal integration as variables to access the effect of integration on performance, Zhao et al. (2011).

Authors uses word TQM either solely or with philosophy, programme, approach, system as a suffix. Does these suffixes affect the basic meaning of TQM? It is observed during reviewing of various literature that in the same paper authors uses multiple prefixes, which rather difficult to understand their thought. Juran criticizes by saying that it is astounding how the term TQM is tossed about defining what it means. To me, TQM consists of those actions needed to get to world class quality. Right now, the most comprehensive list of those actions is contained in the Baldrige Award criteria (Juran, 1994, p 32). About this Hellsten, U., & Klefsjo, B. (2000) expressed their thought that if quality gurus were resisting to the term TQM then people got confused and doubtful. Not all size fit to all, organization develop their own TQM system to implement TQM program on the basis of TQM philosophy to achieve the goal through this approach. To achieve the TQM goal, the critical success factors are further decided by the decision makers, like leadership (commitment of top management to the principles of TQM), empowerment with the philosophy of TQM etc. Al-Mashari, M. et al. (2005) enlisted few key elements of TQM as fundamental building blocks such as product and service quality, customer satisfaction, benchmarking, internal customer-supplier chains, cross-functional team-work, multi-disciplinary use of quality tools, embedded with its own set of cultural beliefs, norms, values and assumptions, Ngowi, A.B. (2000).

The literature on performance measurement of TQM is less well developed than others. There is, thus, a need for a practically useful analytical framework that allows for the assessment of TQM system performance as well as the identification of factors influencing performance.

2.1.1 Practical approaches to TQM Conceptualization

The concept of a total quality management is neither limited in scope to the analytical methods of assay, control charts, product inspections made during the manufacturing processes and prior to finished products form distribution, nor to the statistical techniques utilized in these discrete operations. The concept includes all control measures contributing to the completed market form also. The Fast Moving

Consumer Goods (FMCGs) Manufacturers Association in its 'General Principles of Total Control of Quality in the packaged goods Industry' consistently has stated that 'Total control of quality as it applies to the consumer goods industry is the organized effort within an entire establishment to design, produce, maintain and assure the specific quality in each unit or product distributed. Total control of quality is a plant-wide activity and represents the aggregate responsibility of all segments of a company.' Total Quality Management (TQM) particularly is about making sure that quality production process is adhered to rather than checking for poor quality products after manufacturing process. The stronger voice of the consumer has become a driving force for FMCGs manufacturers to produce smarter. To differentiate themselves, manufacturers need to place consumers at the centre of operations and respond effectively to changing demands.

Corredor, P., & Goni, S. (2011) suggested that if TQM system is implemented at early stage, then organization experience better performance than later one because the impact of TQM on performance takes place a year after receiving external recognition for implementation. Research conducted by Brown et al. (1994) has already indicated that more than 50 percent of the companies that implemented TQM, two years later decided to give up further introduction of quality management. Time is needed in order to integrate the appropriate quality principles and techniques into the culture of the organization (Goetsch & Davis, 1994). Ernst and Young and the American Quality Foundation jointly conducted a study and published in the form of report "International Quality Study (IQS)" in which it is advised on the basis of finding to the organizations that those new to the quality game: concentrate on the basics, promote teamwork, benchmark immediate competitors only, and become more responsive to the customer first, certain practices potentially beneficial for beginners tend to be of little use to quality veterans later on, about this Steven E. Brigham (1993) mentioned.

In a book edited by Adrian Wilkinson, (1995), Stephen Hill stated that companies seem to pick up bits and pieces of TQM and then report that they are operating TQM, when in reality most schemes appear an ill-matched mixture of quality circles, employee involvement, quality tools and long-established quality assurance systems. The full implementation of TQM increases competitiveness and customer satisfaction, reduces waste and improves the working lives of employees, Ngowi (2000). Ngowi (2000) further suggests that implementation of TQM requires changes to the shared assumptions, frames of reference, and understandings that most organizations have developed through interaction with their environment. These changes will impact basic beliefs and values that employees hold about work. Tari (2005) found that while the critical factors of TQM like training, leadership, process management are differ from one author to another.

2.2 An overview of definitions of TQM

The word 'Quality' originated from Latin word 'QUALITAS' meaning "of what", and the Roman orator and politician Cicero (106-43 BC) is credited. Bengt Klefsjo (2003) observed that for a long time, the word quality was used as synonyms of "characteristics," and still used sometimes in that sense. Different quotes about 'Quality' by various quality gurus are tabulated in Table 2.1.

Table 2.1: Some definitions of Quality by quality gurus

Sr. No.	**Quality Guru**		**Remark**
1	Garvin (1987)	Quality is synonymous with innate excellence	transcendent, product based, user based, and manufacturing and value-based approaches
2	J.M Juran	quality as "fitness for use"	trilogy of quality planning, quality control, and quality improvement.

Sr. No.	Quality Guru	Definiation	Remark
3	Crosby (1996)	quality as “conformance to requirements or specifications”	customer needs, focuses on the tolerances set. And has a producer’s perspective.
4	Deming (1986)	quality is a predictable degree of uniformity and dependability, at low cost and suited to the market	thinking of the customers of tomorrow.
5	Walter Shewhart	There are two common aspects of quality. One of these has to do with the consideration of the quality of a thing as an objective reality independent of the existence of man. The other has to do with what we think, feel, or sense as a result of the objective reality.	there is a subjective side to quality.
6	Ishikawa and Lu (1985)	Quality is defined as excellence, or fitness for use at an acceptable price	Value based definition
7	Feigenbaum	The total composite product and service characteristics of marketing, engineering, manufacturing and maintenance through which the product and service in use will meet the expectations by the customer	Customer centric definition
8	Ginichi Taguchi	Lack of quality is the costs to society by a product after its delivery.	definition of quality for goods it is suitable for services as well.
9	ANSI and ASQC (1978)	The totality of features and characteristics of product or service that bears on its ability to satisfy given needs.	This definition encompass internal as well as external customer satisfaction

Sr. No.	Quality Guru	Definiation	Remark
10	ISO 9000:2000	The degree to which a set of inherent characteristics fulfills the requirements, i.e. needs or expectations that are stated, generally implied, or obligatory.	It discusses set of inherent characteristics
11	Shahin and Nikneshan (2008)	quality is considered the ability to meet the stated and implied requirements of customers and not an inherent feature	Inherent feature of product or services are not so important rather than customer requirement
12	Reed et al. (1996)	quality means continuously meeting, or exceeding, customer expectations.	Present and future customer focused

These definitions of quality encompass the transcendent, product-based, user-based, manufacturing based and value-based definitions. As the perspective changes for quality, the definition changes. So, it can be said that there is no any fix definition of quality for all. Each have viewed it from a different vantage point. Quality is seen as John Ruskin did: "Quality is never an accident. It is always the result of intelligent effort. There must be the will to produce a superior thing". Quality does not exist, but arises stated van Kemenade and Hardjono (2019). But Seawright & Young (1996) suggested that before implementation of the quality program, firm must get ensure that all involved personnel understand what the term 'quality' means and which definition of quality will support the TQM objective. Managers who understand the implications of the quality definition continuum can improve TQM implementation, means TQM calls for cooperation across all the functions in the firm, stated Seawright & Young (1996).

Kristianto, Y. et al (2012) suggested that companies must define quality for themselves if TQM is there , because with a clear definition the company can focus on target for change and conflicting view on definition of quality create difficulties to focus on implementing changes. Tobin (1990) states that TQM is integrated for gaining competitive advantage by every fact of the organizational culture which also stated by John Ruskin. Sink (1991), however, views that TQM only if the operational definition for the organizational system is evolved by the leadership and is crystallized and communicated with conviction and clarity. Saskin and Kiser (1993), TQM can be dealt by the development of the organizational culture through an integrated system of tools, techniques and training.

2.2.1 TQM as an approach and practices

Pfau (1989) viewed TQM as an approach for continuous improvement through quality of goods and services proactive involvement of all levels and functions of the organization. Further Pfau (1989), tagged TQM as a strategy as-well-as an operational process and also described as a holistic approach, to integrate all organizational functions and organizational objectives in a focus on meeting customer needs (Kumar et al., 2008). TQM envelop and expedite entire functional areas, processes and systems of organization (Jung et al., 2008). TQM emphasize on prevention rather than detection of defects and for that the main facet of are goal setting, measurement and corrective action suggested Ngowi, (2000). Omachonu and Ross in their book Principles of total quality also give explanation that 'TQM is the integration of all functions and processes within an organisation in order to achieve continuous improvement of the quality of goods and services'. TQM is regarded as an approach for improvement by Sadikoglu and Zehir (2010, p. 13) for firm-wide management for performance improvement in context of quality, productivity, customer satisfaction, and profitability. Shafiq, M. et al. (2017) also contemplated and narrated that TQM is an approach to manage and continuously improve all the processes of an organisation and suggested to involve everyone to achieve customers' satisfaction at the minimized cost. TQM is considered as a management process that applies management principles to improve all processes within an organisation (Jitpaiboon and Rao, 2007). The holistic approach is a key feature for TQM which includes strategic, process and technology management (Castle, 1996).

2.2.2 TQM as a system

In the view of Sauser, B. et al. (2010) any system is a collection of parts (elements) and their relationship (contextual) assembled together (interconnectivity) in order to form a whole with changed properties, behaviors and purposes. TQM system is a system of organizational system that is linked with the organizational goal. Authors like Dale 1999; Tari et al. 2007 opined that TQM is a system of management which includes a set of practices to manage an organization that may have positive effect on performance. TQM views whole the organizational system as total systems of interlinked activities mentioned R. R. Lakhe & R. P. Mohanty (1994) and these activities act in their own ways to create added value to products and services for end-users. Yeung et al. (2003) categorizes four types of quality management systems in manufacturing firms: undeveloped, framed, accommodating and strategic quality system. Zhao et al. (2004) also consider four levels of QM practices for the service organizations with replacing framed quality system with soft quality system. High performing firms therefore have been associated with "quality" mission statements defined by the choice of components (Darbi, 2012). Other than TQM system, JIT system, TPM system, Lean system's goal is also linked with the goal of organization. The constructs of the integrated approach to manufacturing includes Quality Management, Strategic Management, Human Resources Management, Just-In-Time (JIT), Technology Management, and Top Management Support states Flynn et al. (1994). Like others mentioned above, TQM is as an interdependent system that combined with other organizational assets generates competitive advantage (Hackman and Wageman, 1995). In the sense of Deming (1994b, p.50), TQM is a network of interdependent components that work together to try to accomplish the aim of the system.

Accoding to Bourne, M.et al. (2017), a system of system is a metasystem comprised of multiple embedded and interrelated autonomous complex subsystems. These complex subsystems must function as an integrated metasystem to produce desirable results in performance subject to constraints' (Keating, Padilla, and Adams 2008, 24). Bengt Klefsjö (2002) mentioned about several benefits of the system view of TQM. One is that it emphasizes the role of top management another is that it focuses on the totality and hopefully decreases the risk that an organization will pick up only parts of the system. His belief that one reason why several companies have failed with implementing TQM is that they just use small parts from the system, it means that companies pick up a few tools or methodologies and believe that these will solve their problems. They do not see TQM as a whole system.

N. Slack et. al. (2010) mentioned in their book that TQM is an effective system for integrating the quality development, quality maintenance and quality improvement efforts of the various groups in an organization so as to enable production and service at the most economical levels which allow for full customer satisfaction. As the activities accomplished by the employees to achieve TQM goal is important one so the human chain is important one of TQM system. In support of this Pike and Barnes (1996) argue that organizations are not only technical systems, but also human systems. In the form of either employee or customer they involve and participate in the TQM system. Whereas Hansson and Klefsjo (2003) define TQM as "a management system in continuous change, which is constituted of values, methodologies and tools, the aim of which is to increase external and internal customer satisfaction with a reduced amount of resources". Singh (1991), views TQM as a three-dimensional system consisting of management commitment, team-work participation and quality tools and techniques.

However, it was the Japanese who first made the concept work on a wide scale and subsequently popularized the approach and the term 'TQM'. It was then developed further by several, so-called, 'quality gurus'. Each 'guru' stressed a different set of issues, from which emerged the TQM approach. ISO 8402-1986 standard defines quality as "the totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs." Hellsten, U., & Klefsjö, B. (2000), viewed TQM as a management system consisting of three interdependent components i.e values, techniques and tools. Techniques and tools both support to improve the values and together they form a whole. Value improvement means ability to meet customers expectations similarly mitigating unnecessary cost involved cost (Berk and Berk 1993). Feigenbaum (1954) considered TQM in terms of control and defines Total Quality Control (TQC) as an effective system for integrating the quality development, quality maintenance and quality improvement efforts of the various functions of business to enable production and service at the most economical levels to meet full customer satisfaction.

2.3 Literature classification

2.3.1 Performance measurement and performance measures of TQM

In this section, purpose is to compile a number of contributions that conceptualize PMS and PM of TQM from different theoretical and practical perspectives. In doing so, I hope to understand whether it is feasible to expect a metatheory for PMM to emerge and, if it is, what needs to be done to enable such a theoretical basis to emerge.

Performance measurement system (PMS) may be defined as: "the formal, information-based routines, procedures and process of collecting and tracking data used in Performance Management by managers to maintain or alter pattern in organizational activities" (adapted from Simons 2000; de Waal 2002). One of the most difficult areas of performance measurement systems is the selection of performance measure. This involves the methods by which an organization articulate its own measurement system. Rouse and Putterill (2003) stating that performance measurement frameworks assist in performance measurement system development by clarifying boundaries, specifying dimensions and providing initial intuition into relationships among the dimensions. On this basis Beamon & Balcik (2008) analyzed that performance measurement frameworks a basis for performance measurement systems. From the existing literature on frameworks, techniques and tools for designing performance measurement system (PMS), Hudson et al. (1999) and Bititci et al. (2000), both in their independent studies has summarized the following as the basic requirements for performance measures designing: Identify Stakeholder Requirements, Perform External Monitoring, Develop Objectives, Aligned Deployment System (performance indicators), Causal Relationships (between leading and lagging indicators), Quantify the Causal Relationships and Identify Capabilities. Most of these requirements would be contented through brainstorming amongst various level of management. Several theoretical lenses have been used to analyze the of TQM systems. Like as Sitkin et al. (1994) distinguish control from learning goals in the implementation of TQM; Hackman and Wageman (1995) use organizational routine and work design theories to illustrate the benefits obtained from TQM; Westphal et al. (1997) adopt an institutional and network perspective to explain differences in the adoption of TQM. Kumar, V. et al. (2008) states that Performance measurement systems and performance measures are less financially and more process-oriented in a TQM environment. One of the important aspects of TQM is the need to continuously measure and control conformance to customer requirements and agreed standards and to correct quickly defective measures and keep performance on track through statistical process control tools suggest R. R. Lakhe & R. P. Mohanty (1994).

An effective performance measurement system should provide timely, accurate feedback on the efficiency and effectiveness of operations, Kaplan and Norton (1993).

Sinclair and Zairi, (1995); Bourne et al., (2000) belief that through proper performance measurement, effective strategy for organization can be formulated and for processes, communication, resource allocation, motivation to employee will be supported. This statement is endorsement of Bititci et al. (1997). In context of performance measurement of TQM, is not a straightforward task stated Kumar,V.et al. (2008). Performance Measurement offers a comprehensive review of related measures and introduces a new framework to examine their measures.

Relating one of the CSFs of TQM i.e customer satisfaction with performance measurement, Kristianto, Y. et al. (2012) states that TQM performance measurement should include the continuous improvement of performance and maximization of customer satisfaction Claver and Tari (2003) suggested to develop a scale for critical factors of TQM to measure TQM performance. Despite the vast amount of research on performance measurement in the TQM context, there is still a lack of empirical research seeking to discover what performance measures are actually being used by those who adopt TQM and how appropriate these companies find them, states Kristianto, Y. et al. (2012). Tangen, 2005 classified three classes of performance measures i.e lowest, mid and highest class. The lowest class which is said traditional measures concentrates on financial performance whereas the next level instigates a more balanced view.

2.3.2 TQM contribution to organizational performance

Organizational performance is driven by the measures like customer satisfaction and employee morale emphasising on customers and employees, which were also the measures of TQM. The customer focus and people focus are two core principles of the TQM Philosophy.

Performance is a set of financial and nonfinancial indicators which offer information on the degree of achievement of objectives and results (Lebans & Euske 2006 after Kaplan & Norton, 1992). Performance may be illustrated by using a causal model that describes how current actions may affect future results, Lebans & Euske (2006). Ismail Salaheldin (2009) found positive effect of quality management on operational and organizational performance and used structural equation as a test tool for small and medium enterprise. Organizations which took long term view of TQM they link their TQM program to organizational objectives and mission statement, Waish, A. et al. (2002). Kumar et al. (2009) suggested TQM as performance and productivity improvement tool for organizations. To analyze the performance of the organization, Corina Gavrea et al. (2011) categorizes the variables into two categories as external and internal environment. external environment considers the variables: competition, customers and suppliers and internal environment is reflected through the variables: strategy, leadership, employees, quality, performance measurement, innovation and development information technology and corporate governance. Quality and performance measurement is considered as internal environment of the organization.

Authors like Bititci et al. (1997); Mehra et al. (2001); Brah et al. (2002); Taylor and Wright (2006) considered performance measurement as one of the dimensions of TQM and a critical success factor for TQM implementation. It is also warned by Goodman et al. (1994); Najmi and Kehoe, (2001); Chang, (2005),2006) that improper performance measurement can undermine all TQM philosophy and prohibit the company from gaining the expected benefits from TQM implementation. Quality management has been identified as the prime driver for enhanced business performance (Corbett et al., 1998). Bouranta et al. (2017) identified the TQM critical factors and their effect on organization performance in the hotel industry context of Greece and found that strategic quality planning, top management, employee knowledge, and education, employee quality management and customer focus are the factors responsible for quality improvement.

A number of past studies on TQM have examined the compatibility of TQM with other management practices in determining organizational performance. This includes just-in-time (JIT), Flynn et al. (1995); Vuppalapati K. et al. (1995), operations management practices Jayaram and Ahire (1998), business process reengineering (BPR), Schrnederjans and Kim (2003), Hill and Collins (1999), design for manufacturing, Youssef et al. (2002) and management systems, practices and behavior in the World Class Manufacturing (WCM) context, Morita and Flynn (1997).

The relationship between quality implementation and organisational performance in service industries is investigated by Kunst and Lemmink (2000) and found that TQM leads to higher business performance. Prajogo and Sohal (2004) measured organisational performance mediating quality performance and innovation performance. Brah et al. (2000) shown in their investigation that how an organisation benefited from TQM implementation for improved financial and operating performance. Kanji and Wong (1999) measured the performance of supply chain and TQM is emphasized for the development of changed SCM model for excellent organizational performance.

2.3.3 TQM contribution to financial performance

In the contemporary economic and financial crisis knowing the factors that generate success and the ways in which it can be measured has a critical importance. Performance indicators are designed to provide information on the quality of processes performed within an organization offering support to achieve the objectives on time and within a predetermined budget. But, to fulfill this role is necessary to understand their full and proper use. Shetty, (1993), Hendriks and Singhal, (1997), Easton and Jarrell, (1998), Handsfield et al. (1998), Samson and Terziovski (1999), Reed et al. (2000), Allen and Kilmann (2001), Wrolstad and Krueger (2001) claim that there exist positive relation between TQM and financial performance. Financial performance measures are still very often used and that is not necessarily contradictory with the TQM philosophy, since a balance must be maintained between financial and non-financial indicators stated Kumar, V. et al. (2008). Hendricks and Singhal (1996) conducted their study on awardee organizations to establish link between TQM and stock price (financial) performance but found no evidence. Further, in disparity to the findings of Hendricks and Singhal (1996), significant relationship between stock-price performance and TQM is found by Easton and Jarrel (1998). Hendricks and Singhal (2001) extended their study with more dataset and concluded that many TQM implementers significantly outperform in the post-implementation period. Douglas and Judge (2001) considered perception-based constructs for financial performance and their results indicates that the level of TQM implementation was positively related to perceived financial performance. Some TQM researchers like Schmidt and Finnigan (1992); Powel (1995); Strubering and Klaus, (1997) argue that TQM cannot produce reliable financial performance for SMEs, while Ahire and Golhar (1996); Hendricks and Singhal (2001); found substantial results for same. Haim (1993) notes that there has been little in the way of independent measurement of TQM and their impact on financial or non-financial measures of performance. A book authored by Oakland, J.S., mentioned in context of TQM, that the financial indicators used in many organizations have remained static while the environment in which they operate has changed dramatically.

2.3.4 TQM contribution to non-financial performance

Financial as-well-as non-financial performances are equally important in TQM principles, although financial performance is the ultimate aim of any organization. Kaynak (2003) supports that TQM may not affect directly the financial performance, but affect indirectly, like through: increasing innovation (Singh and Smith, 2004); market competitiveness (Chong and Rundus, 2004); market share and market share growth (Kaynak, 2003); employee morale (Rahman and Bullock, 2005); productivity (Rahman and Bullock, 2005; Rahman, 2001); changing organizational culture

(Irani et al., 2004); overall organizational performance (Powel, 1995). Prajogo and Sohal (2001) presented two mutually opposite arguments about relationship between TQM and innovation, the reason presented by (Prajogo and Sohal, 2006) is that organization concentrate into captive market and that causes the ignorance in the direction of innovation of new products. Choi and Eboch (1998) argue that the strength of positive relationship between plant performance, as influenced by TQM practices, and customer satisfaction, is still far from being conclusive. Samson and Terziovski (1999) noted negative relationship for smaller size firms in their survey, whereas Lee(2004) reports that Chinese SMEs perceive positive relationship between TQM practices and non-financial performance measures (i.e. production performance, cost improvement and sales improvement). While there is no detailed analysis of the relationship between TQM practices and non-financial performance for SMEs in the prior literature (Ahire and Golhar, 1996). Demirbag et al. (2006) shown through study a strong positive relationship between TQM implementation and non-financial performances (such as innovations, new product/service development and market development) of small and medium sized enterprises in Turkey. Corina Gavrea et al. (2011) states that complexity of the performance measurement system increased by using both financial as well as non-financial indicators. It has been suggested by Zairi (1994), that non-financial performance measurement can be used to link TQM to positive internal performance, which should then be followed by improved financial performance.

2.3.5 TQM contribution to operational performance

Operational performance is the capability of an organization to share information, process and routines, activities and methods with suppliers and customers. Goods delivered on time, increase in inventory levels, and control on the scrap rates, increase in product quality, and increase in product line and can be improvement in capacity utilization counted as operational performance. Heizeret al. (2008) defined operational performance as an organization's ability to reduce operational management costs, meet order cycle time, improve raw material utilization efficiency and meet delivery capacity. Supplier partnership is considered as one of prominent CSFs of TQM, in this manner a combination of high performance operations and a consumer-driven supply chain help to achieve agility of the organization. TQM helps firms improve their competitive advantages through good management practices that enhance internal operation (Reed, Lemak, & Mero, 2000). operational performance focuses on key operational factors such as technological efficiency, product quality, new product introduction, or market-share. Finally, organizational effectiveness includes others organizational goals and the influence of multiples constituencies or stakeholders. Nigel Slack et al. in a book of operations management mentioned that many companies adopted TQM in the simplistic belief that it would transform their operations performance overnight. Yet the general precepts and principles that constitute TQM are still the dominant mode of organizing operations improvement. Fuentes-Fuentes et al. (2004) discussed that critical success factors of TQM never assess non-financial performance directly, although operational performance indicators are related to financial performance dimensions. Parast, M. M., & Adams, S. G. (2012) found that the TQM CSF Corporate social responsibility has a direct effect on improving internal quality results (operational performance) while it has an indirect effect on external quality results (firm performance). A study was conducted by Anderson and Sohal (1999) for the examination of relationship between quality management practices (using Australian Quality Award framework) and organizational performance found that quality goals are linked to organizational objectives. Research presented by Brah and Tee (2002) in form of investigation of the relationship between TQM and organizational performance found positive correlation between TQM implementation and quality performance. TQM practices as well as TQM tools and techniques contribute to the successful of TQM implementation. In the way to test the linkage between quality and various dimensions of manufacturing performance Maani et al. (1994) years before proposed framework for the Quality Performance Model. That study revealed that process output is significantly related to business performance measures and findings of the study shows that quality practice has positive effect on performance measures. Benito and Dale (2001) reported on some empirical observations of the way in which the Spanish auto components industry implements supplier quality practices. They pointed out that suppliers which are more advanced in the use of quality practices are achieving better operational performance in terms of quality, reliability, cost, flexibility and design. The TQM practices considered by Kebede and Virdi (2021) in the theoretical framework, supplier quality management, continuous improvement and process management were found to have a positive, direct and significant effect on operational performance. However, TQM practices, such as top management support, customer focus, employee involvement and empowerment and education and training had an insignificant effect on operational performance. Overall, the study showed the importance of implementing TQM practices for improvements in operational performance results.

2.3.6 Empirical Performance Measurement Models

Past research papers have been reviewed on the basis of the models adopted or developed to measure the performance of any system or subsystem of the organization. The ultimate goal of the measurement is to improve the performance of the organization in terms of financial, non-financial or operational. Meng, X et. Al (2011) study contribute to the establishment of various performance models and their comparative analysis, which include Balanced Scorecard (BSC), the Business Excellence Model (BEM), the key performance indicators (KPI), the Capability Maturity Model (CMM) and the application of their concepts into the facility management with aim to identify the effectiveness of proposed models and recommendation of the important performance indicators. Pitt, M. et al. (2008), aims to examine the state of knowledge of performance measurement in facilities management, the paper suggests that a fully developed performance measurement solution through effective benchmarking can deliver as a business tool in facilities management (FM), further, performance measurement is a driver to an innovation process in an organization. Thus, performance measurement has become important both for reasons of justification to general management and to support management and practice within facility management organizations. Various authors developed tailor made quantitative and qualitative models of performance measurement. P. Suwignjo et al. (2000) developed Quantitative Models for Performance Measurement Systems (QMPMS) using cognitive maps, cause and effect diagrams, tree diagrams, and the analytic hierarchy process (AHP). It is described that how the technique can be used to identify factors affecting performance and their relationships, structure them hierarchically, quantify the effect of the factors on performance, and express them quantitatively. J. Sarkis (2003), by following the P. Suwignjo et al. (2000) work showed that how a generalizable analytical hierarchy technique based on the analytical network process (ANP), can be applied as an alternative methodology to SBC's quantitative model for performance measurement system. Nordic paper The normative literature in particular emphasizes that the measures which a unit uses to monitor performance should be clearly linked to its strategy (Dixon et al., 1990; McNair et al., 1990; Kaplan and Norton, 1996). Our study also shows a relatively strong connection between strategic planning and the measures used. To analyze the new service development in the wholesale center the fuzzy analytic network process (FANP) approach with agile theory is developed by Ling-Zhong Lin et al. (2008). This technique has proved useful for comparing the importance among the determinants of agile for new service development in decision maker's mind, including agile cost, time, robustness and scope.

Y. Zhao et al. (2011) presented performance measurement approach for a transportation network i.e travel demand management strategy for which considered into account three perspectives, i.e., transportation service provider's, the user's, and the community's and is based on network-Data Envelopment Analysis (DEA) where the perspectives are inter-related through intermediate inputs/outputs. B. Wolfslehner et al. (2005) compared through application of AHP and ANP to evaluate sustainable management strategies for forest management, proposed to compare four different strategic management options with a set of six criteria and 43 indicators. Schuur (2015) indicated the importance of performance measurements, like as: convey the information about the performance of an organization, Show how effectively the organization uses its resources, assist in setting goals and monitoring trends, provide the inputs for analyzing the sources of errors or under-performance, identify opportunities for on-going improvement. Few of the empirical performance measurement models are reviewed are presented below:

(i) Balanced Scorecard (BSC)

According to the balanced scorecard (BSC) of Kaplan and Norton (1992) and the related strategy map (Kaplan and Norton, 2004), organizational performance should be evaluated from four perspectives: (a) financial: profitability, revenue, sales growth; (b) customer: customer retention, customer satisfaction, market research; (c) internal business processes: processes to meet or exceed customer expectation; and (d) learning and growth: how to grow and meet new challenges. Bradley (2002) classified various performance criteria into six perspectives of business performance according to the BSC concept: (1) financial health; (2) cost efficiency (financial perspective); (3) stakeholder perception (customer perspective); (4) organizational development; (5) environmental responsibility (internal business process perspective); and (6) productivity (learning and growth perspective). In addition, the balanced scorecard contains a serious flaw because if a manager were to introduce a set of measures based solely on it, he would not be able to answer one of the most fundamental questions of all-what are our competitors doing (the competitor perspective)?, Neely,A (2005).

(ii) Business Excellence Model (BEM)

The process of continuous improvement is to be sustained and its pace increased it is essential that an organization monitors, using an appropriate performance measurement system, on a regular basis what activities are going well, which have stagnated, what needs to be improved and what is missing, it's all depends upon self-assessment of the organization. Self-assessment as a process is holistic in nature, and as such will affect the whole structure of the organization. Assessors need concrete plan for self-assessment and not just choose to do it on a whim to fill a void. Business excellence is considered to be a long-term process, concerned with key strategic issues such as developing core functional processes, to be the best, to get people performing better, and to develop a quality framework in order to provide excellent customer service mentioned by Ritchie, L et al. (2000). Further in the same research it was mentioned that the end product of business excellence is to instill best practice within an organization in order to support its values and strategic objectives, meet stakeholder's expectations, and maintain and exceed its competitive position. European Foundation for Quality Management (1994), defines self-assessment is a comprehensive, systematic and regular review of an organization's activities and results against a model of business excellence. The self-assessment process allows the organization to discern clearly its strengths and areas in which improvements can be made and culminates in planned improvement actions which are monitored for progress.

Kanji's Business Excellence model is developed by Kanji's (1996) as a modified pyramid model. The Business Excellence model translated the pyramid model's principles and core concepts into a structural model for business excellence. Kanji's model consists of four principles: delight the customer; management by fact; people-based management; and continuous improvement. Each principle is divided into two core concepts, that is: customer satisfaction and internal customers are real; all work is process and measurement; teamwork and people make quality; continuous improvement cycle and prevention. The model components synthesize not only those critical requirements for quality management prescribed by eminent quality practitioners such as Juran, Deming, Feigenbaum, etc. but also other critical success factors for business excellence. The models in use e.g. Deming, European, Baldridge, Japanese are indicative models mentioned as critic by Kanji et al. (1999), whereas kanji its own model titled an improvement model i.e Kanji's Business Excellence model. Kanji et al. (1999), argued about the former models are indicative in the sense that they only highlight the important factors for business excellence; they do not utilize suitable statistical methods to determine factor weights, factor scores and total evaluation score. Kanji et al. (1999) further mentioned that they also do not show structural relationships among factors and how the factor scores contribute to business excellence. On the other hand, Kanji's Business Excellence model is an improvement model because it performs simultaneous computation of mathematical equations of factor relationships to obtain factor indices and business excellence indices which allow organizations to compare themselves against the different organizations with whom they are competing. This is of particular benefit to organizations which are not doing as well as they might, as it will give them an incentive to do something about their failings. European Foundation for Quality Management (EFQM) Business Excellence Model (founded in 1988) is being given a considerable amount of attention by European organizations, Deming Application Prize in Japan (established in 1951 to signify Dr Deming's contribution) and the Malcolm Baldrige National Quality Award (MBNQA) in USA (established in 1987). The purpose of the award is to promote awareness of quality and an understanding of the requirements for quality excellence, to recognize quality achievements of US companies and to share information on successful quality strategies. Although there are some differences between the models, they have a number of common elements as themes. EFQM has a key role to play in enhancing the effectiveness and efficiency of European organizations by reinforcing the importance of quality in all aspects of their activities and stimulating and assisting the development of quality improvement. The EFQM model is divided into two parts enabler criteria and results criteria and allocates balanced weights (50-50) between the two areas.

Enabler concentrate on how the organization is run and operated and results concentrate on what is seen to be achieved by all those who have an interest in the organization and how achievement is measured and targeted (EFQM, 1997). Now a day, since the inception of the European Quality Award, Deming Prize and Baldrige Award, the quality journey has undergone change from being just a buzzword to a corporate management philosophy today. The number of state awards in USA and other national/international awards are modeled after the Malcolm Baldrige Award criteria.

(iii) Key Performance Indicators (KPI)

Many performance measurement practices include metrics of key performance indicators (KPIs). Cable and Davis (2004) suggested that KPI can be identified by keeping in view the organization's goal and then performance measurement can be conducted which focuses on overall performance evaluation. And in the process of performance evaluation, developing performance metrics is an important step. (Baldwin et al., 2000) suggests that performance metrics indicate long- term and short-term finance and performance-related goals. Further Cable and Davis (2004) asserted that performance measurement through the establishment of KPIs helps the senior management team to make important strategic decisions.

(iv) Capability Maturity Model (CMM)/ Maturity Model

Maturity models are proven important instrument because they allow for a better positioning of the organization and help find better solutions for change. The maturity of the organization enhances its capability of performance. Nolan and Gibson's (1974) seminal work led the Software Engineering Institute to develop the capability maturity model (CMM), which essentially is a process maturity framework focused on the information systems function (Moultrie,J. et al. 2007). It is well known that in the early stage of the organization it will be not result oriented performance of the organization. Gradual increase of maturity increase capability which leads to consistency of a manufacturing or service organization. The longevity of the time frame is important to consider in the CMM model. Dooley, Subra, and Anderson

(2001); Bititci et al. (2011); Chen and Fong (2012) strongly recommend that higher levels of maturity leads to higher levels of performance. Garengo (2009) proposed a maturity model, to assess the structure of the performance measurement system and some of the managerial practices. Bititci et al. (2014) suggests that a practical implication of the continual use of such models for self-assessment result in growth in the maturity levels of performance management practices that lead to improved levels of performance.

(v) Activity Based Costing (ABC) System

Activity Based Costing help managers make more informed, accurate product-pricing, marketing, mix, and design decisions and avoid the cost of errors such as selling unprofitable products, making poor capital investment decisions based on overhead savings that do not materialize, and making inaccurate budgeting decisions about the level of operating expenses required (Cooper, 1988). According to Hall and Jackson (1992), ABC approach follow three phases: first identify the activities to be performed, second, tracing the cost involved to those activities and third, use the cost drivers to trace the cost involve activities. A major focus of ABC are those factors, or cost drivers, that determine the "work load and effort required to perform" each of these activities (Turney, 1992, p. 20). Smith (1992) suggest that although implementing an activity-based costing system will be appropriate for most modern, competitive manufacturing firms, companies must be aware of potential limitations and considerations of such a system prior to recommending it as a course of action.

Performance measures are based on data, and tell about whether an organization/system or activity is achieving its objectives and if progress is being made toward attaining policy or organizational strategic goals. In technical terms, a performance measure is a quantifiable expression of the amount, cost, or result of activities that indicate how much, how well, and at what level, products or services are provided to customers during a given time period.

(vi) Strategic Measurement Analysis and Reporting Technique (SMART)

Strategic Measurement Analysis and Reporting Technique (SMART) also known as Performance Pyramid, was developed by Cross and Lynch (1989) to eliminate the disadvantages associated with traditional, financially focused performance measurement systems. The pyramid structure is to integrates the strategic objectives and operational performance dimensions along with internal efficiency and external effectiveness measures. Oakland (2003) suggested that the key to successful performance measurement at the strategic level is the identification of a set of critical success factors (CSFs) and associated key performance outcomes.

(vii) Performance Measurement Questionnaire (PMQ)

To audits the compatibility of an organization's performance, Dixon et al. (1990) developed structured questionnaire in relation to organization's aims and objectives. The questionnaire is to analyze alignment, congruence, consensus and confusion – helping maintain consistency between the firm's strategy, improvement actions and measures. Essentially it is different from previous frameworks and models as it does not attempt to provide a framework for designing a performance measurement system, rather it is a tool for auditing the appropriateness of a performance measurement system.

(viii) Reference Model and Audit Method

Centre for Strategic Manufacturing (CSM), University of Strathclyde, has developed a Reference Model and Audit Method to assess the robustness and integrity of performance measurement systems. Bititci et al. (1997) states that the prime objective of the Reference Model is to describe, in precise terms, the features of an integrated, effective and efficient performance measurement system. To achieve this objective it describes the constituent components of a performance measurement system and provides guidelines on the appropriate performance measures. Further, Bititci et al. (1997) suggest that It is intended that the reference model will be used for both the design of new systems and for auditing of existing systems.

An Audit Method has been developed for assessment of the integrity of an organisation's performance measurement system against the Reference Model. The audit method examines the level of conformity with the structure of the reference model; appropriateness of the performance measures used and; appropriateness of the targets and objectives set. Table 2.2 consists the different frameworks of TQM with their focused areas.

Table 2.2: Different models of TQM with their focused areas

Model/Framework	**Developed/ Created**	**Focus areas**
Balance Scorecard (BSC)	Kaplan and Norton (1992)	Financial, customer internal business processes and learning and growth
Business Excellence Model (BEM)	Kanji's (1996)	in order to support its values and strategic objectives, meet stakeholder's expectations, and maintain and exceed its competitive position
Key Performance Indicators (KPI)		Performance metrics which indicate long-and short-term finance and performance-related goals
Capability Maturity Model (CMM) / Maturity Model	Nolan and Gibson's (1974)	focused on the information systems
function activity based costing system	Cooper (1988)	identify activities performed; second, trace costs incurred to the activities; and third, use cost drivers to trace the cost of activities to cost objects.

Model/Framework	Developed/ Created	Focus areas
Strategic Measurement Analysis and Reporting Technique (SMART) also known as Performance Pyramid	Cross and Lynch (1989)	Clarify measures of strategic importance. Build consensus horizontally across functional or department lines. And Institute measurements at the operational level in each department
Performance Measurement Questionnaire (PMQ)	Dixon et al. (1990)	

2.4 Literature review on research methods

2.4.1 Questionnaire-based Survey

The survey is regarded as flexible research approach which is used to investigate a wide range of topics to describe reality. Surveys approach often employ the questionnaire as a tool for data collection to establish the prevalence or incidence of a particular condition.

Black and Porter (1996). conducted factor analysis on a questionnaire administered to quality manager practitioners. From this Black and Porter established a list of ten factors that are described as critical to TQM and used eigenvalues and 'variance explained' criteria to justify their choice of 10 factors. The interviewees must have considerable managerial experience to examine the questions and they provided a valuable opinion about their readability, adequacy to the TQM measurement and correct understanding, Santos-Vijande, et al. (2007). Yusuf, Y. et al. (2007) expressed their opinion that the most suitable person to fill the questionnaire is the most accountable person responsible for the quality function because they have sufficient understanding and experience of developing and implementing quality management in their companies.

2.4.2 Case Study

In the advocacy of case study, Yin (1989) advocated that case study design is the logical sequence that connects the empirical data to a study's initial research questions and, ultimately, to its conclusions. Colloquially, a case study design is an action plan for getting from here to there, where 'here' may be defined as the initial set of questions to be answered, and 'there' is some set of conclusions (answers) about these questions. Development of theory is a central activity in organizational research, Eisenhardt, K. M. (1989). Laszlo (1999) accomplished a case study of airlines and identified that it had implemented key dimensions of TQM in all operations and these were top management commitment, employee involvement and customer focus by doing this it achieved good result. Using a case study approach in the region of Murcia, Spain, Martinez-Lorente et al. (2004) also concluded that TQM improves many aspects of performance such as customer satisfaction and business performance. A study conducted by Arumugam et al. (2008) to explore the relationship between TQM performance and TQM practice (factors) within Malaysian manufacturing organization, and found that the level of quality management practices partially influenced quality performance.

Kebede and Virdi (2021) conducted a cross-sectional survey to examine the effect of Total Quality Management (TQM) practices on the operational performance of ISO 9001:2008 certified manufacturing companies in Ethiopia. The results revealed that among the practices of TQM used in the model only supplier quality management, continuous improvement and process management were found to have significant and positive effect on the operational performance. Kumar et al. (2009) investigated the impact of TQM implementation on different dimensions i.e. employee relations, operating procedures, customer satisfaction, and financial results of company performance. The case study was conducted on Canadian firm and the study provides useful insights into the performance improvement that can be achieved through TQM. Daoud (2012) investigated through survey the impact of HRM practices on the implementation of TQM practices and on quality performance in Jordanian service organizations.

2.4.3 Fuzzy Logic/ Fuzzy Set Theory

During the second half of the 20th century, in the areas of systems science and systems engineering, the seemingly non-stoppable emergence of various theories and methodologies of unascertained systems has been a great scene. For instance, L. A. Zadeh established fuzzy mathematics in the 1960s, Z. Pawlak advanced rough set theory in the 1980s, Guongyun Wang created uncertainty mathematics in the 1990s, etc. All these works represent some of the most important efforts in the research of uncertain systems of this time period. From different angles, these works provide the theories and methodologies for describing and dealing with uncertain information. Uncertainty, complexity, and scarce or unreliable information become a threat to the effective use of traditional quantitative techniques, Lin, C.-T., & Chen, C.-T. (2004), further they stated that A fuzzy set can be defined mathematically by assigning a value to each possible member in a universe representing its grade of membership.

Fuzzy Logic is a mathematical way of refinement of linguistic data which allows the rendering of vagueness. This is a refinement of ray tracing which allows the rendering of soft phenomena. Fuzzy logic is a very powerful tool that can deal with decisions involving complex, ambiguous, and vague phenomena that can only be assessed by linguistic values rather than numerical terms, suggested Lin, C.-T., & Chen, C.-T. (2004). The fact is that vagueness is a fairly mysterious phenomenon that plays a significant (if not crucial) role in human thinking. Fuzzy sets theory provides a useful tool for dealing with decisions in which the phenomena are imprecise and vague. Using fuzzy concepts, evaluators can use linguistic variables to assess the factors in a natural language expression; and the importance and effect of the factors can be approximated by their membership functions. Thus, fuzzy concepts are well suited for decision making with uncertainty. Furthermore, such concepts have been applied to the evaluation of multi-criteria decision problems (Chen, 1997; Kangari & Riggs, 1989; Tsourveloudis, 1998). Fuzzy logic is a useful tool for capturing the ambiguity and multiplicity of meanings of the linguistic expression. This is the basis on which we propose the use of fuzzy logic in the performance measurement of TQM system. Thus, one may agree that a working mathematical theory of vagueness phenomenon is necessary. We argue that until now, this goal is most successfully accomplished by fuzzy logic, which attempts to grasp vagueness by introducing a well-established and substantiated structure of truth degrees and by using the latter for modeling the way vagueness manifests itself in various situations. argue that it is a reasonable mathematical model having enough power to deal with vagueness-nothing more, nothing less.

Ghalia et al. (2000) applied fuzzy logic inference for estimating hotel room demand by eliciting knowledge from the hotel managers and building fuzzy IF–THEN rules. Since fuzzy weighted average approach produces more informative results, Kao and Liu (1999) used this technique to devise a competitiveness index of firms based on automation technology and manufacturing management for manufacturing firms; Lin (2000) devised a fuzzy-possible-success-rating for evaluating whether to bid or no-bid a project based on a set of biding-criterion; Chen and Chiou (1999) devised a fuzzy credit-rating for controlling commercial loans. Furthermore, On the basis of fuzzy sets theory, Eldukair (1990) proposed a fuzzy bidding decision method. In that method, it is assumed that the experts are capable of making an adequate scale of a given factor. However, in many cases it is virtually impractical for experts to directly determine the scale of a vague factor (Karwowski & Mital, 1986). Moreover, when a factor is ill defined, the experts simply adjudge that the score of a given factor is "low," "high," "fairly high." It is natural to use linguistic expressions to estimate ill-defined factors. Hepu and Chung-Hsing (2006) presented a simulation-based study to evaluate the performance of twelve defuzzification-based approaches for solving the general fuzzy multi-attribute decision-making (MADM) problem requiring cardinal ranking of decision alternatives. The decision mechanism is constrained by the uncertainty inherent in the determination of the relative importance of each attribute element, Machacha and Bhattacharya (2000). Fuzzy multiattribute decision making (MADM) has been developed for handling the problem of inherent uncertainty and imprecision in human decision-making processes involving multiple attributes, strongly suggested various authors like H. Deng (1999); C. Carlsson (1982); B. S. Ahn (2003); F. Herrera and J. L. Verdegay (1997); R. C. Kwok et al. (2002); K. S. Park (2004); J.-B. Yang and D.-L. Xu (2002).

The fuzzy logic process has been explained by the following steps. Initially, a crisp set of input data have been converted into a fuzzy set by using fuzzy linguistic variables, fuzzy linguistic terms and membership functions. This process is known as fuzzification. Secondly an inference is framed by using a set of rules. Finally, the process of defuzzification has been carried out with the output of the fuzzification and converted to a crisp data using the membership functions. In fuzzy MADM, defuzzification is widely used as an effective means for aggregating the fuzzy attributes' weights and fuzzy ratings of the alternatives, H. L. Dong and D. Park (1996); T. Jiang and Y. Li (1996); C.-H. Yeh and H. Deng (2004), however numerous defuzzification methods have been developed, and there is no best method stated by Deng & Chung (2006). Whereas, Fuzzification is a process in which the membership functions defined on the input variables are applied to their actual values to determine the degree of truth, argued Machacha and P. Bhattacharya (2000).

2.4.4 Interpretive Structural Modeling (ISM)

Interpretative structural modeling (ISM) was first proposed by Warfield in 1973, with the aim of analyzing complex systems, Warfield, J.N. (1974). ISM emerges as a solution to the problem, i.e provide the hierarchical structure of the parameters; as various quality initiatives in industries demand for structuring of parameters to execute the new quality strategy smoothly (Poduval et al., 2015; Yadav et al., 2016). ISM helps in building the hierarchical structure of the parameters from bottom to top, representing input to output hierarchy of the methodology to be implemented (Piltan and Sowlati, 2016). Materializing the pragmatic experiences and ideas of experts into a hierarchical system is the basic theme of ISM, Yadav et al. (2017). The hierarchy-based ISM delineates those factors which are really critical and need more focus on the root causes of the problem. The model so formed portrays the structure of a complex issue or problem in a carefully designed pattern implying graphics as well as words, Raj and Attri (2011) stated. Attri et al. (2012) have applied ISM approach for identifying and analysing the mutual interaction of the enablers in the implementation of Total Productive Maintenance (TPM) and also have applied for identifying and analysing the barriers in the implementation of TPM. Dewangan et al. (2015) used ISM to analyse the relationships among enablers for promotion of innovation in the Indian manufacturing sector and further used fuzzy MICMAC (Matriced Impacts Croise Multiplication Applique a UN Classement) analysis to find out driving and the dependence power of that identified enablers. ISM is intended for use when desired to utilise systematic and logical thinking to approach a complex issue under consideration, Ravi et al. (2005).

The versatility of ISM approach is widely used as a tool in various field. Liu et al. (2018) employed ISM to ascertain the interrelations among CSFs for safety management in subway construction, whereas Chauhan et al. (2016) used to address the problem of waste management in India. Wang et al. (2004) applied this method to classify the nine kinds of accident causes into five layers, with definitive relationships between different layers.

2.5 Strengths of contemporary research

Based on the review of reported literature, following strengths can be cited

- Many leading research journals such as TQM, Omega, IJPR, IJQR, IJQM, Journal of Production Economics, European Journal of Operational Research etc have recently given significant importance and thrust to the issues related to TQM performance measurement. Some of these journals have come out with special issues on TQM performance measurement. This support is one of the major reason to boost in research in this area.

- The advancement in the information and communication technologies (ICT) opened new window in the area of TQM. This accompanied by other developments, have drawn the attention of researchers.

- Companies are now recognizing the significance of TQM to gain competitive advantage in the marketplace. Workshops and seminars are frequently being held to make the managers aware of TQM and its performance. The literature is dominated by empirical, case and conceptual studies so that managers are able to need to understand the dynamics of TQM.

2.6 Gaps in contemporary literature

The few gaps identified from the review of the literature have been presented in Table 2.3 The identified gaps provide motivation for the present research. Issues related to TQM performance measurement are not widely attempted. The surveys of the Indian FMCGs industry are not all focused towards assessing the TQM performance practices. The issues related to TQM performance would be covered in the later chapter of this thesis.

Table 2.3: Gaps identified from the review of the literature

Sr. No.	Identified gap	Remarks
1	The topic of measurement of TQM performance has not received adequate attention from researchers and practitioners.	A comprehensive survey to assess the TQM performance practices has been conducted along with modeling of issues related to TQM performance measurement
2	Few empirical studies on TQM have been conducted in the context of India; based on case studies or descriptive statistics alone.	Some hypothesis have been formulated and tested in this research. Case study is also conducted to supplement the findings.
3	Literature discusses about the TQM implementation practices by the industry and organizational performance but the performance of TQM practices in FMCGs industry lacks. In India, few surveys on TQM have been reported but no insight has emerged about.	On TQM performance, some hypothesis have been formulated and tested in this research
4	Lack of significant study of TQM practices and its performance in developing countries, in general and India, in particular	A comprehensive survey to assess the TQM performance practices in the Indian context has been conducted.
5	The implementation of TQM is not possible without its CSFs, however mutual relationships of these CSFs are not available in the literature	An ISM-based approach has been used to model these CSFs.
6	Very few literatures are available on TQM performance measure selection	An Fuzzy Logic Rule-based model has been presented for the measurement of TQM performance.

2.7 Conclusion

This chapter reports about the TQM related available review of literatures. TQM performance based literature review has been presented. Broad and systematic review of literature is conducted keeping in view the objective of the research. Due to the nature and scope of the presented research, articles related to TQM performance measurement are the main focus areas of the literature review. The papers/articles related to survey, case study, quantitative modeling has been presented. The gaps in literature and relevant research issues have been identified. This has provided direction and motivation for the present research, which is reported in the subsequent chapter.

Chapter 3

Research Method and Design

3.1 Introduction

This chapter is to describe the research carried out by the researcher and to introduce the set-up and research methods precisely that is used for the study.

Sounders et al. (2016) enlightens to carry out the research following onion architecture analogy which comprised of five layers, viz. philosophies, approaches, strategies, choices and time horizon interfacing each other towards the core that represents the data collection and analysis. A. Melnikovas (2018) suggested that the research onion enables the researcher to choose the most suitable theories or practices within existing layers in order to answer the research questions.

In the context of the present research, it is observed that nowadays measuring performance becomes essentiality for any organization. But the question arises that what to be measured? Why is it measure? How to be measure? There are various empirical tools and techniques are available to measure the performance, viz. Balance score Card, KPI, BEM etc. about which in chapter two we discussed in detail. Many authors proposed the methodology to measure the performance of the entire organization and suggested improvement points. The performance of the organization directly linked with the strategy implemented as a tool to excel the performance of the organization. In the cut-throat competitive global market, every organization believe in benchmark performance. The increased competition brought about by globalization and economic reforms requires that manufacturing companies in India and similar dynamic environment not only have to develop appropriate strategies but they also need to understand how these strategies affect performance, Sahoo (2020).To achieve the set goal, organizations implement the strategy as per their need, but few of them are the backbone strategy of the organization like lean manufacturing, SCM, JIT, TPM, TQM etc. These all strategies aim to achieve the organizational goal, although they also have their own goal individually. TQM encompasses all these strategies and ranked above all in the priority list of the organization. Like other strategies TQM also having its goal which ultimately converged with the organizational goal, and to achieve the intended goal of TQM the critical success factors (CSFs) must be determined keeping in view the TQM goal. These identified CSFs help to achieve the targeted goal, so continuous monitoring and assessment is necessary for excellent performance. Furthermore, individual academics and institutes produced numerous studies and instruments, such as the Malcolm Baldrige Award, EFQM (European Foundation for Quality Management), and the Deming Prize Criteria, to determine essential TQM characteristics. A wide range of management concerns, strategies, approaches, and systematic empirical investigations have been developed as a result of these studies Bayraktar (2008).

Literature review examine studies that are closely related to research objectives. In this context The majority of research investigations in the literature focus on generating performance measurements or applying optimization models to real-world scenarios. The current study, on the other hand, has combined both parts and presented a KBPM to quantify TQM performance using a fuzzy logic technique. The application of applied model in an Indian FMCGs industry returned very positive results in the technical field as well as in the managerial field. In an Indian FMCGs (Food Industry) industry, this research was conducted and for that a systematic approach is followed. The two set of questionnaires is administered with the help of related literature, academia and industries persons to catch the proximity of the study. First set of questionnaires were related to TQM awareness among the employees, and second set of questionnaires is related to the identified TQM CSFs to collect the view and to measure the impact of the CSFs on TQM performance. Extensive literature of the peer reviewed journals is reviewed but rarely found about the measurement of TQM performance. This void in the research is the motivation focal of this research. Mostly literature available related to the TQM implemen-

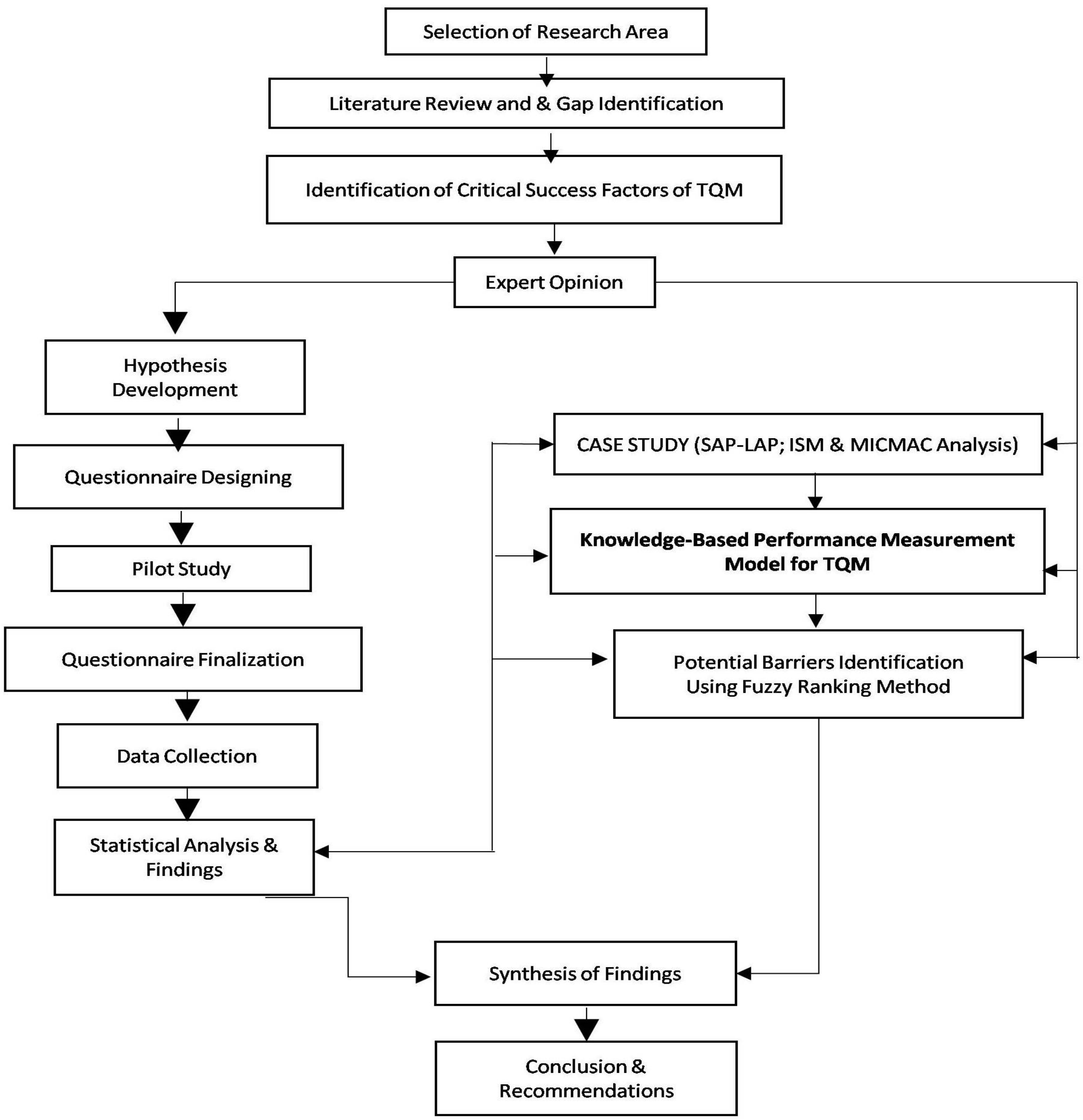

Figure 3.1: Flowchart of adopted research methodology

tation and its impact on the organizational performance. Figure 3.1 depicts the research methodology adopted for this research work.

3.2 Research philosophy and approaches

Despite significant progress in the design of performance measurement frameworks and systems in recent years, companies rarely address the practicalities of measuring in ways that make them useful in practice. Neely et al. (1995) correlated performance measurement with the process of quantifying action, where measurement with the process of quantification and action.

As the present study aims to measurement of the performance of TQM so that the barriers can be identified and removed to perform TQM more effectively.This shows that a mixture between positivist and interpretivist approach, perhaps reflecting the stance of realism.Organizations use to implement various strategies like SCM, JIT, Lean manufacturing, six-sigma, TQM etc. to achieve the targeted goal(s) and objective(s). Individually the implemented strategies have their own continuum under which they operate for their goal. Although the goal of these strategies is directly linked with the organizational goal. Further to achieve their intended goal, the strategies follow their drivers and enablers (combinedly called critical success factors). These critical success factors change as the goal change and the success of the implemented strategies depends upon the critical success factors. Critical Success Factors (CSFs) are the measurement constructs which strongly related to the strategic goals of the organization and they are the essential areas of activity that should receive constant and careful attention from assessor and must be performed well if one wants to achieve precise goal(s). If the critical success factor(s) not performing well it means that factor(s) is hindering for the strategy and acting as barrier(s). And if once the barrier(s) is identified then its easy to take the corrective action to the managers. Industrial consultants were facilitators and enablers of better results, not drivers, since the use of performance measurements expanded organically through time. It is widely observed that users of performance measurement tools were typically more concerned with "chasing their numbers" than with improving the underlying processes, and that the company was not gathering consistent, useful data. Finally, management realised that the data they were receiving frequently encouraged the wrong behaviours. The current approach of performance measurement is characterized by a transformative focus on objective-driven performance management which is the foundation of operational excellence. It's a process-centric strategy to aligning critical process execution with strategic goals by assessing and improving what matters most to a company. Drawing upon these contributions, we establish the rudiments of a knowledge-based performance measurement (KBPM) model. Measurement is all about the keep tracking and about establishing dimensions. In business, measuring is linked with the objectives which lead to performance of the organization as a whole.

3.3 Questionnaire design

To check TQM awareness among in-job-employees and to identify the TQM CSFs, questionnaire is the basic instrument considered in this study to gather the required data for the analysis and is designed and developed from validated scales.The population of this study were the employees, salesmen and vendors of and Indian FMCGs industry. Salesmen and vendors having the customer's perspective towards product quality is the main reason of their inclusion in the study. Purposive sampling technique was adopted in selecting the area where the copies of the questionnaire were administered.This has been seen as a step to ensure content validity of measures.However, the survey was conducted in English due to the commonality to understand. To be more effective and practical oriented the questionnaire was pretested with 04 academic domain experts and 06 senior managers from FMCGs industry. The pretest sought to evaluate the content validityof the measures, and whether the informants understood the instructions, items, and scales.

We conducted a cross-departmental study with structured interviews in which observations were made using a questionnaire designed to assess the awareness about TQM among the in-job-employee and then to assess the performance of TQM with help of identified TQM CSFs.Although the survey was originally administered to individual employees, department-level average scores were used for this research due to reasons related to data confidentiality.Few employees did not provide names on the survey form, but the combination of organizational unit, experience, and demographics made it theoretically possible to identify individual respondents. Consequently, only the data aggregated by organizational unit were reported. Moreover, from a managerial perspective, the data by organizational unit allowed the firm to better identify those units with substantive concerns, which was then followed by more intensive, qualitative research.Neither the top-level management nor human resources managers were given access to the individual data. Among 2356 employees, more than 30% of the firm's employees participated in the study. The study was created in English and same version data are reported in this study.

In Table 4.3 (chapter 4), demographic details of the employees included in this study are listed. The employees were invited to participate in an open discussion related to quality and its tools and techniques. The respondents were asked to indicate their response on these measures on a five-point Likert scale. Scoring rubrics were defined for each Likert-type scale for questions linked to measuring elements of constructs/criteria under each topic, and they also served as a reference for respondents in evaluating their replies to each question given by the interviewer. The use of Likert scales and rubrics throughout the evaluation tool is an attempt to push responders to make a single, clear decision. Questionnaires rated with five-point Likert scale are simple to answer and are not confusing (Leung, 2011). Figure 3.2 shows the classification of survey respondents according to their job positions. In the way of study activity, responses to the poll ranged from low-level employees to higher-level management. As a consequence, the acquired results may be regarded as legitimate and accurate in presenting relevant organisational practises.

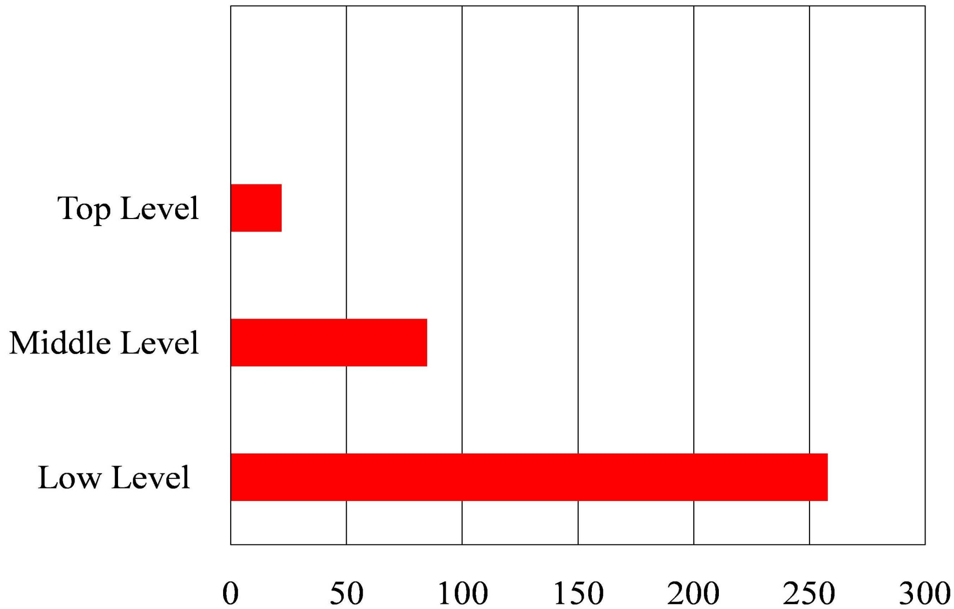

Figure 3.2: Classification of survey respondents

3.3.1 Data collection

Data for this study was drawn from the employees of XYZ FMCGs Ltd. perspective in the form of yes/no and likert's scale by using a questionnaire survey presented in the Appendix. XYZ FMCGs Ltd. is a ISO certified company about which Sahoo (2020) suggests that if any organization wish to be participate to mount a campaign in the data collection as a respondent, the company must also meet participate to mount a campaign. The purpose of the survey is primarily to collect data on TQM practice in the XYZ FMCGs LTD.Firm included in the survey is the bakery and dairy products manufacturing industry, and thus the survey primarily targets factory employees who were engaged in production and operation. However, the respondents often havesenior position in the firm.

Our data set in this study is drawn from 720 persons associated with XYZ FMCGs Ltd. as an employee, salesman and vendor. Because of the not aware about TQM tools and techniques, we do not include all the employee in our study.

We collected data from 365 respondents. However, because we are only interested in TQM performance, we choose constructs under the category of quality management. With these criteria, we have 30 sub-attributes for 12 constructs in our data set.

As noted by Dzurec and Abraham (1993), The type of data collected (i.e. quantitative vs. qualitative) has no significance on the meaning. Rather, meaning is derived through the interpretation of data, whether quantitative or linguistic. With exception of quantitative researchers, who use statistical tools and subjective inferences to determine what their data mean in the context of an a priori theoretical or conceptual framework, qualitative researchers use phenomenological procedures and their own perspectives on reality to discover meaning (Dzurec & Abraham, 1993). To measure the performance of TQM strategy in an Indian FMCGs manufacturing company,the present study collects data from employee survey, which describe show TQM CSFs acts to achieve its goal. Of the 720 persons who participated in the survey, 600 were in-job employees, 112 salesmen and 08 were vendors. Most importantly the employee's response is as the number of employees were included more. The selected sample was deemed adequate for general conclusions about the entire population. The sample was also adequate for the statistical tools which were used in the data analysis. Five-point Likert-type scales were used to measure each respondent's level of agreement with each statement. The items for checking awareness about TQM and the items for measuring TQM performance. The respondent participant stated that the employees who internalize TQM principles through experiential learning with well-functioning teams will be better prepare to participate in similar collaborative work. In turn, will lead to clearer TQM goal(s) and more precisely work of improvement in quality.The data are analysed by the MINITAB software to gauge the dependent variable with its independent variable and to establish action plans for performance measurement of TQM.The current work of the measurement of TQM performance by which the CSFs of TQM are identified so that they can be addressed. Measurement forms the basis of a plan for services or action.

These is distinction between measurement (act of measuring, without putting any value on the 'observation') and assessment (putting a value on the measurement of performance).

3.3.2 Construct reliability and validity

Variables extracted from test instruments are deemed trustworthy only when they produce steady and consistent response throughout several administrations of the test. Cronbach's alpha is a measure of reliability related with the variance accounted for by the "underlying construct's" internal consistency. Construct is the hypothetical variable that is being measured (Hatcher, 1994). In this regard, the Cronbach's α coefficient was used to test the reliability of all the constructs and their specific dimensions. α scores for all the main variables exceeded the recommended cut-off point of 0.70 (Nunnally et al., 1967). The higher the score, the more reliable the generated scale is. Nunnally (1978) has indicated 0.7 to be an acceptable reliability coefficient. The Cronbach's alpha values of the variables are summarized in Table 4.1. The alpha values ranges from shows good true score of the data collected. The data collected in survey are evaluated for reliability using Cronbach's alpha-coefficient method. The test was conducted in SPSS Statistics v.23 software. Reliability tests were performed separately for the items of each critical success factors in the same Table 4.1.

Validity Analysis Validity explains how well the collected data covers the actual area of investigation (Ghauri and Gronhaug, 2005). Validity basically means —measure what is intended to be measured(Field, 2005). The main types of validity namely are; face validity, content validity, construct validity and criterion validity. The approach to establish content validity involves literature reviews, as for this research and then follow-ups with the evaluation by expert.

Kerlinger, F.N (1986) argues that content validity is representative of the content. Thus, content validity of an instrument depends on the adequacy of a specified domain of content that is sampled (Nunnally, J.C.). Bush (1985) pointed out that content validity refers to the degree that the instrument covers the content that it is supposed to measure. It also refers to the adequacy of the sampling of the content that should be measured (Polit D.F. et al. 1991). Cronbach (1971) noted, when the items of a test are judged to adequately represent well-defined domains of content, it is permissible to view responses to these items as generalizable samples of the responses examines would exhibit if they were tested on all of the items constituting these domains. An evaluation of the theoretical and practical soundness of using each of the mentioned notions to define content validity suggested that these notions are best regarded as definitions of concepts other than content validity.

3.4 Hypothesis development and testing

Hypotheses lie on a continuum ranging from exploratory to confirmatory. It is a procedure used to assess whether there is sufficient evidence to conclude or not. As in the present research for example consider that the Human Resource Management is the one of the drivers of TQM which make involve employees for the quality work and involvement of employee automatically empowers the people to make decisions, make choices, take risks, and make new contributions. The recognition and reward motivate the employee for the stipulated work in a systematic teamwork. Using hypothesis testing, assessor can test whether it has been successful in significantly effective TQM by considering the HRM factors.

A confidence interval should always accompany the acceptance and rejection of a hypothesis to reflect the claimed accuracy. An x % confidence interval, on the other hand, is an interval produced by a rule that has the property of covering the real value x percent of the time under simulated conditions, provided the model is accurate. More precisely, for a confidence interval with confidence level -p, the appropriate number of standard errors is the “critical value of the t distribution with a tail area probability of 1-p and d degrees of freedom for error”, where the number of degrees of freedom (“d.f.”) is the sample size (n) minus the number of parameters which have been estimated from it (which is 1 in the case of the mean model). Parametric statistics have been named after their assumption that the experimental results are distributed according to a function which may be completely specified by one or more parameters.

3.4.1 Hypothesis development through literature review

Literature review is the perfect mean for the development of hypothesis as it provides in-depth about the concerned subject with test ability and validity. The peer reviewed published research provide the legitimate information to the researcher to carry forward the research work and also for the postulation if required. Literature review endorse if one hypothesized any statement then it requires prior authentication, that we gain from the available literature and manuscripts.Hypothesis compels researcher to think intensely and specifically about the outcomes of a study. Consequently, it enables to understand the implication of the question and the different variables involved in the study.Specificity of the hypothesis makes easier to reduce the number of ways in which the results could be explained.

3.4.2 Hypothesis Testing using statistical tools

The traditional notion of hypothesis testing, which is a cornerstone of statistical analysis and the scientific method, is the foundation of hypothesis testing. Using language from classical theory, one could wish to conduct a test whether the statement is in a state H0 called the null hypothesis, thought of as the background”, or in another state Ha called the alternative hypothesis, which is the “signal” that one desires to detect. In the Chapter 5 of this research, we consider hypothesis testing for TQM CSFs and develop aperturbative approach to hypothesis testing using Anderson-Darling Normality Test and t-test.

Each alternative hypothesis might be evaluated by fitting a more sophisticated model and evaluating the significance of its extra coefficients, but we shouldn't depend just on significance tests to determine the model's accuracy-we should draw on any other knowledge we may have, particularly given the small sample size. we should not just blindly test a lot of other models without good motivation.

Anderson-Darling normality test

Theodorsson, E. (1988) suggested that Goodness-of-fit tests are essential when using statistical tests that assume that the distribution of observations is, for example, Gaussian.Stephens (1976), (1982); D'Agostino (1986), Cited by Pomory, C. M. (2006) and stated that the Anderson-Darling test (Anderson & Darling, 1954) has been recommended as one of the more powerful tests for normality. As in the present research the data set follows a specified distribution i.e normal distribution, so The Anderson-Darling test is used. For each hypothesis the test involves calculating the Anderson-Darling statistic and then determining the p value for the statistic is presented in chapter 5.

t-test

The t distribution is called "Student's t distribution" because it was discovered by W.S. Gossett of the Guinness Brewery, who was a pioneer of statistical quality control in the brewing industry and who also published scientific articles anonymously under the pen name "Student". Mathematically, the t distribution is the distribution of the quantity

$$\frac{(\overline{X} - \mu)}{SE_{mean}} \tag{3.4.1}$$

which is the number of standard errors by which the sample mean deviates from the true mean when the standard deviation of the population is unknown (i.e., when SEmean is calculated from s rather than σ). In comparing a t distribution to a standard normal distribution (z), what matters is the "tail area probability" that falls outside some given number of standard errors: a 95% confidence interval is the number of standard errors plus-or-minus outside of which there is a tail area probability of 5%. For a lower number of degrees of freedom the "tails" are slightly "fatter", so a greater number of standard errors is needed for a given level of confidence that your estimate won't deviate from the true value by more than that amount.

Each separate table (and graph) in MINITAB output is tagged with the construct name and the sample size. Often all twelve constructs are fitted to the different variables during analysis sessions, and pieces of output from the best are later copied and pasted into reports.

3.5 Critically examination of the case company (Using SAP-LAP)

A case study concerning an Indian FMCGs manufacturing industry(XYZ FMCGs Ltd) post-implementation TQM is analysed in order to validate the model presented.Enquiry for the identification of TQM CSFs is the part of this study uses SAP-LAP(situation–actor–process and learning–action–performance) proposed by Sushil (2000) as a novel approach, which attempts to analyse and synthesise the processes holistically in this study on the performance of TQM rendered only by the case organization (XYZ FMCGs Ltd). Further this SAP-LAP analysis is undertaken in the TQM performance for deriving deeper linkages in the model.

Following the SAP-LAP considers the present operations of the organization especially related to quality management and actors as employees influencing the situation through different processes.Several pertinent issues leading to actions have been analyzed, which have considerable impact on the performance of TQM.Responses elicited through in-depth interviews with the actors (employees) form the basis of primary data along with the published secondary sources.

3.5.1 Interpretive structural modelling (ISM)

The case-study be studied in its own natural settings. Subsequently, by observing actual practices, a meaningful and relevant theory can be generated. Further, it allows significant research questions such as why, rather than just what and how. SAP-LAP method lends to early, exploratory investigations where variables are still unknown and the context phenomenon still to be under-stood. Although the SAP-LAP inculcated the same point, but ISM emphasize the interpretive activities of variables being studied. ISM used a structured approach to describe the data and deriving interpretive themes as a tool for the selection and description of data sets.The contextual relation must be cogently stated as a possible statement of relationship among the elements.Relations may be of several types like influencing, comparative, temporal or neutral(Austin and Burns, 1985).ISM is a well-proven strategy for analyzing the synergic influences of various attributes to the overall system under study, Pramod, V. R. and Banwet (2010). The ISM process involves the identification of factors, the definition of their interrelationships, and the imposition of rank order and direction to illuminate complex problems from a systems perspective, Attri et al. (2013).ISM model (Fig. x, chapter X) provides a direction for successful measurement of performance of TQM CSFs in the FMCGs organization in a phase-wise manner. It shows the sequential approach for sustainable performance measurement. In this sequence the order of TQM CSFs is very important. If TQM CSFs are not in the apt sequence,then there is high risk of its failure. With the help of experts, the structural self-interaction matrix is developed, which is the foundation of this research work and verified the logical consistencies of the ISM model.It is evident from form further chapters that CSFs of TQM categorized under enablers and drivers not only affect effectiveness of TQM system, but also influence one another. In this context, it is essential to understand mutual relationship among them. In other words, identification of those critical factors (variables) that are TQM drivers and enablers would be helpful for effective TQM.An advantage of this methodology is that it depicts both order and direction of relationships among elements of a system (Ravi and Shankar, 2014).

3.5.2 MICMAC analysis

MICMAC (Matriced Impacts Croises Multiplication Appliquee a UN Classement) analysis used to find out driving and the dependence power of variables under study.The MICMAC analysis work on the principle of multiplication properties of matrices (Kannan et al., 2009; Diabat and Govindan, 2011). The use of MICMAC analysis is beneficial to calculate the drive and dependence power of enablers as shown in Table. 6.x in chapter 6. With the help of key TQM drivers and enablers this analysis is done so that drive the structure in different categories. However the relationship between TQM drivers and enablers always not equal, some relation may be strong, especially strong and better.ISM model along with MICMAC analysis offers an excellent framework for performance measurement of TQM.

3.6 Development of KBPM framework for TQM performance measurement

A KBPM framework for TQM of excellence is developed by the author as shown in Figure 7.3 of Chapter 7. By now, the KBPM framework is almost self-explanatory and can form the basis for measuring performance of TQM.The measurement of

TQM performance is quantitative, where mathematical model is created to represent the weight the individual TQM CSFs. This performance measurement model is only applicable when used to measure the potential CSFs of TQM for acting for a specific task. The task needs to be repeatable, measurable, and consist of many variables within a procedure; it can measure an entire procedure on its own. The suggested KBPM model provides a step-by-step improvement opportunity for FMCGs which are committed to improving customer satisfaction through TQM. The suggested framework of performance measurement of TQM fulfils a particular purpose within the practical constraints of time and money.Dependent on the stage of quality development, particular FMCGs can enter into any one of the given phases. This is in order to implement the above objective successfully; the process is as follows:

- Identify the potential TQM CSFs: most important of all establish TQM goal, including a quality steering committee and quality improvement teams;
- assess the current quality system situation to identify all the existing good practices;
- create a documented implementation plan – good project management is essential;
- provide training so that staff are fully aware of the changes;
- create and update quality management documentation (IS0: 9000 or equivalent)
- monitor progress as part of the Deming cycle (plan-do-check-act).

3.6.1 Fuzzy logic based performance measurement of TQM

The case study of this research, based on an Indian FMCGs industry, attempts to illustrate the ability of the proposed KBPM model to counteract TQM performance. More specifically, the four exercises conducted here include:

- Effective ways of counteraction from related literature, e.g. TQM performance.
- Impact of TQM CSFs on its performance
- Incorporation of KBPM model on TQM.
- Identification of the potential barriers of TQM.

First CSFs of the TQM are identified keeping in view the TQM goal as far as possible to the company. There are few researchers who havebeen interested in using fuzzy sets theory to performance measurement in recent years. In particular, the fuzzy performance index (FPI) in this research can be applied in a KBPM model; it can also directly evaluate the TQM performance with CSFs, but it does not need complicated processes. The Fuzzy Performance Index (FPI) based on fuzzy sets theory is an appropriate solution for unclear responses.The natural-language expression of Fuzzy Performance Index set, FPI = Very Low (VL), Low (L), Fairly Low (FL), Fairly High (FH), high (H), Very High (VH), is chosen for labeling. Furthermore, to simplify, suppose the membership functions shown in Fig. 7.4 are chosen for matching. (One can choose other membership functions if necessary).

The FPI assesses the degree of fuzziness generated by a set of classes. FPI values can vary from 0 to 1. Values close to 0 suggest separate classes with limited membership sharing, whereas values close to 1 imply no distinct classes with a lot of membership sharing. When the index is at its lowest, reflecting the least membership sharing, the ideal number of clusters for each calculated index (FPI) is attained (FPI). And the Euclidean method consists of calculating the Euclidean distance from the given fuzzy number to each of the fuzzy numbers representing the natural-language expressions set.

3.7 Conclusion

The research aspects related to the research process of this thesis are discussed. A general description of incorporated research methods is introduced underpinning a discussion of why and how suitable for this specific research. As this research aims to measure the performance of TQM and how TQM CSFs can be identified, applied effectively and efficiently in FMCGs industry. The contextual relationship among the identified constructs were developed using ISM method and MICMAC analysis is done to understand the TQM CSFs in terms of their interdependence. Then further research develops a knowledge-based performance measurement (KBPM) model based on fuzzy logic concepts. Further research acknowledges the diversity of factors which TQM must satisfy and highlights some of the problems encountered in implementing the model, based on well-founded research and experience of the authors.

Chapter 4

Hypothesis Formulation, Questionnaire Administration and Descriptive Statistics

4.1 Introduction

As this research is based on case study, thus hypotheses are regarded important by Mills et al. (2010) because they help single out a limited set of features present in the observed cases that the researcher considers to be more relevant to describe them or explain their behavior.This chapter is about on the hypotheses development on the basis of the questionnaire-based survey in anIndian FMCGs industry have been reported and discussed, before it the awareness among the employees in context of TQM is analyzed and that is also one of the objectives of this research. Knowing the level of awareness about TQM helps in hypothesis setting. Two major objectives of the survey are: (i) to examine the current practices and issues related to total quality management performance in the targeted FMCGs industry, and (ii) to test the validity of some hypothesis, which have been formulated in the next section of this chapter. This is followed by a description of the methodology adopted to achieve the survey-oriented research objectives. Subsequent of this, observations from the survey have been reported and discussed. Some other aspects of the survey questionnaire development, its administration, validity, descriptive statistics, etc. have also been discussed in this chapter.

4.2 Questionnaire development

Two sorts of information/data were utilized in our examination. Primary information, displayed in Table 4.1, was analyzed to characterize the examination targets and foster the exploration model. Further, with top to bottom employee meetings were completed including all the three degree of representatives (Top, middle and low) on TQM objective and it's CSFs to get bits of knowledge identified with the examination instrument and testing plan methodology. Information assortment measure was completed utilizing an organized survey that was grown explicitly for the examination purposes. The exploration things were estimated on five-point Likert-type scale.

Two different sets of questionnaires have been developed. First set of questionnaires is to know the TQM awareness and second set of questionnaires is related to impact of TQM CSFs on its performance.The questionnaire-based survey approach is undertaken in the Indian FMCGs industry (XYZ FMCGs Ltd.). For this the set of questionnaires was designed on the basis of available literature and quality experts. It is normally felt that the response rates of such survey are not enthusiastic and the respondents are generally reluctant to spare time in responding questionnaires. Therefore, the questions were close-ended, so that lesser time and effort would be needed in answering.

4.2.1 Structure and content validation of the questionnaire

The questionnaire was tested for content validity and construct validity both.Content validity mainly depends on an (i) appeal to the propriety of content and (ii) the way it is presented (Nunally, 1978). The instrument developed for pre-testing in this examination shows the substance validity as the choice of estimation things depended on both, a thorough survey of the literature and point by point assessments by academicians and practicing managers. The construct validity was checked by factor analysis. All the items in the question related to TQM and its effectiveness loaded with a minimum factor loading of 0.49. This is in agreement with Kim and Mueller (1978) who suggested the use of only those items, which have a factor loading more than 0.40.

Construct validity It is significant to realize that to conduct study well we need to measure well. Until this point in time, restricted information exists concerning the evaluation of TQM effectiveness in the manufacturing environment particularly in FMCGs industry. In general, because of the subjective character of a questionnaire, it is prone to many threats to validity. Accordingly, albeit better than no means for organized assessment by any stretch of the imagination, it is unfair to state firm ends in regards to TQM execution dependent on a survey. Recollect that evidence got from validation studies is rarely steady; it will indeed vary between settings. Construct validity refers to the degree to which inferences can justifiably be made from the operational point of view in a study to the theoretical constructs on which those operationalizations were based Trochim, W.M. (2006). About it Karras D (1997) stated earlier that By direct or indirect objective criteria, construct validity refers to the idea that novelty really resembles what it aims to replicate. When test results are rational and consistent with the parameters of interest, it is satisfied. Agarwal, N. K. (2012) states that Constructs are higher level concepts which are not directly observable or measurable (nature) while variables (sometimes used interchangeably with indicators or measures) seek to measure the underlying construct (nature exposed to our method of reasoning) and when both convergent and discriminant validities are satisfied, construct validity is said to be satisfied.

Content validity Bums and Grove (2005) stated that content validity is obtained from three sources: literature, representatives of the relevant populations, and experts and considered it as the most important type of validity because it ensures congruence between the research target and data collection tool.The fundamental issue in content validity lies in the procedures that are used to develop the research instrument (Churchill, 2001). The term "validity" implies to an instrument's individual scores being meaningful and allowing the researcher to make valid inferences from the sample population being studied (Crewell, 2005). Content validity was utilized in the flow exploration to quantify how well the questions address the conceivable outcomes of inquiries accessible. Content validity is the degree to which the inquiries on the instrument and the scores from these queries address all potential information that could be posed about the substance or ability (Creswell, 2005).

Table 4.1 summarizes the reliability and validity results for all constructs of the study. For each construct of the variables, the Cronbach's α score, Kaiser–Meyer–Olkin (KMO) values and percentage variance were calculated to gauze the reliability and validity of constructs used in the study. All constructs that accounted for more than 50% of the variance were retained. Thereafter, an inter-item analysis is used to check the construct's scales for internal consistency or reliability. Cronbach's reliability coefficient α values for HRM/recognition/ teamwork, Top management commitment and leadership and Process management are 0.812, 0.865 and 0.767 respectively. Similarly, Cronbach's reliability coefficient α values for each construct of dependent variables (i.e. Customer focus and satisfaction, Supplier partnership, Training and learning, Information/analysis/data, Strategic quality planning, Culture and communication, Bench-marking, Social and environmental responsibility and Innovation) ranged from 0.789 to 0.873. Subsequently, value of α of factors scales surpassed by a comfortable margin regarding 0.70 measures commonly considered as satisfactory for exploratory work, in this way showing a acceptable level of reliability. The validity of these constructs was additionally gauzed by KMO test with values more noteworthy than 0.60 for each case, exhibiting that this load of scales are substantial and solid for analysis.

Table 4.1: Reliability and validity of TQM CSFs

Sr. No.	Drivers and Enablers of CSFs	No. of Items	Cronbach's α	KMO value	% variance
1	HRM/recognition /teamwork	6	0.812	0.769	62.66
2	Top management commitment and leadership	5	0.865	0.832	65.17
3	Process management	5	0.767	0.728	60.5
4	Customer focus and satisfaction	4	0.862	0.84	64.44
5	Supplier partnership	4	0.809	0.779	63.7
6	Training and education	5	0.804	0.83	56.43
7	Information/analysis /data	4	0.868	0.819	63.84
8	Strategic quality planning	4	0.873	0.858	60.58
9	Culture and communication	5	0.789	0.874	56.87
10	Benchmarking	2	0.794	0.715	61.45
11	Social and environmental responsibility	4	0.824	0.702	61.78
12	Innovation	3	0.861	0.841	58.95

4.2.2 Questionnaire administration

Questionnaires, as a form of formative assessment, are more structured, but most of them do not seem to assess all areas in TQM performance. In general, questionnaires are seldom properly evaluated. An Indian FMCGs industry was selected for the administration of the questionnaire. FMCGs industry bear mixed characteristics of industries small and medium enterprises and big industries, which increases its system complexity. As far as the manufacturing processes are concerned companies in this sector mainly use automated manufacturing machines for mass production, which is not always true in the case of other industries. The extreme complexities, large bill of materials and automated manufacturing system dependencies further makes it an ideal case for the study of TQM. The FMCGs industry is highly diversified in nature and it may be assumed as representative industry of the entire manufacturing industries. On the basis of the above observation, it may be said that though the other than respondent company do not constitute separate TQM system. The goal may be differing accordingly the CSFs will vary. Therefore, a study of the perceptions and practices of other FMCGs companies on the TQM performance measurement related issues might provide a fair assessment.

4.2.3 Improvement in survey questionnaire

Before distributing the questionnaire to the employees, a pilot study was carried out. The idea behind conducting the pilot study was to: (i) have a feedback from the employees (Top to bottom) working in the area of quality and quality management (ii) add those pints which may have inadvertently been missed by the researcher (iii) delete any irrelevant question(s) and (iv) refine/ rephrase the language of the existing questions to bring in more clarity in questionnaire. A total of twenty executives in the area of quality management were personally contacted. Accordingly, the questionnaire was modified and a final questionnaire was then distributed for response collection.

4.3 Analysis of TQM awareness and implementation in the case company

Up close and personal meetings were held utilizing a generally unstructured format. It was requested that every respondent depict his/her own view on quality, what role quality plays in his/her firm, and regardless of whether and how workers are engaged with quality program. After these overall inquiries, I urged the employees to speak unreservedly about TQM and authoritative execution. The respondent's underlying answer and my examining for elaboration decided the bearing. we generally endeavored to expound on the likely effect of a respondent's self-portrayed quality related information on workers' thought age and application. In the second piece of the meeting, we uncovered to the respondents that the objective of the meeting was to investigate their thought on quality and its application mindfulness among their workers.

This also helps in development of hypothesis related to TQM effectiveness. The awareness among the employees of XYZ FMCGs Ltd. is gauged for which the questionnaire is designed in English language using Five-point Likert scale with "1" being"strongly disagree" and "5" being "strongly agree". The questionnaire had two sections namely: (i) Demographic Information of firm and employees and (ii) Twelve (12) Factors with their sub-factors of TQM consisting of various items (Appendix A). The level of TQM awareness in firm was determined based on summative score of responses collected. The awareness score for every respondent was determined by taking the mean of all responses for twelve TQM success factors. Further, the overall mean was determined by taking the average of the relative multitude of responses and this grand mean is viewed as the remove an incentive for deciding the awareness level of TQM. Those scoring which are more prominent than grand mean was arranged as aware and, in any case, not aware. For the current examination the grand mean was calculated to be 4.12. According to Jerome (2013); Anand (2013) and Nanjundeswara swamy and Swamy (2015) the grand mean was considered as a cut-off score for the Likert scale.

Based on the responses it is evident from the above Table 4.2 that level of TQM awareness in FMCGs industry under study was 81.25%. This indicates that, there is a high scope for improving quality by effectively practicing and adapting to various critical factors of TQM. The following pie chart brings out the TQM awareness

Table 4.2: Status of TQM awareness in selected FMCGs industry

Level of TQM awareness	No. of Respodents	% of Respodents
Aware	325	81.25
Not Aware	40	10
Rejected Answers	35	8.75

profile of the employees in job (EIJ) in the company. It indicates that about 81.25 percent of the EIJ were aware with the TQM program and related tools as shown in Fig. 4.1

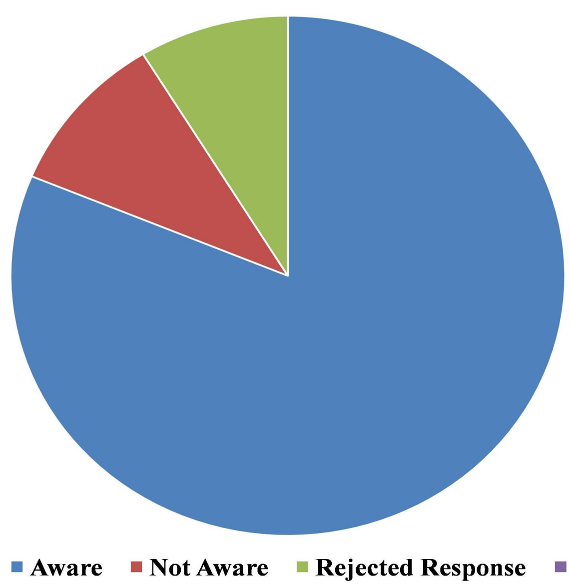

Figure 4.1: TQM Awareness statistics of employees

4.3.1 Relationship between level of TQM awareness and demographic attributes

In any survey-based studies it is important to consider the demography, since the quality practices and approaches are region and culture specific (Aletaiby,2018). Data related to the demographic characteristics of the firm and employees are dissected using chi-square test. The five demographic attributes like gender of employees, instructive capability i.e. educational qualification, nature of work, nature of job and experience are selected to establish the significant contrasts concerning quality management practice (QMP) execution. The Table 4.3 below indicate the relationship between level of TQM awareness and demographic attributes. Based on the chi-square analysis, educational qualification of employees, nature of job and nature of activities are significantly associated (at 5%) while gender and experience had no association with TQM awareness. Since safety is also considered in such working conditions and workers are constantly exposed to mass production environment and automated machines.

It is observed in Indian FMCGs industries that TQM implementer (Top level management) direct to the lower level employees about quality and supervisors (middle level) were ignored. Steven E. Brigham (1993) suggested that middle managers are most often the forgotten link in TQM implementation, having been left out of the planning stages but then being forced to learn an intimidating array of new behaviours; matters are made worse when they receive little or no training for these new skills and abilities, or subsequent reward for their practice. Vouzas(1997) mentioned that despite the fact that middle managers want to be involved in the early phases of TQM, top management does not have confidence in them. Study by Marchington et al. (1993) suggests that middle managers are apprehensive that TQM may lead to a loss of power or an increase in responsibility. Collard (1989), on the other hand, found that middle managers require to improve their communi-

Table 4.3: Relationship between TQM awareness and Demographic attributes

Demographic Characteristics		% of Respodents	TQM awareness		Chi-Sq.	p-value	Sig.
			Aware %	**Not Aware %**			
Gender of employee	Male	47.56	44	17	0.267	0.605	NS
	Female	52.44	26	13			
Employees educational qualification	SSLC	40.32	9	1.24	51.774	0	5%
	ITI	24.56	17	3.22			
	DIPLOMA	20.44	22	1.54			
	GRADUATE	12.68	30	1.33			
	PG	12	14	0.67			
Nature of Job	Technical	57.19	37.79	10.37	51.386	0	5%
	Non-Technical	42.81	32.44	19.4			
Nature of Activities	Planning	9.8	12.18	2.5	56.862	0	5%
	Operations	16.35	16.73	4.27			
	Productions	52.2	37.51	5.36			
	Packaging	14.65	10.25	3.7			
	Maintenance	4	3.04	1.35			
	Safety	3	2.15	0.96			
Experience of Employees	1-5 Years	15.72	10.15	16.43	0.781	0.677	NS
	6-15 Years	77.93	31.8	3.27			
	>15 Years	6.35	37.23	1.12			

cation and presentation abilities, group working skills, and group leadership skills in order to be good leaders in a TQM culture. Furthermore, middle managers' beliefs and attitudes regarding the quality approach to organizational change seemed to be more related to organizational context rather than the type of organization or the role of the middle manager (Collard, 1989; Hill, 1991, 1995; Ishikawa, 1985).

Ishikawa (1985) considers middle managers as "traffic policemen" in quality management and believing that middle managers are at the crossroads: They have to obtain crucial information and acquire the ability to make judgements based on a broad perspective. Thiagarajan and Zairi (1997) praised the role of middle managers and regarded them that they become leaders of empowered employees, facilitators of the new management system, and can also train others about new tools and techniques. Organization must define and identify the robust link between quality processes and the bottom line, then senior management will look into seriously, suggested Garvin (1988). After prior training and education about TQM the awaken employee must adhere the TQM rules and regulation properly to make it successful. The effect of TQM awareness directly reflects on performance of TQM. The employees who are aware of TQM policy and procedures, they are more competent to manage their tasks than those who are not aware. Sewell and Wilkinson (1992) view TQM as a vigilant tool for managers as surveillance and controlling of lower level employees. The results show that when employees are aware of their company's quality policy and principles, they are more competent to manage quality related tasks than those who are not aware of their companies' quality policies. The employees' level of awareness about modern ideas of quality is satisfactory, although further education and training is necessary.

This approach helped in the formulation of hypothesis that further implemented for measure the performance of TQM systems may result in increased productivity, and also showed that too many employees were dissatisfied with the implemented systems. Of course, a certain degree of non-conformity is always necessary; in this case, however, dissatisfaction means employees' aversion to change and lack of involvement. The supposition that quality tools and techniques are rarely used also turned out to be true. In XYZ FMCGs Ltd., quality is treated as an element of promotion and sometimes one can doubt if the implementation of total quality management systems, and then its measurement of performance, is really carried out in order to restructure an organization and adjust it to the quickly changing environment.

Although the fact that awareness and use of TQM techniques and tools are lower in the FMCGs sector, according to many of our interview participants, it is reasonable insofar as the use of most management practices was, and in some cases is still, very limited in FMCGs industry. In contrast, according to participants from the FMCGs industry, many companies have incorporated TQM or similar practices for many years in their operations. However, it seems that during the last years similar practices have entered FMCGs organizations, despite the fact that managers are not so familiar with them.There was a widespread use of various communication techniques in organization under study. This is vital as employees need to be both aware, and reminded, of the importance of TQM to the success of the organization.

4.4 Hypothesis formulation

Twelve set of hypotheses have been formulated and tested. Each set of hypothesis belongs to common TQM success factors in FMCG industry; here the aim is to establish relationship among these issues. The set of hypotheses is concerned with impact of TQM's critical success factors on its performance. According to Sounders et al. (2016) the existing theory is confirmed or refined through hypothesis testing, because of the deductive approach is always theory-driven. The combination of deductive and inductive approaches within the same research is not only perfectly possible, but it is often advantageous (Saunders et al., 2016). Model-based hypothesis testing is not on the same level as reductionistic hypothesis testing. If, for example, the analysis of available data shows a relationship between two or more variables, the hypothesis is not to the same level as the tests done by using models after testing the relationship on several additional cases, it is ready to be used to make predictions. If the predictions are correct, the relationship is again examined to determine how accurate it was in new context. For pragmatic reasons, simple summary scores are often made, but from a methodological perspective, only knowledge of the weighting of the individual aspects permits a wider scientific use of the relationship for a meaningful aggregation of data in the form of an overall index.

4.4.1 Hypothesis related to impact of CSFs on TQM performance

The critically examined factors which were responsible for success to achieve the intended goal is critical success factors of that system. Marais et al. (2017) states that CSFs are those aspects that must be well managed in order to achieve success.CSFs are combinations of activities and processes which are designed to support the achievement of the goals (Brotherton & Shaw, 1996). Furthermore, CSFs are actionable, controllable by management to a variable extent, and potentially measurable (Brotherton & Shaw, 1996). These three-TQM goal, CSFs and per-

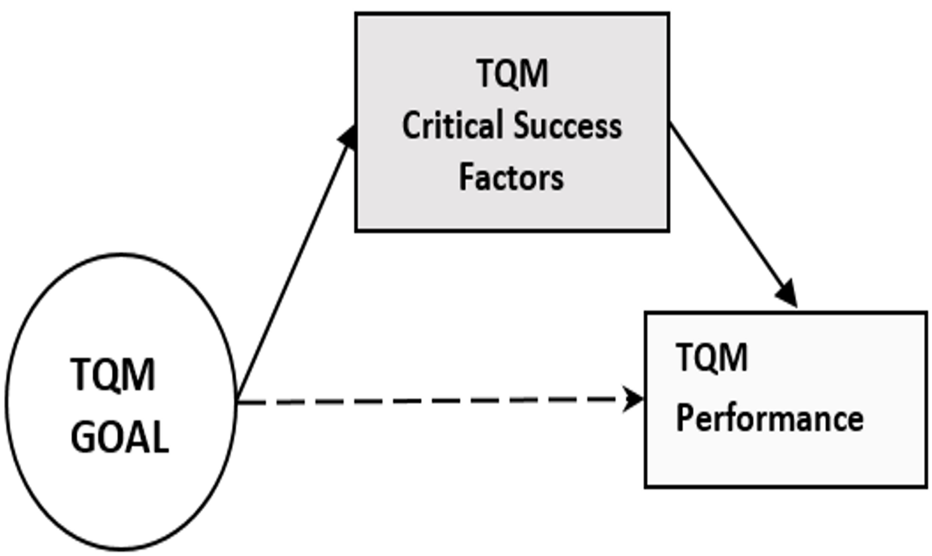

Figure 4.2: Model Depicting Mediating Effect

formance (Fig. 4.2) collectively enable the organization to perform effectively, to enhance productivity and reach across functional boundaries, and to utilize the quality program for effective decision making and performance. They co-exist, covary, and overlap with each other, and collectively define the organization's performance. The interrelation of TQM goal, CSFs and performance, complement and mutually affect one another. The effective TQM enables the organization to perform and realize TQM synergies across functional boundaries so that individual departments are worth more under its governance than they would be under the governance of separate departments.

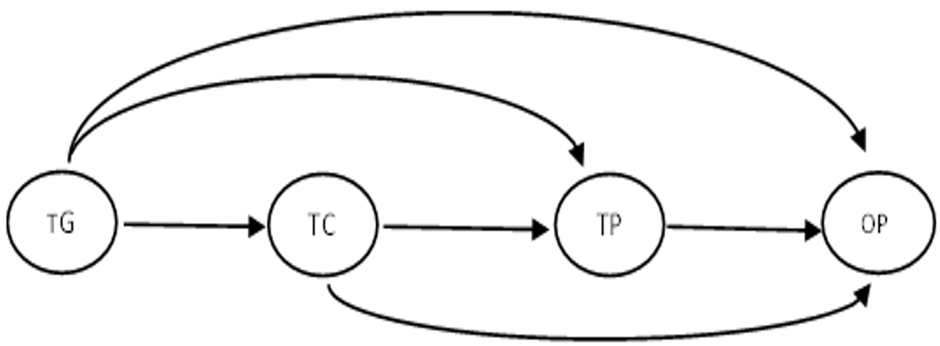

Figure 4.3: Relations between TQM Goal (TG), TQM CSFs (TC), TQM Performance (TP) and Organizational Performance (OP)

Graphically, one might picture the relations as in Fig. 4.3. These three assumptions relation between TC-OP, TP-OP, and TC-TP confounding-essentially amount to controlling for the variables TQM Goal in Fig. 4.3, corresponding with TC-OP variables, TP-OP variables, and TC-TP variables, respectively. In practice, some of the covariates may affect all the TG, TC and TP, and the covariates may also affect each other. None of this is problematic and the covariate groups TGs need not be distinguished from one another. What is important is that the covariates included in the regression models above suffice to control for TC-OP, TP-OP, and TC-TP confounding.

The performance solely depends on critical success factors is challenge able, for this some justification required, which need hypothesis development. For it, the research questions which i tried tends to the answer through this study. Like Will the factors of (i) Human Resource Management (ii) Top management commitment (iii) Process management (iv) Customer focus/ Customer Centricity (v) Supplier partnership/ Supplier's management (vi) Training and education (vii) Quality Information/Information Quality (viii) Strategic quality planning (ix) Culture and communication (x) Benchmarking (xi) Social and environmental responsibility and (xii) Innovation affect the performance of TQM? The study involves formulation of hypotheses related to CSFs of TQM and its performance. Hypotheses are tested using the information and responses gathered from the Indian FMCGs industry. In this section I intend to investigate the relation between TQM CSFs and its performance in the Indian FMCGs industry. The main construct outlines the effects of TQM CSFs in FMCGs industry. The latent variables of all constructs have reflective type of observed variables. The intent is to understand the association of effect of TQM CSFs with subfactors on performance of TQM. The measurements models of the constructs developed were tested for fitness of data for further modelling.

The postulates were developed by the researchers for the estimation in that context which were under consideration for the study. The developed hypothesis needs further testing for whether that fits or unfits for the considered study, then acceptance or rejection of that hypothesis is decided. The testing of hypothesis is fundamental in statistics, and it could be considered as a "method" of making statistical decisions using experimental data. The decision of acceptance or rejection of hypothesis is based on the calculated p-value. p-value is the probability of obtaining a result at least as extreme as the one that was actually observed in the experiment or study, given that the null hypothesis is true. It is a fact that p-values are commonly used for inference in fields of research. Researchers often use p-values to "dichotomize" results into "important" or "unimportant" depending on whether p is less or greater than a significance level, e.g., 5%, respectively. However, there is not much difference between p-values of 0.049 and 0.051, so that the cut off of 0.05 is considered arbitrary. The lower the P value, the lower the error rate. A lower P value thus suggests stronger evidence for rejecting the null hypothesis. In statistical theory, the p-value is a random variable defined over the sample space (i.e. the set of all possible outcomes) of the experiment, such that its distribution under the null hypothesis is uniform on the interval (0, 1). As in present case, to measure the total quality management performance, perceptual data were used in which respondents were asked to evaluate the drivers and enablers effect against the TQM goal to maximize organizational performance. Walsh et al. (2002) theoretically developed a concept that a link exist between the source and driving force of the TQM initiative, because effort for TQM initiated in the quality department and its driven as per need for quality improvement. Dixon et al. (1990) introduce two concepts: (i) the link between strategies, actions and measures; and (ii) the acceptance of changing performance measures. Performance measurement provides the feedback required to control and improve actions, which are themselves taken as a result of decision taken on strategies the organization is to follow, stated Sinclair and Zairi (2000). Odiorne (1987) states that the things for which we can devise indicators can be managed and the things for which we have no indicator can be out of control before realizing it. Performance measures derived from organization strategy with the purpose to implement the strategy, evaluate business performance, provide feedback and ensure communication, help in creating learning environment and continuously improving the organization. Zairi (1994) identifies that performance measurement has been the systematic assignment of number of activities. He further suggested that the function of measurement is to develop a method for generating a class of information that will be useful in a wide variety of problems and situations.

This work renders the reliable data collected from the XYZ FMCGs Ltd., where the developed model is tested. To conduct multiple regression analysis on each independent variable with all of the TQM CSFs, we applied Structural Equation Modeling (SEM) for the connection between e.g. HRM factors (employee involvement, employee empowerment, recognition & reward and teamwork) on TQM performance (unobserved) variables. So, after determining that TQM performance is affected by HRM factors, we use data from the questionnaire survey to interpret the reasons for such connection. Through SEM, we dabbling into canonical correlation among the variables (dependent/independent). Kenneth and Judea (2013) regarded SEM as an inference engine that takes in two inputs, qualitative causal assumptions and empirical data, and derives two logical consequences of these inputs: quantitative causal conclusions and statistical measures of fit for the testable implications of the assumptions. Amos, a structural equation modeling (SEM) software is used to accomplish this part of work. SEM can quickly create models to test hypotheses and confirm relationships among observed and latent variables–moving beyond regression to gain additional insight. This method is preferred by the researcher because it estimates the multiple and interrelated dependence in a single analysis as shown in Fig. 4.4. The symbols in this diagram are the same as defined earlier. The

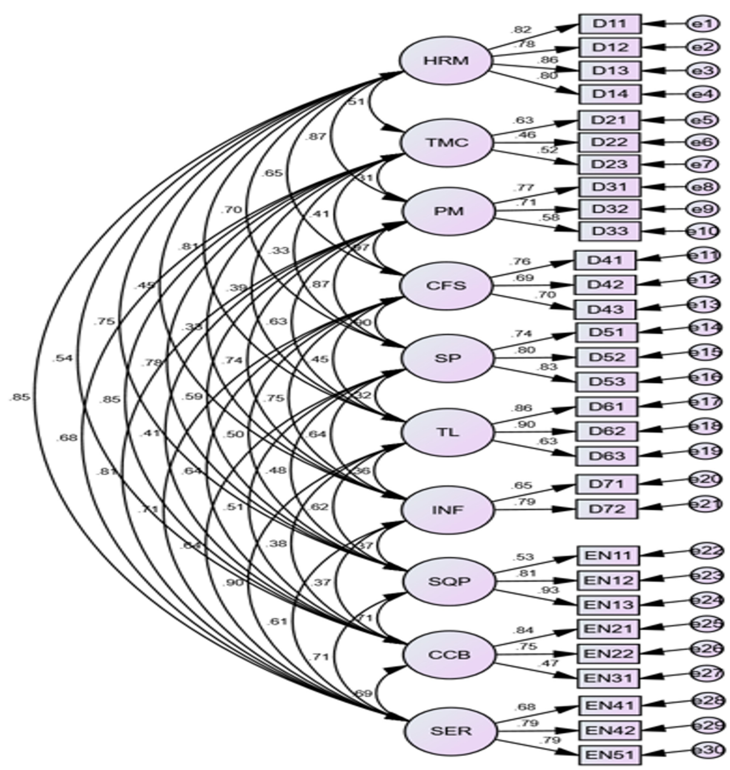

Figure 4.4: Confirmatory Factor Analysis (CFA) model

new representations are the functions which provide a general way to represent the connections between the variables within the parentheses to those on the left-hand side of each node.

Table 4.4: Bivariate correlations between variables

TQM CSFs		D1	D2	D3	D4	D5	D6	D7	E1	E2 & E3	E4 & E5
	D1	–									
	D2	0.51	-								
	D3	0.87	0.31	-							
TQM DRIVERS	D4	0.65	0.41	0.97	-						
	D5	0.70	0.33	0.87	0.90	-					
	D6	0.81	0.39	0.63	0.45	0.32	-				
	D7	0.45	0.33	0.74	0.75	0.64	0.36	-			
	E1	0.75	0.78	0.59	0.50	0.48	0.62	0.37	-		
TQM ENABLERS	E2 & E3	0.54	0.85	0.41	0.64	0.51	0.38	0.37	0.71	-	
	E4 & E5	0.85	0.68	0.81	0.71	0.64	0.90	0.61	0.71	0.69	-

Table 4.5: CFA results of Identified Constructs

	Constructs	Items	Factor Loadings	Composite Reliability (CR)	AVERAGE
1	HRM (D1)	D11	0.82		
		D12	0.78	0.887	0.663
		D13	0.86		
		D14	0.80		
2	TMC (D2)	D21	0.72		
		D22	0.79	0.785	0.549
		D23	0.71		
3	PM (D3)	D31	0.77		
		D32	0.71	0.732	0.507
		D33	0.65		

	Constructs	Items	Factor Loadings	Composite Reliability (CR)	AVERAGE
4	CFS (D4)	D41	0.76		
		D42	0.69	0.760	0.515
		D43	0.70		
5	SP (D5)	D51	0.74		
		D52	0.80	0.833	0.626
		D53	0.83		
6	TL (D6)	D61	0.86		
		D62	0.90	0.871	0.694
		D63	0.73		
7	INF(D7)	D71	0.70		
		D72	0.79	0.715	0.557
8	SQP (E1)	E11	0.69		
		E12	0.81	0.855	0.666
		E13	0.93		
9	CC (E2)	E21	0.84	0.821	0.605
		E22	0.75		
10	BHM (E3)	E31	0.74		
11	SER (E4)	E41	0.88	0.861	0.674
		E42	0.79		
12	INV (E5)	E51	0.79		

Composite reliability that achieved 0.70 or above means the scale has good reliability as tabulated in Table 4.4-4.5. In general, composite reliability is greater than 0.6 and average variance extracted (AVE) is greater than 0.5, indicating that the reliability of this model is good. Composite reliability (sometimes called construct reliability) is a measure of internal consistency in scale items, much like Cronbach's alpha. When the goodness of the model has been confirmed by Table 4.6, the next is to test the hypothesized relationships among the variables (TQM CSFs). Through the running of PLS Algorithm using Smart PLS, the hypothesized model is tested. Therefore, the path coefficients were generated as in the Fig. 4.5.

Table 4.6: Model fit

Goodness of Fit Indices	Results	Recommended Standard Value
CMIN/DF- degree of freedom	2.657	<3
NFI (normed fit index)	0.90	≥ 0.90
NNFI (non-normed fit index)	0.92	≥ 0.90
CFI (comparative fit index)	0.92	≥ 0.90
GFI (goodness fit index)	0.91	≥ 0.90
AGFI (Adjusted goodness of fit index)	0.85	≥ 0.80
RMSEA (root mean square error of approximation)	0.06	<0.10

Table 4.7: Hypotheses results and estimate

				Estimate	p value	Result
H1	TQM	<—	HRM	0.427	***	Fail to reject
H2	TQM	<—	TMC	0.740	***	Fail to reject
H3	TQM	<—	PM	0.571	***	Fail to reject
H4	TQM	<—	CFS	0.314	***	Fail to reject
H5	TQM	<—	SP	0.657	***	Fail to reject
H6	TQM	<—	TL	0.532	***	Fail to reject
H7	TQM	<—	INF	0.475	***	Fail to reject
H8	TQM	<—	SQP	0.560	***	Fail to reject
H9, H10	TQM	<—	CC & BHM	0.454	***	Fail to reject
H11, H12	TQM	<—	SER & INV	0.642	***	Fail to reject

* Significant at 5% level of significance

Note: All pathways represent the influence of a factor independent from other influences in the model.

The p values in hypothesis testing are used to classify the data into two groups being 'significant' or 'insignificant' depending upon whether it 'rejects' or 'fails to reject' the null hypothesis. A level of significance (α level) is set between 0 and 1 as an arbitrary cut off value to determine statistical significance as mentioned in Table 4.7. Analysis of the linkage between the TQM critical success factors and the

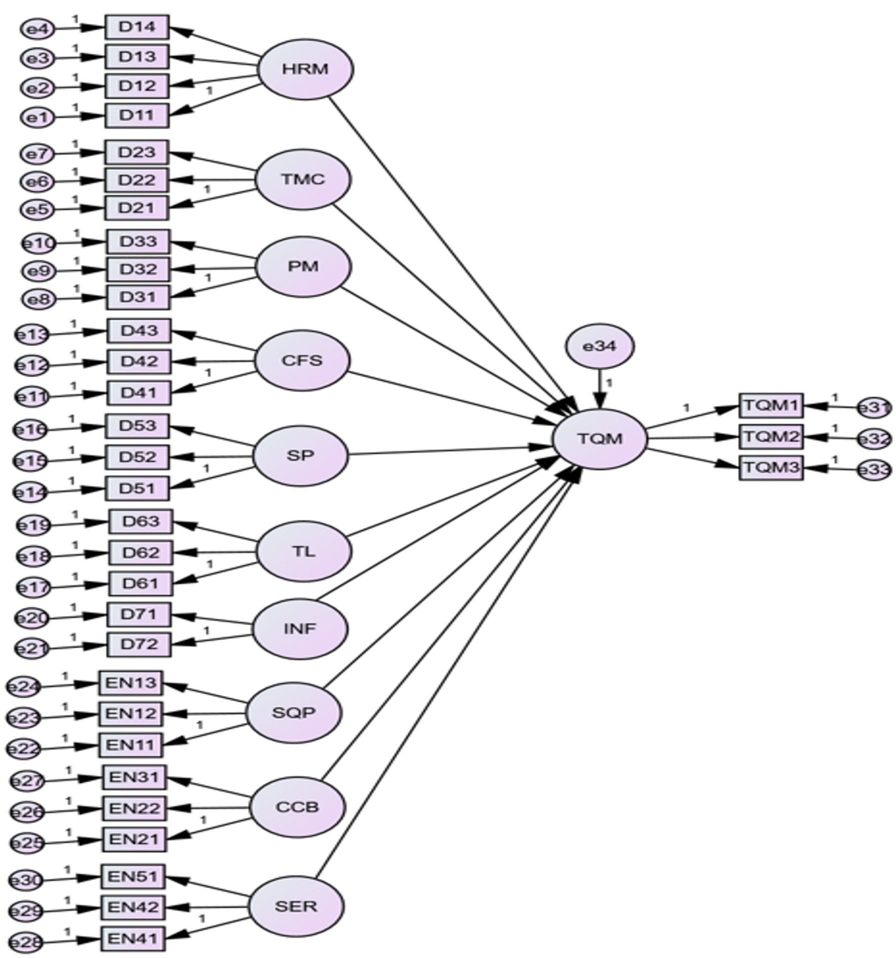

Figure 4.5: Path Diagram of Structural equation with twelve (two variables E2, E3 and E4, E5 are combined) explanatory variables

effectiveness of TQM provides an insight into the prevailing TQM system conditions that could improve/prohibit TQM effectiveness.

4.4.2 Impact of TQM CSFs on organizational performance

Performance is the process of quantifying an action, where, measurement is the process of quantification and action leads to performance. Pfau, 1989 termed TQM as a strategy as-well-as operationalized process and holistic approach through which organizations seek improvement of quality, productivity and competitiveness to integrate the entire functions and objectives of organization in a focus on meeting customer needs (Kumar et al., 2008).

Several TQM researchers have taken previously identified CSFs and adapted them to determine the levels of success or failure for TQM implementations.The performance of the organization mainly the aggregation of its financial, non-financial and operational performance. In a combination of these, the organization gets outcome such as effectiveness, efficiency, development and participant's satisfaction.After using all supports and efforts when the organization produces a product or service that is called the organizational performance. Organizations apply various strategies, stratagems and tactics to perform well, TQM is one of them which organizations use to apply holistically. Skills, expertise, experience, capabilities core competencies, reduce cost and time, improve quality consideration and ability to act are used to improve the organizational efficiency in identifying and utilizing available resources.Thus, OP can be referred to the attainment of actual results by an organization against its intended targets.To reinforce the benefits of TQM it is also advisable by Santos et al. (2007) to facilitate comparison across studies by avoiding differing conceptualizations and TQM-related measures.Demirbag, M. et al. (2006) conducted a study to determine the critical factors of total quality management (TQM) and measure their effect on organizational performance of SMEs operating in the Turkish textile industry.The General Accounting Office (GAO) study was one of the first studies trying to establish a link between TQM practices and the performance of companies, see GAO (1991). In his study, Malcolm Baldrige recipients and companies that had received a site-visit (i.e., companies that in a sense were close to receiving an award) were evaluated. The main conclusion from the GAO study was that the companies investigated had improved their operating results. Relationship between TQM goals and performance is shown in Fig. 4.6. TQM becomes ever growing essential features of organizational strategy for many leading organizations across the world for their sustainable competitiveness in the global market.There are

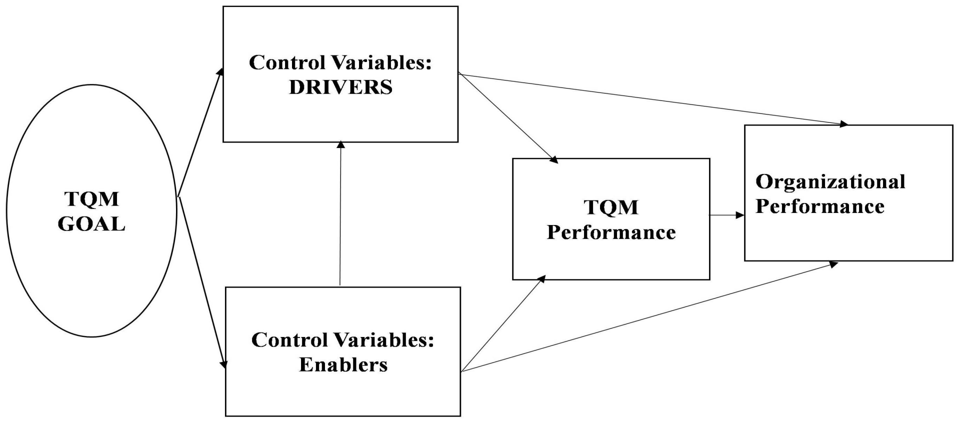

Figure 4.6: Relationship between TQM goals and performance

several studies which have been carried out to determine the linkages or predictive correlations between TQM elements or factors and performance measures, Barros, S. et al. (2014). Performance of a company reflects to what degree the company accomplishes the corporate strategy and goals stated Oztaysi & Kutlu (2011).

Yusuf,Y. et al. (2007) emphasizes that as per TQM philosophy the customer requirements and business goals are inseparable. TQM is an integrated management strategy that uses a collection of strategies to achieve corporate goals. TQM is most effective when it is a central, planned component of an organization's forward drive, one that necessitates top-level leadership, is based on a strong commitment to customers, and stresses significant improvements in "core" processes endorsed by Steven E. Brigham (1993) of reports survey by A. T. Kearney,TQM: A Business Process Perspective. Non any study is found in which the researcher proposed the impact of TQM CSFs on organizational performance. G. Muruganantham et al. (2018) mentioned that TQM provides a set of guidelines, which help to improve the performance of organization. Although in the way of measuring the MBNQA performance Wilson & Collier (2000) states that manufacturing system influence their performance variables through its mediating variables but quality model, as he considered MBNQA model, directly influences company performance.

Always the performance of TQM (positive or negative) as-well-as other strategies make effect on organizational performance. Individuals, team, department, and process goals may all be aligned with the organization's strategic goals through performance assessment, and stakeholders' voices can be included in all planning and management activities (Oakland, 2003). The formulation of operational strategies that are aligned with the firm's competitive strategy can aid to enhance and personalize the product offering for consumers as well as the internal efficiency and effectiveness of manufacturing facilities, (Robson et al., 2013). Therefore, an operational strategy is a subset of a firm's competitive strategy, Sahoo, (2020). Matching the dots, it can anticipate that the TQM drivers and enablers (CSFs) will positively affect the overall performance of the organization through positively affecting TQM performance. The TQM CSFs will enable the organization to perform better for its targeted goal. Human resource management practices for the selection of right person for the right work and creating the mindset of teamwork may lead to employee empowerment irrespective of recognition and reward, hence increasing productivity and, consequently performance. TQM empowers employees by delegating functions. In addition, learning, knowledge and education & training should positively affect way of doing work by following quality principles and standards, hence positively affecting performance of TQM. Critical success factor (CSF) theory was originally applied in other industries and areas, including general project management, manufacturing systems, and re-engineering (Holland & Light, 2003).

Hypothesis: TQM Performance positively mediates the relationship between TQM CSFs and Organizational Performance.

Human resource management(D_1)

Many studies have identified human resources management as one of the critical factors of total quality management (TQM). Even in 'quality gurus' theories, human resources have a great importance: training, employees' empowerment and quality culture development are the basic organizational requirements to implement a TQM system and on this the performance of TQM relies. The success of firm depends on human resources management Alessandro Ruggieri and Roberto Merli (1997). The survey report published in Gallup Management Journal (2002) (www.gmj.gallup.com) on "employee engagement" states that "more than half of the employees may not be engaged with their work" and for this various causes are mentioned. Human resource management practices used to reinforce employees' commitment and dedication towards work for improving the quality of products and services states Joiner T. (2007). Employee involvement, automatically empowers the people to make decisions, choices, new contributions and take risks. This coherence improve employee motivation and attitudes towards effective implementation of TQM. White and Nebeker (1996) point out that: A team-based perspective that focus on process improvement and personal development could improve effectiveness of performance appraisal as well as TQM objectives. Soltani, E. el al. (2005) survey indicates that their performance management systems in relation to having a positive impact on employee motivation towards successful implementation of quality programs. The reward system reflect the quality and customer satisfaction mission, stated Fundacao G. V. et al. (2000).

Human resource management related practices are emphasized and included in most TQM frameworks (Hoang et al. 2006, Perdomo-Ortiz et al. 2009, Vanichchinchai and Igel 2009) such as MBNQA (NIST 2007), EFQM excellence model (EFQM 2010), Khan (2003), Pun (2002). Jime nez-Jime nez and Martı nez-Costa (2009) also found a positive relationship between TQM and human resource management practices of empowerment, teamwork, staffing, training, appraisal and compensation. In fact, how well these human resources are managed is probably the most critical factor in an organization's overall performance.

According to studies including Flynn et al. (1995), Kaynak (2003), and Ravichandran and Rai (2000)-employee involvement in quality efforts plays a key role in dealing with quality data, designing products, and managing processes. Employee empowerment and involvement are recommended by Walsh et al. (2002) as an essential component of TQM programme. Very early, Zink (1995) predicted that employee empowerment is an important area of assessment of major quality awards around the world. TQM is perceived as too abstract (the most serious problems concern the field of human resource management). Because, the cause of this lack of interest in quality issues is something that can be called "a lack of quality awareness". Yusuf, Y. et al. (2007) Recognition and reward are both effective motivators and stimulators for desired performance and employee satisfaction. They are the key forms of positive reinforcement and for letting people know they are valuable members of the organization.

HRM can reinforce human relationships and group consciousness, raise employee competence, and achieve culture change; therefore, it acts as the catalyst for the implementation of TQM (Palo and Padhi, 2005; Oakland and Oakland, 1998; Wilkinson, 1992; Lammermeyr, 1991).

HRM and TQM combinedly enhanced the performance of organisation, analysed by Yang, C. (2006), and found that HRM practices has positive effects on TQM performance. Whereas, "employee relations", has little influence on TQM practices thus discarded. Rather than "employee relations" the "job rotation" and "employee security and health" have more influence on TQM performance. But, in FMCGs industry there require consistent technical skills due to highly automated manufacturing system, so the practice of "job rotation" has weaker effect on TQM practice. Further Yang, C. (2006) recommends "training and education" with respect to the effect of HRM on TQM. TQM training builds human capital and provides employees with a foundation that prepares them to participate in a more decentralized organization (Wruck et al., 1998).

H: *Performance of TQM is positively related with Human Resource Management factors (a) employee involvement (b) empowerment (c) recognition and reward (d)* *teamwork*

Top management commitment(D_2)

Top level management is the one, which is responsible for a firm's strategy, can also be judged how performance is scaled for improvement. The majority of respondents reported "the lack of complete top management commitment from the start, and through the process" to be the obvious barrier to TQM success. The achievement of organizational goals is based on top management teams' ability to anticipate and respond to external change (Burgelman, 1991; Child, 1972). W. C. Auden et al. (2006) emphasized as summary of the work that the top management team seems to have a strong influence on the firm's performance. In the Malcolm Baldrige framework leadership is the driver of quality systems (Wilson and Collier, 2000). Leaders in a TQM system view the firmas a system; support employee development; establish a multi point communication among the employees, managers,and customers; and use information efficiently and effectively. In addition, leaders encourage employee participation indecision-making and empower the employees. Bowles & Hammond (1991) believe that leadership cannot exist in the absence of teamwork. Both must move ahead with strong collaboration for the successful result, this also develop good sentimental health towards work in synchronize manner. Effective leaders recognize that the support they provide is vital to the success of the initiative and is committed to implementing change within the span of their influence. They play a variety of roles from being the communicator to an instructor to liaison to advocate etc.

Top management commitment and participation in TQM practices are the most important factors for the success of TQM practices. Managers should demonstrate more leadership than traditional management behaviors to increase employee's awareness of quality activities in TQM adoption and practices, Criado, F. (2009) and Goetsch, D. L. (2010).

H: *Performance of TQM is positively related with Top management commitment factors (a) Top management support (b) Executive commitment (c) Leadership*

Process management(D_3)

TQM vastly belief on shift from managing people to managing processes. In general, in FMCGs industry work tasks are re-organized into well-defined process flows, data are used to measure the performance of the process; performance criteria and continuous improvement goals are set and achieved. Typical measured key performance indicators include cost, schedule, thruput, and quality. A process-oriented organization is more suitable for a TQM strategy than a function-oriented organization. TQM methods for improvements, such as QFD, process management, policy deployment and bench-marking, can help organizations to adapt to a process orientation, Leif Kenner falk (1995). To get more and increasingly satisfied internal and external customers, it is important that the processes are maintained and improved to satisfy and preferably to exceed the expectations of the customers. According to Harrington (1991), the objectives of process management are to make processes more effective, more efficient and more adaptable. Walsh, A. (2002) states that the concept of continuous improvement is a critical success factor of any organization and should be used as foundation stone upon which every successful TQM initiative should be built.

H: *Performance of TQM is positively related with Process management factors (a) Tools and techniques (b) Continuous improvement (c) Process design*

Customer focus/Customer centricity (D_4)

It is obvious that all TQM practices significantly influence customer satisfaction. Customers are the focal point of all quality improvement effects; customer satisfaction and meeting customer requirement are key elements of quality management, Benson et al. (1991). Customer Focus involves researching what customers or end users want from products or services. Prajogo and Cooper (2010) argue that quality customer service is one of the most important aspects of TQM because in any customer-oriented business the customers are the organisation's main stakeholders. Nair (2006) highlighted the importance of customer focus by demonstrating evidence of a strong relationship between customer focus and firm performance. Moreover, customer focus receives attention as a CSF, because every effort of TQM is a customer orientated. FMCGs industries driven by external customers. By the aid of successful customer focus efforts, production can be arranged with respect to the customers' needs, expectations, and complaints.TQM encourages firms to produce high quality and reliable products on time with increased efficiency and productivity. When customer expectations are met, their satisfaction will be increased, and the firm's sales and the market share will increase.

H: *Performance of TQM is positively related with Customer focus/Customer centricity factors (a) Customer and market focus (b) Customer satisfaction (c) Customer relationship*

Supplier partnership/Supplier's management (D_5)

supplier's management acts as an interface between TQM and Supply Chain Management (SCM). Managing the flow of goods between the manufacturer and customers is a fundamental part of organizations. To accomplish this the well-trained employees, ensure consistent, reliable and secure supply. Material traceability is always also maintained through robust quality management systems. Vanichchinchai, A. and Igel, B. (2011) investigated the relationships among TQM practices, SCM practices and firm's supply performance in the automotive industry and found that the set of these three measures are reliable and valid. Fish, Lynn A. (2011) advocates that TQM programs between suppliers and buyers should focus on prevention of defects, and product and process variance reduction through programs such as supplier certification programs. Monitoring should shift from product monitoring to process monitoring for consistency and reducing variation.

Gunasekaran and McGaughey (2003) earlier also suggested that TQM could play a key role in improving SCM. In a survey based research by Baird et al. (2011), conducted on 145 (largely ISO 9000 certified) Australian manufacturing and service business organizations, reveals that supplier quality management have significant effects on operational performance in terms of inventory management. Sweis and Saleh (2017) also shown their agreement with finding that establishing long-term relationship with suppliers and actively engaging them in quality improvement efforts can facilitate the systemic exchange of information between supplier and manufacturers that influence the operational performance of organizations in terms of quality and inventory management measures. Kanter,R.M. (1985), refers to supplier relationships as the "fifth constituency"-bringing in suppliers as the final link into the chain of constituencies the firm has to consider in its strategic development. The most prominent developments towards partnerships have occurred at the stage of product design and development. This is often termed "co-makership". Companies which are adopting a co-makership approach to suppliers, according to Bevan, J. (1989) have done so for a combination of reasons: first, serious threats from the competition or a decline in markets have forced change; second, new initiatives such as quality improvement programs and just-in-time have created the need for communicative problem-sharing relationships; and third, the need or desire to be in a position to take pre-emptive action rather than simply react with firefighting methods. The second reason points to the increasing importance placed by many firms on the "quality management" aspects of a relationship and of moving beyond traditional approaches. This view is supported by Harrison, A. (1990), who states that "... as relationships evolve from 'supplier' to 'co-maker' the role and definition of 'quality' will change".

H: *Performance of TQM is positively related with Supplier partnership and Sup-*

plier's management factors (a) Cooperation with suppliers (b) Supplier quality management (c) Supplier relationship

Training and education (D_6)

Mital et al. (1999) recommend that there is a dire need to train workers in manufacturing organizations and thereby improve the overall effectiveness and efficiency of such organizations. Further also mentioned that in order to compete successfully in the global market, manufacturing organizations must aim at training workers in skills necessary to produce quality goods. Strong correlation between quality performance and employee training is established in a study by Solis et al. (2000). Fundacao Getulio Vargas and Sao Paulo, (2000) stated that training creates a favorable climate for work motivation because employees see it as valuable to them personally. It also serves to demonstrate the company's commitment to continuous improvement. Employees' effective knowledge and learning capability will provide sustainability of quality management in the firm. Furthermore, learning organizations adapt rapidly to the changes and develop unique behavior, which distinguishes them from other firms and enables them to obtain better results. Kaynak, H. (2003) ; Phan A.C.(2011) studies report that training is positively related to operational performance.
H: *Performance of TQM is positively related with Training and education factors (a) Learning (b) Knowledge and (c) Education & training.*

Quality information/information quality (D_7)

To have an effective TQM implementation, organization must ensure that data are valid and reliable. They measure what they are supposed to consistently, and employees should have access to the data that are needed to carry out the tasks, Seetharaman, A. et al. (2006). Lakhal et al. (2006) establish through study and confirm the relevance of data-based factual decision-making by pointing out that information and analysis have a significant direct effect on various performance measures. Information and analysis and plant performance are correlated positively, years back shown by Choi and Eboch (1998) in their study.

H: *Performance of TQM is positively related with Quality Information/Information Quality factors (a) Quality data and reporting (b) Internal quality information usage.*

Strategic quality planning (E_1)

Instilling the principles of total quality management (TQM) into organizations is called the Strategic Quality Plan. It is the vehicle for the transformation. It is the "foundation on which the rest of strategic planning is built" (Whyte and Blair 1995, 293) and is the basis for all other organization planning, including quality planning. Strategic quality planning includes vision, mission, and values of the firms. They are formed by taking into account the quality concept. With effective strategic quality planning efforts employees are taken as an input in developing the vision, mission, strategies,and objectives. Strategic planning involves formulating organizational objectives and implementing strategies to achieve them. It necessitates both internal and external environmental assessment.

Strategic Quality Planning is derivative. Its purpose is to link quality initiatives to strategic planning generally and specifically to improve the quality of health services organization outcomes, Rakich, J. S. (2000). Ittner, C. D. et al. (1997) and Phan, A.C. et al. (2011) studies have found that strategic quality planning is positively associated with operational performance,inventory management performance.

H:*Performance of TQM is positively related with Strategic quality planning factors (a) Quality policy (b) Quality planning (c) Vision & plan statement*

Culture and communication (E_2)

As a concept, 'Quality' implies that an organization understands what customers require of a product or service, and is able not only to meet this requirement but can also exceed the expectations of the customer. This demands a particular culture that can in fact, be seen to be embedded in TQM philosophy, which embraces the idea of encouraging an organization to strive for continuous improvement in its values and methods of operation in order to achieve customer satisfaction.Competent organizational culture can be defined as, a set of congruent behaviors, attitudes, and policies that come together in a system, agency, or among professionals that enable them to work effectively in cross cultural situations, (Saldana, 2001). Culture is important to improve the communication among top-to –bottom, bottom-to-top and across the departments, in which the information is shared by each staff suggested Antony, J. et al. (2002). HRM and TQM combinedly enhanced the performance of organisation, analysed by Yang, C. (2006), and found that HRM practices has positive effects on TQM performance. Whereas, "employee relations", has little influence on TQM practices thus discarded. Further Yang, C. (2006) recommends "training and education" with respect to the effect of HRM on TQM. TQM training builds human capital and provides employees with a foundation that prepares them to participate in a more decentralized organization (Wruck et al., 1998).
H: *Performance of TQM is positively related with Culture and communication factors (a) Trust (b) Cultural change*

Bench-marking (E_3)

Bench-marking has been regarded as one of the practices associated with quality management (Drew, 1997; Rao et al., 1999). Bench-marking aims to measure organization's operations or processes against the best-in-class performers from inside or outside its industry. The usefulness of bench-marking for improving the performance of the organization and to achieve competitive advantage help in continuous service improvements and establishment of customer satisfaction. Bench-marking can significantly affect the improvement of key business processes and consequently, increase the quality level, Hietschold, N. et al. (2014). Without bench-marking, organisations do not know their relative performance and they probably fail to design processes more effectively (Rao, S. et al. 1999).Bench-marking is, according to Bergman and KlefsjoÈ (1994), a way of finding opportunities for process improvements. According to Main (1992) bench-marking is ”the art of finding out, in a perfectly legal and aboveboard way, how others do something better than you do so you can imitate and perhaps improve upon their techniques”. Bench-marking encourages the company to apply TQM so as to improve its product and service quality states Kristianto, Y. et al. (2012).

The bench-marking of performance between the case under review and other FMCGs manufacturing companies shows that serious work must be done to improve its production process and cleaning standards. In most of these areas, the company lags behind its competitors. This means that a better system must be implemented and also more professional employees should be recruited to bring the company's products to the bench-marked level.Bench-marking aims to measure organization's operations or processes against the best-in-class performers from inside or outside its industry. The usefulness of bench-marking for improving the performance of the organization and to achieve competitive advantage help in continuous service improvements and establishment of customer satisfaction. Bench-marking can significantly affect the improvement of key business processes and consequently, increase the quality level, Hietschold, N. et al. (2014). Without bench-marking, organisations do not know their relative performance and they probably fail to design processes more effectively (Rao, S. et al. 1999).

H:*Performance of TQM is positively related with Bench-marking (a) Competitors*

Social and environmental responsibility (E_4)

Mellat-Parast, M. 2013 states that the level of involvement and engagement of the firm with its community and environment or the quality of the relationship between the firm and its environment – which is defined as corporate social responsibility or quality citizenship. Quality citizenship tackles the practice of company responsibility and its social role in society such as improvement of education, safety, and health care in the community (Florida 1996, Punter and Gangneux 1998, Castka and Balzarova 2008b). Mellat-Parast and Adams (2012) examined by utilising a theory of quality management that the impact of several practices associated with quality management on the development and formation of corporate social responsibility, and also examined the impact of corporate social responsibility on operational and organisational performance. Their findings suggest that top management support for quality is the main driver for implementation of corporate social responsibility. Furthermore, within a quality management framework, corporate social responsibility has a significant impact on employee involvement (Mellat-Parast 2013). These empirical findings suggest that quality management could provide a useful theoretical framework to determine the impact of corporate social responsibility on quality practices. Mellat-Parast 2013, finds in his study that top-management support and corporate social responsibility practices would have a positive effect on employee involvement, the analysis suggests that corporate social responsibility would be a much stronger driver of employee involvement. Organisations that implement quality management practices are more likely to address public good and environmental issues (King and Lenox 2001, Bernes et al. 2007). Madu and Kuei (1995) who introduced strategic total quality management (STQM) as a reflection of the overall performance of a firm. This is a strategic and holistic view of quality by defining the focus of a firm on its stakeholders rather than customers and defining quality to include environmental quality and social responsibility issues.The organizations which implement TQM they give consideration to quality citizenship, and actively promote, social responsibility and ecological sustainability both. Through open and inclusive stake holder engagement, organizations meet and exceed the expectations and regulations of the wider community.

As well as managing risk, they seek out and promote opportunities to work on mutually beneficial projects with society, inspiring and maintaining high levels of confidence with stakeholders suggested Khanna, et al. (2011).

H: *Performance of TQM is positively related with Social and environmental responsibility factors (a) Wider community (b) Quality citizenship*

Innovation (E_5)

An understanding of the needs and wants of the customer, the competitive environment, and the nature of the market are important for new product success. The chief variables that propel customer needs are cost, time, and quality. A company faces many uncertainties and challenges in a new project launch.TQM practices enhance competitive performance by improving the quality of products and processes. The continuous improvement leads to dynamic outcomes of innovation, namely product innovation – changes in the specific products/services offered to the customers and process innovation – and changes in the mode by which the products are created or delivered. Innovation refers to an outcome perceived as new, regardless of whether it is an idea, object or process, as well as to the process of creating this newness (Slappendel, 1996).In determining performance of quality and innovation Prajogo & Sohal (2006) presented an analysis by integration of TQM practices and technology and research and development (R&D) management.Szakonyi, R. (1992) suggests that the R&D function must integrate its activities with company efforts to improve quality by adapting key principles about quality improvement to their operations.Reviewing the empirical studies Prajogo & Sohal (2006) concludes that TQM is an effective resource that can be employed to pursue other types of competitive performance than quality, including innovation. Innovation has been recognized as one of the major sources of competitive advantage, Narver and Slater (1990).

H: *Performance of TQM is positively related with Innovation factor (a) Product innovation*

4.5 Conclusion

In the way to collect the primary data, questionnaire-based survey was undertaken to address firstly the TQM awareness among the XYZ FMCGs Ltd. then few issues related to TQM performance and the impact of TQM CSFs on its performance is postulated. The questionnaire was tested for its content and construct validation. Before distribution the questionnaire to the employees of XYZ FMCGs Ltd., a pilot study was carried out. In context of Indian FMCGs Industry, there have been many attempts to measure the performance at organizational level, but very few attempts have been made to measure the performance of system of systems. This survey tries to identify this gap. The survey presented in this research empirically examines the TQM performance measurement system practices in Indian FMCGs industry. Results from the study indicates that performance measurement plays pivotal role in TQM. Long term strategies should be developed to boost the effective performance measurement across the TQM, so that all the quality partners can effectively and efficiently manage the quality activities.

Chapter 5

Descriptive Statistics Hypothesis Testing & Validation

5.1 Introduction

In the previous chapter, hypothesizes related to the TQM performance are presented. These hypothesizes are developed on the basis of response of respondents for given questionnaire. From the detailed literature review of the works carried outby the previous researchers, it has been inferred that testing and validation of developed hypothesizes is essential. Moreover, it has been also observed that rejection of null hypothesis is the utmost priority. For this purpose, Anderson-Darling normality test have been employed. In this chapter, a detailed statistical analysis for the developed hypothesizes for their testing and validation is provided.

5.2 Approaches for hypothesis testing & validation

In this chapter, two different approaches are used to test & validate the developed hypothesizes i.e. Anderson-Darling normality test and t-test. The Anderson-Darling test is an empirical distribution function omnibus test for the composite hypothesis of normality. Compared to Lilliefors test, Anderson-Darling test gives more weight to the tails of the distribution. It is generally considered to be one of the most powerful tests of normality, even on quite small samples.

Whereas, t-test is a type of inferential statistic used to determine if there is a significant difference between the means of two groups, which may be related in certain features. It is mostly used when the data sets, like the data set recorded as the outcome from flipping a coin 100 times, would follow a normal distribution and may have unknown variances. A t-test is used as a hypothesis testing tool, which allows testing of an assumption applicable to a population.

5.2.1 Anderson-Darling normality test

The Anderson-Darling test (Stephens, 1974) is used to test if a sample of data came from a population with a specific distribution. It is a modification of the Kolmogorov-Smirnov (K-S) test and gives more weight to the tails than does the K-S test. The K-S test is distribution free in the sense that the critical values do not depend on the specific distribution being tested (note that this is true only for a fully specified distribution, i.e. the parameters are known). The Anderson-Darling test makes use of the specific distribution in calculating critical values. This has the advantage of allowing a more sensitive test and the disadvantage that critical values must be calculated for each distribution. Currently, tables of critical values are available for the normal, uniform, lognormal, exponential, Weibull, extreme value type I, generalized Pareto, and logistic distributions. The Anderson-Darling test is an alternative to the chi-square and Kolmogorov-Smirnov goodness-of-fit tests. The procedure to follow for the test is as follows:

- Arrange the data in rank order.
- Estimate the mean and standard deviation of the data (Y).
- Standardize each of the values of Y by subtracting the mean and dividing by the standard deviation to give z-values.
- Calculate the test statistic A, where A2 is given by:

$$AD = -n - \frac{1}{n}\sum_{i=1}^{n}(2i-1)[lnF(X_i) + ln(1 - F(X_{n-i+1}))]$$

Where,

- A is the (uncorrected) Anderson-Darling statistic,
- n is the number of observations,
- sum from i=1 to n,
- i is the rank of each value, assuming no ties.
- F is the specified normal cumulative distribution function. If values have been standardized, it is the standard normal. For example, for a standardized value of Y of 1.4, F(1.5) = 0.0808.
- Adjust for estimating parameters from sample data:

  $$A^2c = A^2(1 + \frac{0.75}{n} + \frac{2.25}{n^2})$$

- if A^2c is greater than 0.752, then the null hypothesis that the data conform to a normal distribution is rejected at the 5% level.

Data can be tested against other theoretical distributions by using the appropriate cumulative distribution function. Critical values and software applications are available for the normal, lognormal, exponential, Weibull and logistic distributions.

The primary advantage of the Anderson–Darling test is its applicability to test the departure of the experimental data from different theoretical distributions, which is the reason why we decided to identify the method able to calculate its associated p-value as a function also of the sample size. The sample size influences the p-value of statistics, so its reporting is mandatory to assure a proper interpretation of the statistical results. Our study aimed to identify, assess, and implement an explicit function of the p-value associated with the Anderson–Darling statistic able to take into consideration both the value of the statistic and the sample size.

5.2.2 t-Test

A t-test is a statistical test that is used to compare the means of two groups. It is often used in hypothesis testing to determine whether a process or treatment actually has an effect on the population of interest, or whether two groups are different from one another.The null hypothesis (H_0) is that the true difference between these group means is zero. The alternate hypothesis (H_a) is that the true difference is different from zero. A t-test can only be used when comparing the means of two groups (a.k.a. pairwise comparison). The t-test is a parametric test of difference, meaning that it makes the same assumptions about input data as other parametric tests. The t-test assumes that data is independent and normally distributed. It have a similar amount of variance within each group being compared (a.k.a. homogeneity of variance).

5.3 Hypothesis testing & validation

The test of hypothesis begins with considering two hypotheses. They are called the null hypothesis and the alternative hypothesis. These hypotheses contain opposing viewpoints.

(H_0)***: The null hypothesis: It is a statement about the population that either is believed to be true or is used to put forth an argument unless it can be shown to be incorrect beyond a reasonable doubt.***

(H_a)***: The alternative hypothesis: It is a claim about the population that is contradictory to H0 and what we conclude when we reject*** (H_0)***.***

Since the null and alternative hypotheses are contradictory, we must examine evidence to decide if you have enough evidence to reject the null hypothesis or not. The evidence is in the form of sample data. After determined which hypothesis the sample supports, we make a decision. There are two options for a decision. They are "reject H_0" if the sample information favors the alternative hypothesis or "do not reject H_0" or "decline to reject H_0" if the sample information is insufficient to reject the null hypothesis.

In this work, first we developed null and alternate hypothesises of the statement. Thereafter we try to reject null hypothesis on the basis of p-value. If the calculated p-value is greater than 0.05 then we assume that null hypothesis is true. If the p-value is equal to and less than 0.05, we consider that null hypothesis is rejected and alternative hypothesis is accepted. All the p-values are calculated at 95 % confidence interval.Skewness and kurtosis are parameters that describe the form of the distribution. Skewness measures deviations from symmetry. A positively skewed distribution is asymmetric with an extended right tail while a negative skewed curve is asymmetric with an extended left tail. Kurtosis refers to 'steepness' of a curve. The results for validation of all 12 hypothesis statements are mentioned in next sections.

5.3.1 Hypothesis-I

Statement: Performance of TQM is positively related with Human Resource Management (D_1) factors (a) employee involvement (D_{11}) (b) empowerment (D_{12}) (c) recognition and reward (D_{13})and (d) teamwork (D_{14})
(H_0)*: TQM is not positively related with Human Resource Management factors (a) employee involvement (b) empowerment (c) recognition and reward (d) teamwork*
(H_a)*: TQM is positively related with Human Resource Management factors (a) employee involvement (b) empowerment (c) recognition and reward (d) teamwork*

After developing null and alternative hypothesizes, Anderson-darling normality test has been carried out. The results of that test are shown in Fig. 5.1, 5.2, 5.3 and 5.4. The results confirmed that the p-value for all four factors is less than 0.05 and rejected the null hypothesis. Figure 5.5, 5.6, 5.7 and 5.8 shows the residual plots for all four factors.All tests were performed at 95% confidence intervals. Table 5.1, 5.2 & 5.3 contains the results of descriptive statistical analysis, correlation matrix and co-variance matrix for HRM factors. Table 5.4 contains the Test and CI for one proportion: D11, D12, D13, D14 for HRM factors.

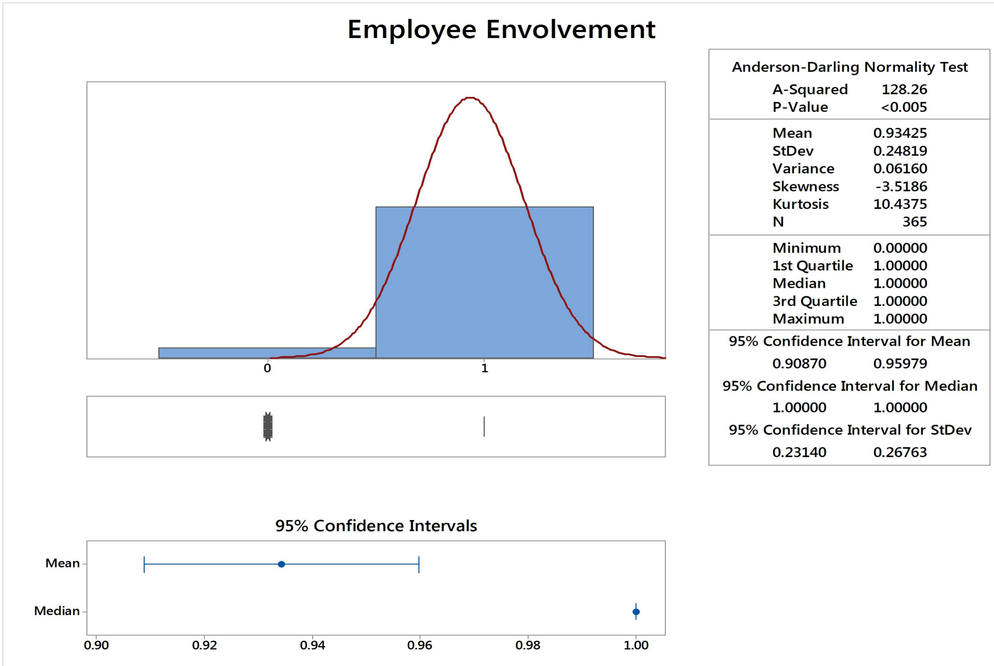

Figure 5.1: Anderson-Darling normality test graph for employee involvement

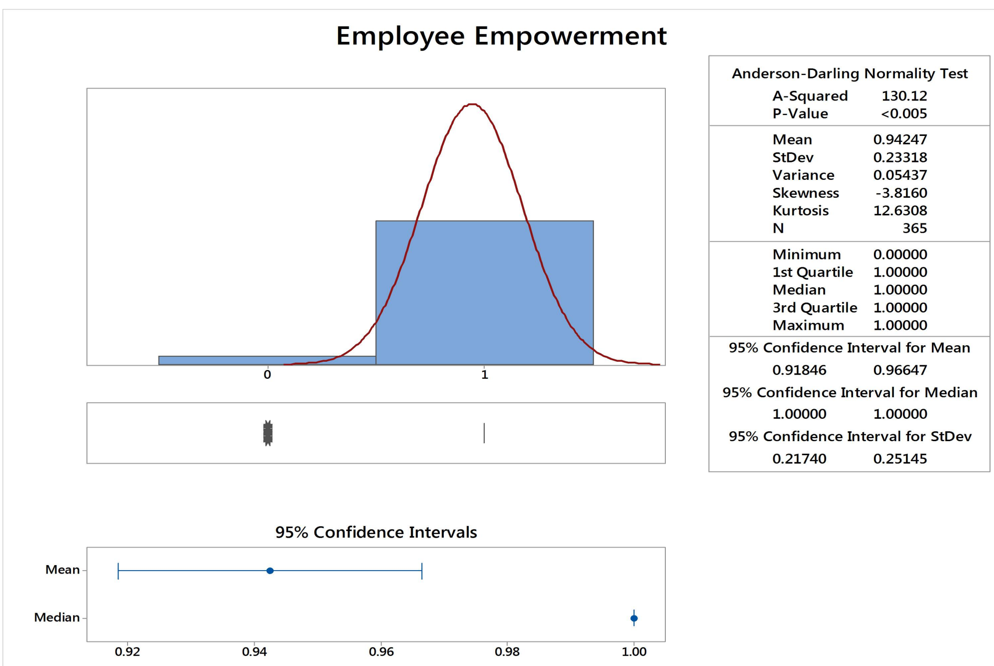

Figure 5.2: Anderson-Darling normality test graph for employee empowerment

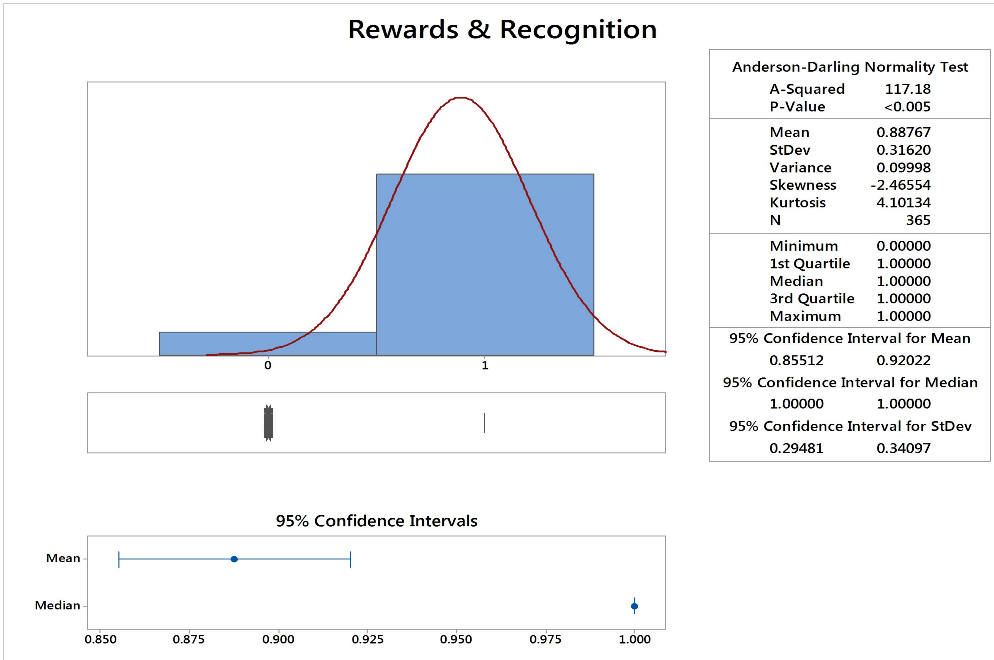

Figure 5.3: Anderson-Darling normality test graph for rewards & recognition

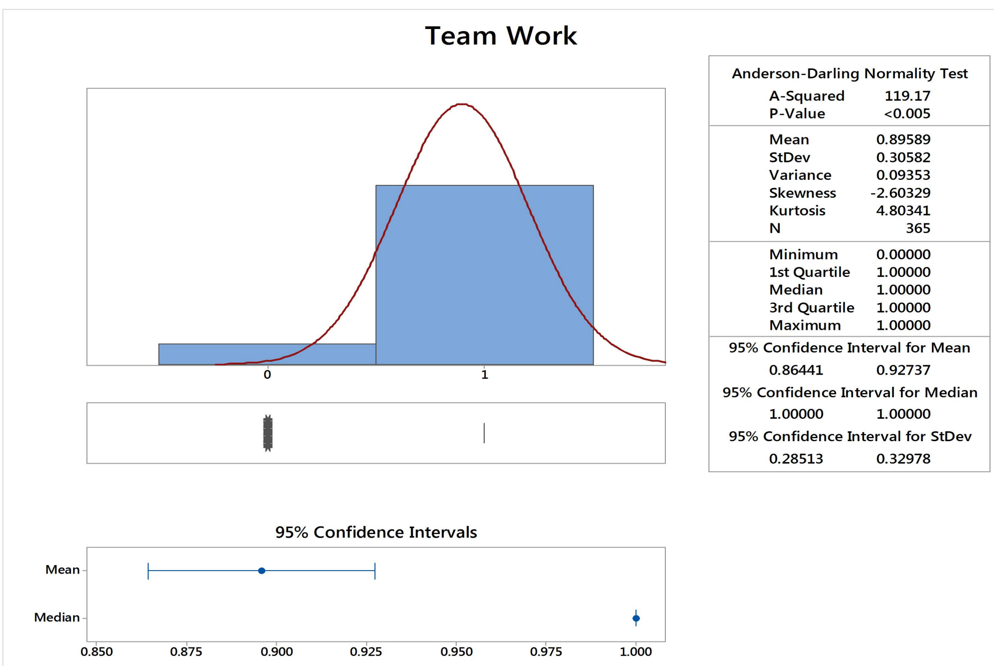

Figure 5.4: Anderson-Darling normality test graph for team work

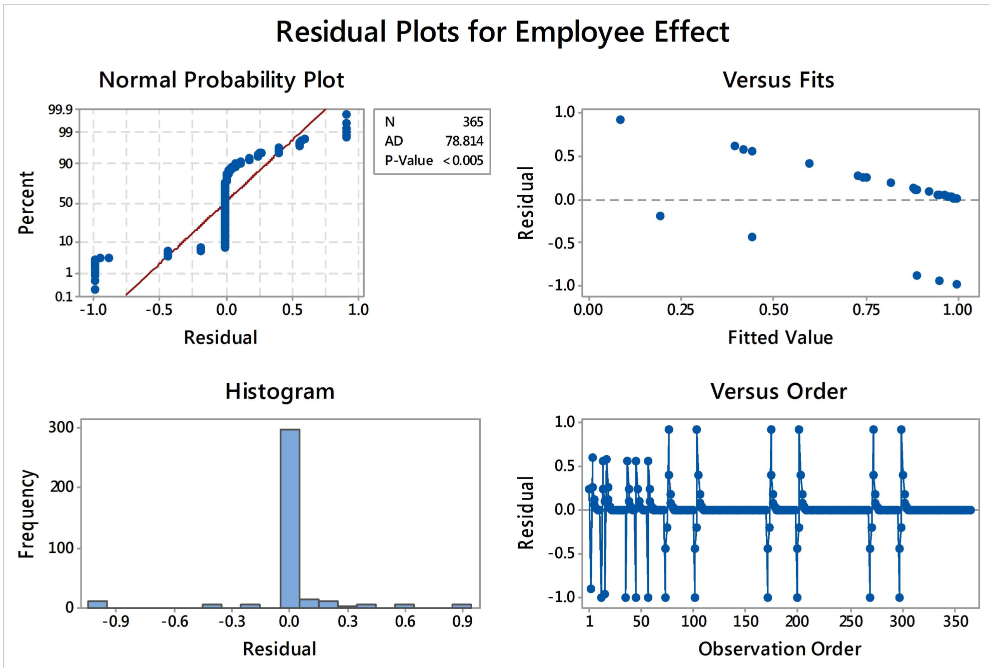

Figure 5.5: Residual plots for employee involvement

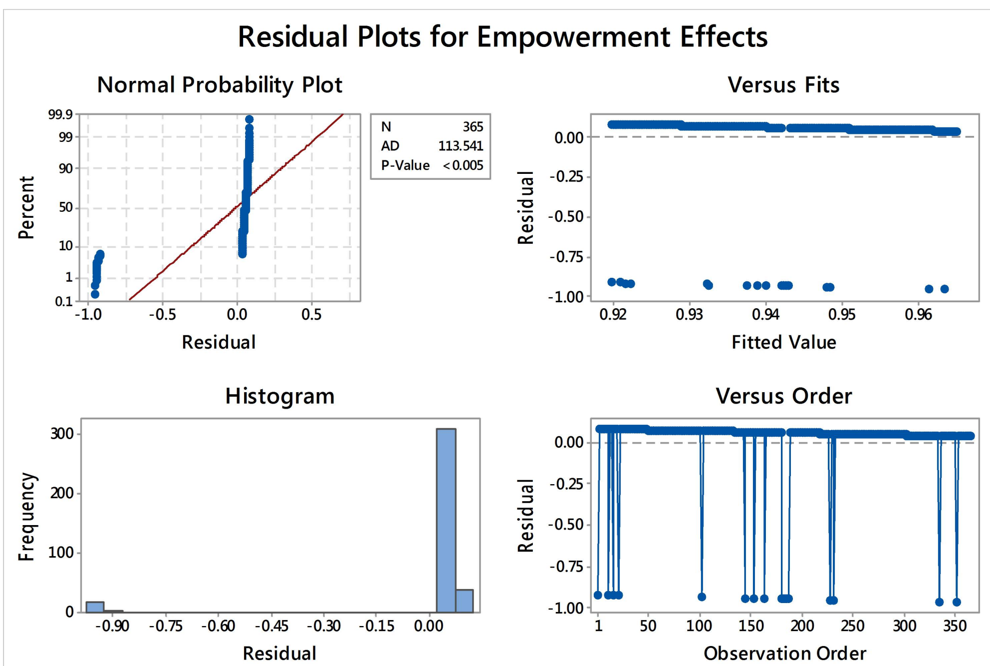

Figure 5.6: Residual plots for employee empowerment

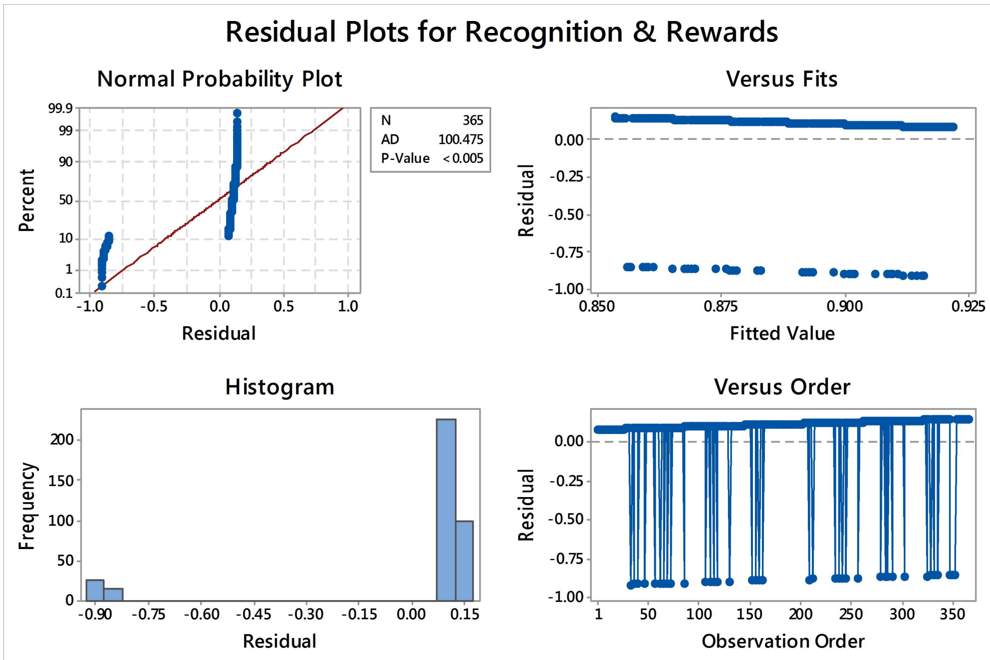

Figure 5.7: Residual plots for recognition & reward

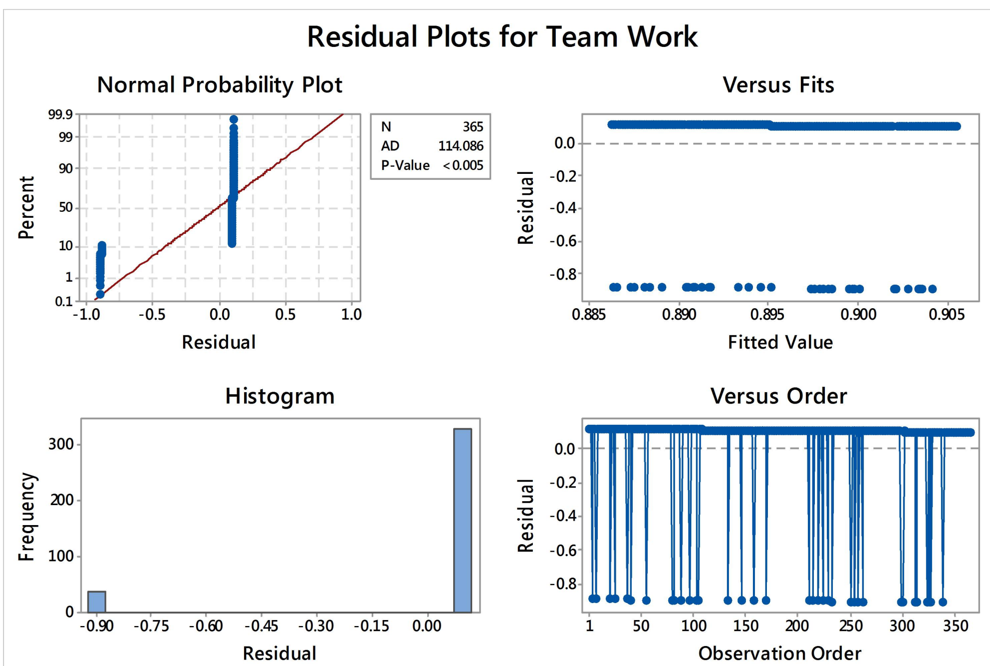

Figure 5.8: Residual plots for teamwork

Table 5.1: Descriptive statistics for HRM factors

Variable	Count	N	N*	Cum N	%	Cum Pct	Mean	SE Mean	Tr Mean	Std. Dev	V
D11	365	365	0	365	100	100	0.93	0.01	0.98	0.24	0.06
D12	365	365	0	365	100	100	0.94	0.01	0.99	0.23	0.05
D13	365	365	0	365	100	100	0.88	0.02	0.93	0.31	0.1
D14	365	365	0	365	100	100	0.89	0.02	0.93	0.30	0.09
Variable	**CoefVar**	**Sum**	**SS**	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Range**		
D11	26.57	341	341	0	1	1	1	1	1		
D12	24.74	344	344	0	1	1	1	1	1		
D13	35.62	324	324	0	1	1	1	1	1		
D14	34.14	327	327	0	1	1	1	1	1		
Variable	**Inter Quartile Range**	**Mode**	**Mode**	**Skew-ness**	**Kurt-osis**	**MSSD**					
D11	0	1	341	-3.52	10.44	0.033					
D12	0	1	344	3.82	12.63	0.0343					
D13	0	1	324	-2.3848	4.1	0.0989					
D14	0	1	327	-2.6	4.8	0.0852					

Table 5.2: Correlation matrix between HRM factors

	D11	D12	D13
D12	0.029		
	0.576		
D13	0.11	-0.013	
	0.839	0.799	
D14	-0.054	-0.046	-0.064
	0.301	0.384	0.219

Table 5.3: Covariance matrix between HRM factors

Variable	D11	D12	D13	D14
D11	0.0615987			
D12	0.001701	0.054373		
D13	0.0008355	-0.00099	0.0999849	
D14	-0.0041171	-0.00326	-0.0062321	0.093527

Table 5.4: Test and CI for One Proportion: D11, D12, D13, D14

Test of p = 0.05 vs p ≠ 0.05						
Event = 1						
Variable	X	N	Sample p	95% CI	Z-Value	P-Value
D11	341	365	0.934247	(0.908820, 0.959673)	77.51	0
D12	344	365	0.942466	(0.918577, 0.966355)	78.23	0
D13	324	365	0.887671	(0.855277, 0.920066)	73.43	0
D14	327	365	0.89589	(0.864559, 0.927221)	74.15	0
Using the normal approximation.						

5.3.2 Hypothesis-II

Statement: Performance of TQM is positively related with Top management commitment (D_2) factors (a) Top management support (D_{21}) (b) Executive commitment (D_{22}) (c) Leadership (D_{23})

(H_0)*: TQM is not positively related Top management commitment factors (a) Top management support (b) Executive commitment (c) Leadership*

(H_a)*: TQM is positively related with Top management commitment factors (a) Top management support (b) Executive commitment (c) Leadership*

After developing null and alternative hypothesizes, Anderson-darling normality test has been carried out. The results of that test are shown in Fig. 5.9, 5.10 and 5.11. The results confirmed that the p-value for all four factors is less than 0.05 and rejected the null hypothesis. Figure 5.12, 5.13 and 5.14 shows the residual plots for all four factors. All tests were performed at 95% confidence intervals. Table 5.5, 5.6 & 5.7 contains the results of descriptive statistical analysis, correlation matrix and co-variance matrix for top management commitment factors. Table 5.8 contains Test and CI for one proportion: D21, D22, D23 for top management commitment factors.

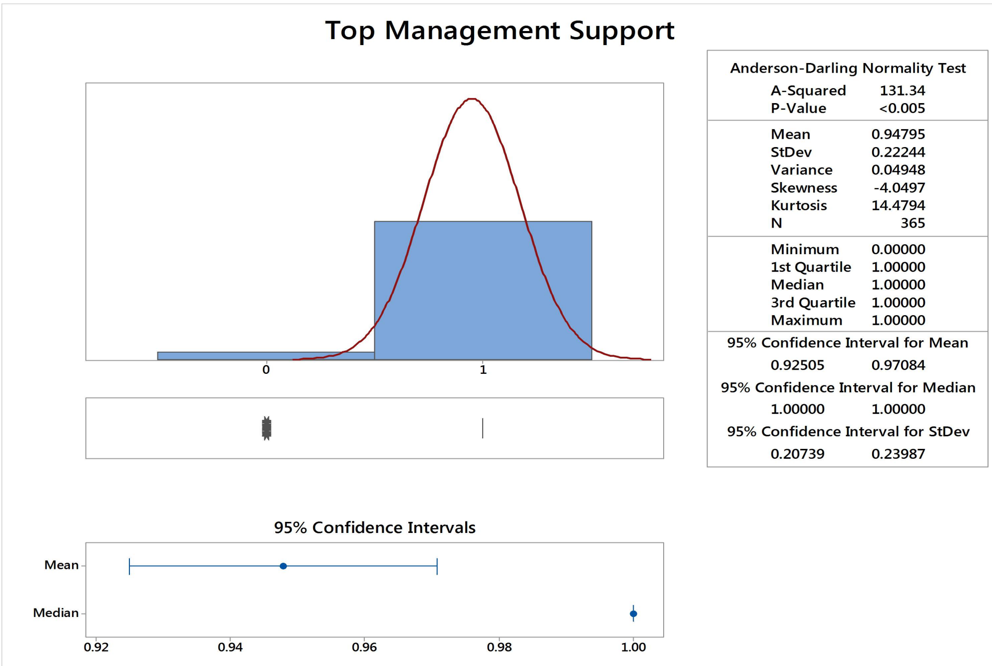

Figure 5.9: Anderson-Darling normality test graph for top management supprot

5.3.3 Hypothesis-III

Statement: Performance of TQM is positively related with Process management (D_3) factors (a) Tools and techniques (D_{31}) (b) Continuous improvement (D_{32}) (c) Process design (D_{33}).

(H_0): *TQM is not positively related with Process management factors (a) Tools and techniques (b) Continuous improvement (c) Process design*

(H_a): *TQM is positively related with Process management factors (a) Tools and techniques (b) Continuous improvement (c) Process design*

After developing null and alternative hypothesizes, Anderson-darling normality test

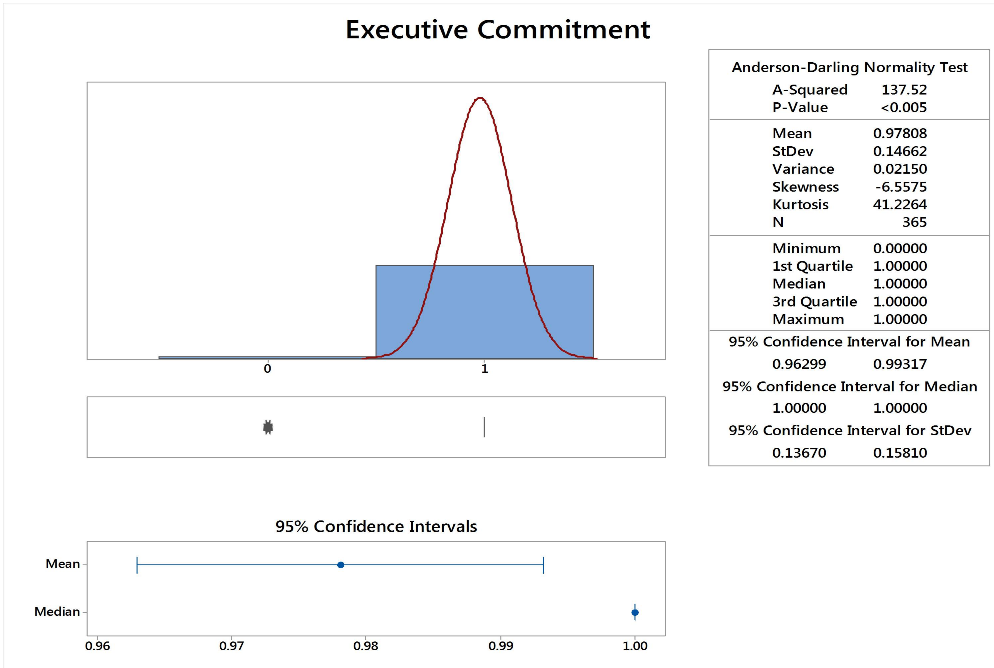

Figure 5.10: Anderson-Darling normality test graph for exicutive commitment

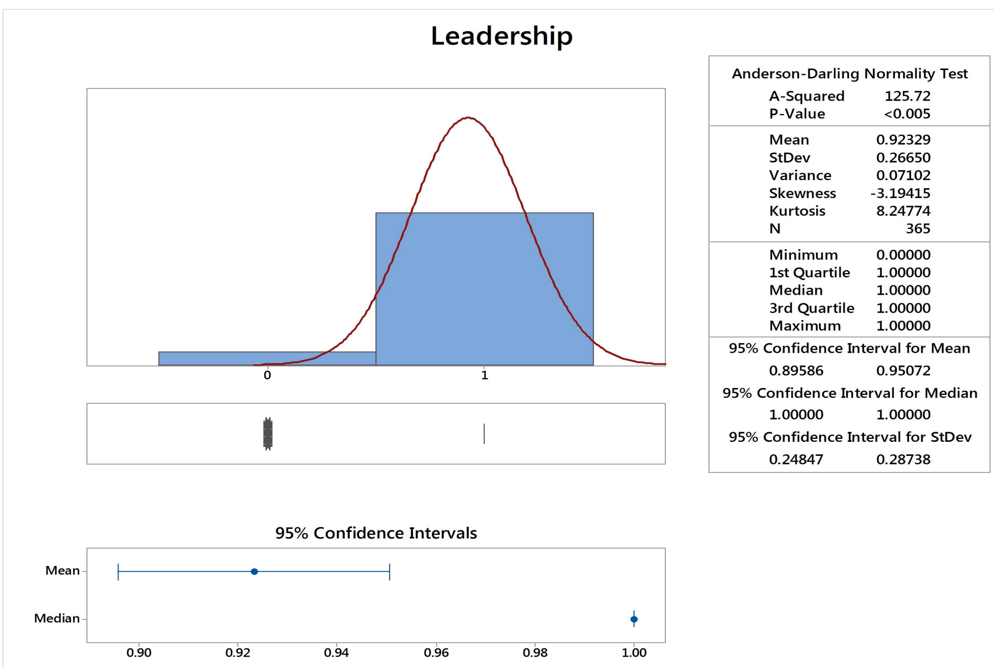

Figure 5.11: Anderson-Darling normality test graph for leadership

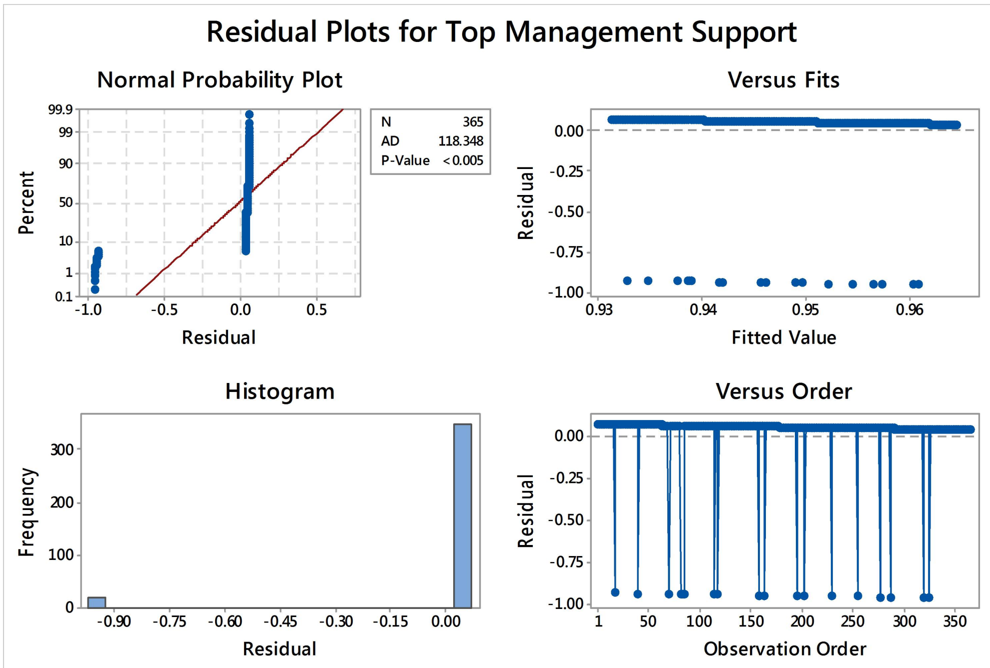

Figure 5.12: Residual plots for top management support

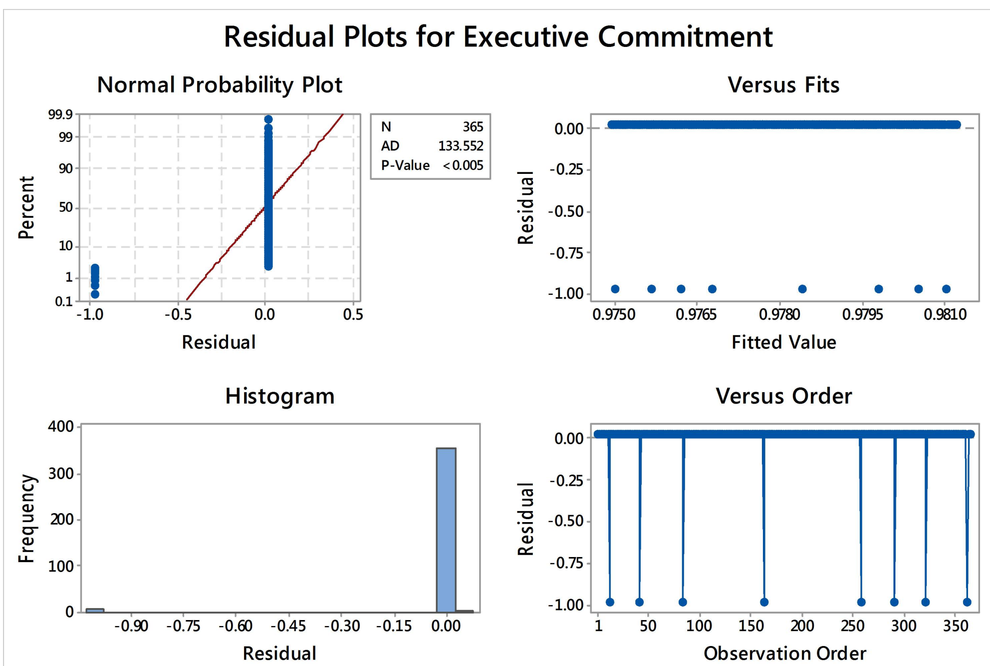

Figure 5.13: Residual plots for exicutive commitment

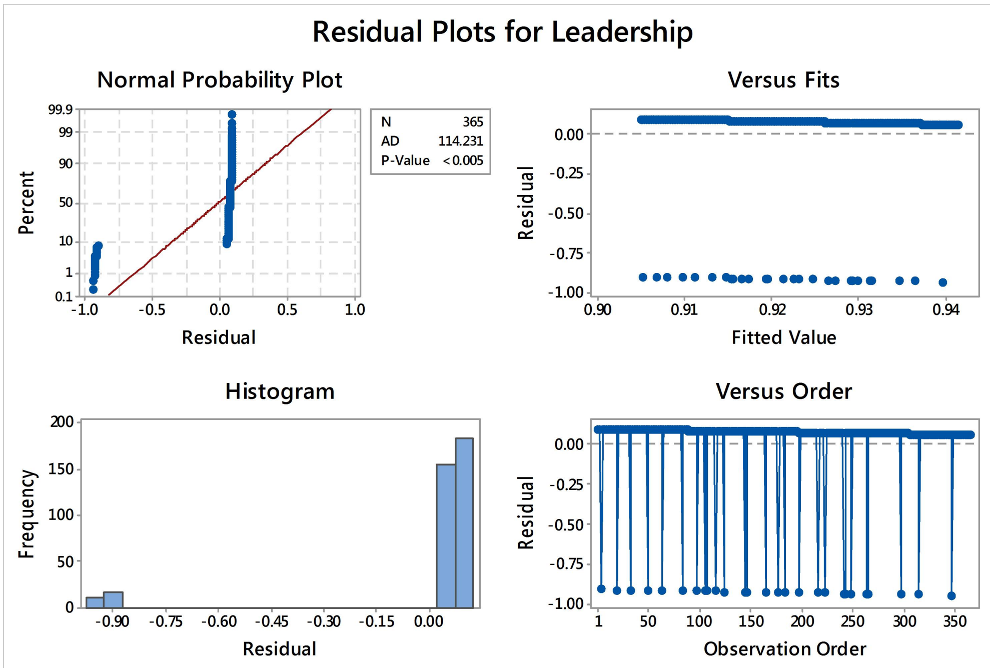

Figure 5.14: Residual plots for leadership

has been carried out. The results of that test are shown in Fig. 5.15, 5.16 and 5.17. The results confirmed that the p-value for all four factors is less than 0.05 and rejected the H0. Figure 5.18, 5.19 and 5.20 shows the residual plots for all four factors. All tests were performed at 95% confidence intervals. Tables 5.9, 5.10 & 5.11 contain the results of descriptive statistical analysis, correlation matrix and covariance matrix for Process management factors. Table 5.12 contains est and CI for one proportion: D31, D32, D33 for Process management factors.

5.3.4 Hypothesis-IV

Statement: Performance of TQM is positively related with Customer focus/Customer Centricity factors (D_4) (a) Customer and market focus (D_{41}) (b) Customer satisfaction (D_{42}) (c) Customer relationship (D_{43}).

(H_0): *TQM is not positively related with Customer focus/Customer Centricity factors (a) Customer and market focus (b) Customer satisfaction (c) Customer rela-*

Table 5.5: Descriptive statistics for top management support factors

Variable	Count	N	N*	Cum N	%	Cum Pct	Mean	SE Mean	Tr Mean	Std. Dev	V
D21	365	365	0	365	100	100	0.94	0.01	0.99	0.22	0.04
D22	365	365	0	365	100	100	0.97	0.01	1	0.14	0.02
D23	365	365	0	365	100	100	0.92	0.01	0.96	0.26	0.7
Variable	**CoefVar**	**Sum**	**SS**	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Range**		
D21	23.47	346	346	0	1	1	1	1	1		
D22	14.99	357	357	0	1	1	1	1	1		
D23	28.86	337	337	0	1	1	1	1	1		
Variable	**Inter Quartile Range**	**Mode**	**Mode**	**Skew-ness**	**Kurt-osis**	**MSSD**					
D21	0	1	346	-4.05	14.48	0.044					
D22	0	1	357	-6.56	41.23	0.021					
D23	0	1	337	-3.19	8.25	0.068					

Table 5.6: Correlation matrix between top management support factors

	D21	D22
D22	0.049	0.349
D23	-0.021	-0.043
	0.686	0.411

Table 5.7: Covariance matrix between top management support factors

Variable	D21	D22	D23
D21	0.0494807		
D22	0.001603	0.0214963	
D23	-0.0012570	-0.0016860	0.0710221

tionship

(H_a): *TQM is positively related with Customer focus/Customer Centricity factors (a) Customer and market focus (b) Customer satisfaction (c) Customer relationship*

Table 5.8: Test and CI for One Proportion: D21, D22, D23

Test of p = 0.05 vs p ≠ 0.05						
Event = 1						
Variable	X	N	Sample p	95% CI	Z-Value	P-Value
D21	346	365	0.947945	(0.925156, 0.970734)	78.71	0
D22	357	365	0.978082	(0.963062, 0.993103)	81.36	0
D22	357	365	0.923288	(0.895985, 0.950590)	76.55	0
Using the normal approximation.						

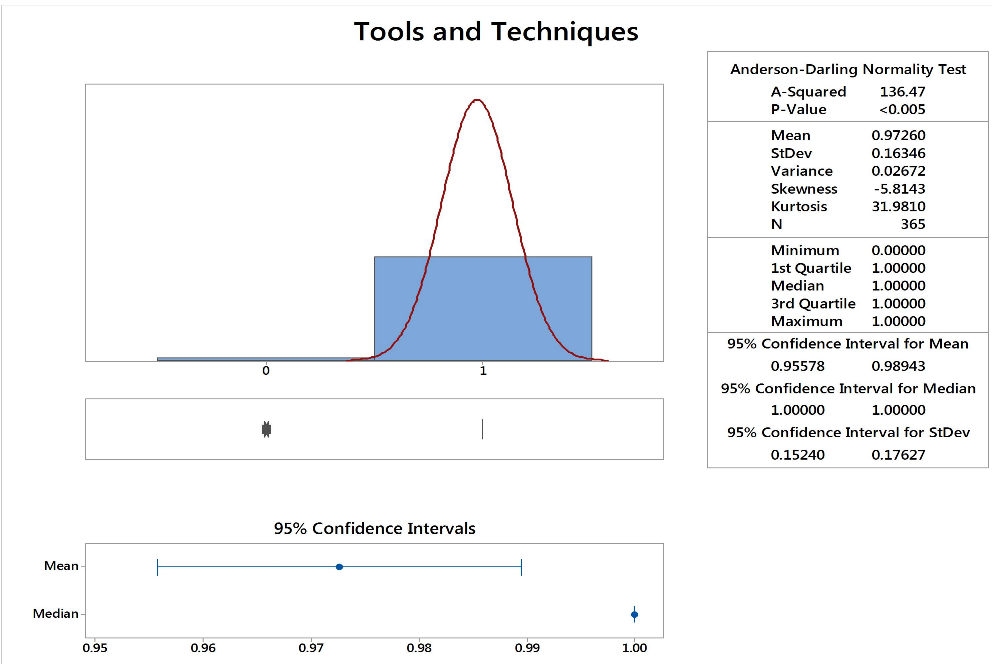

Figure 5.15: Anderson-Darling normality test graph for Tools and techniques

After developing null and alternative hypothesizes, Anderson-darling normality test has been carried out. The results of that test are shown in Fig. 5.21, 5.22 and 5.23. The results confirmed that the p-value for all four factors is less than 0.05 and rejected the null hypothesis. Figure 5.24, 5.25 and 5.26 shows the residual plots for all four factors. All tests were performed at 95% confidence intervals. Tables 5.13, 5.14 & 5.15 contain the results of descriptive statistical analysis, correlation matrix and co-variance matrix for Customer focus/Customer Centricity factors. Table 5.16 con-

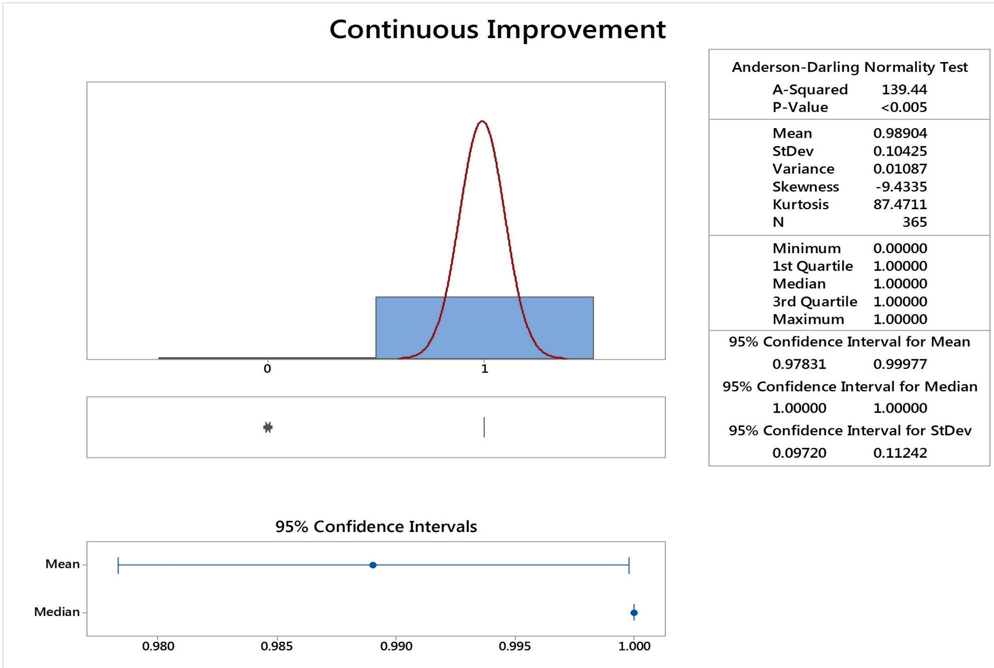

Figure 5.16: Anderson-Darling normality test graph for continuous improvement

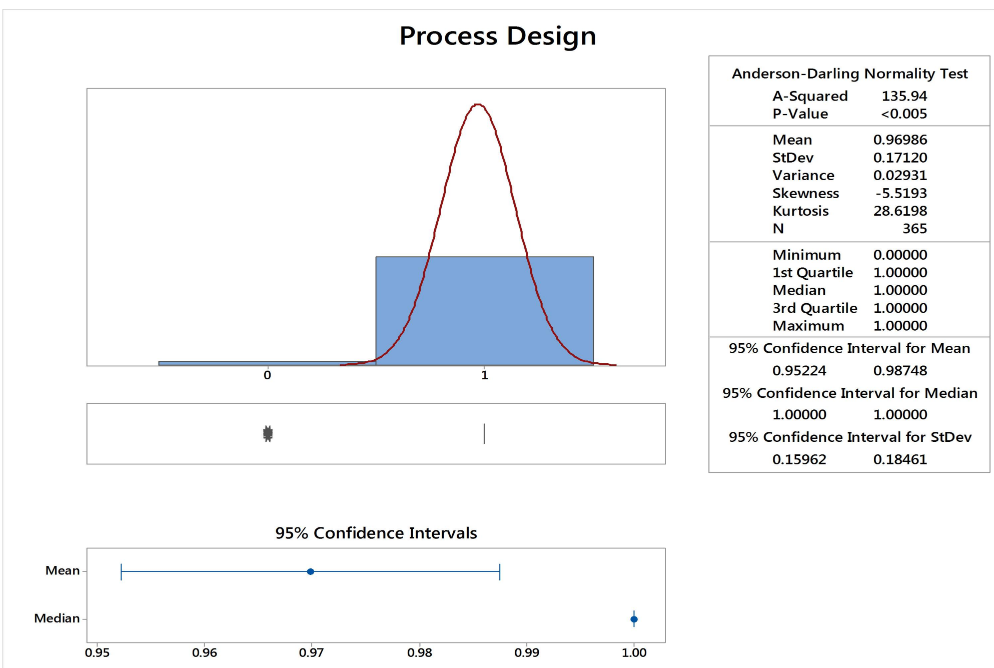

Figure 5.17: Anderson-Darling normality test graph for process design

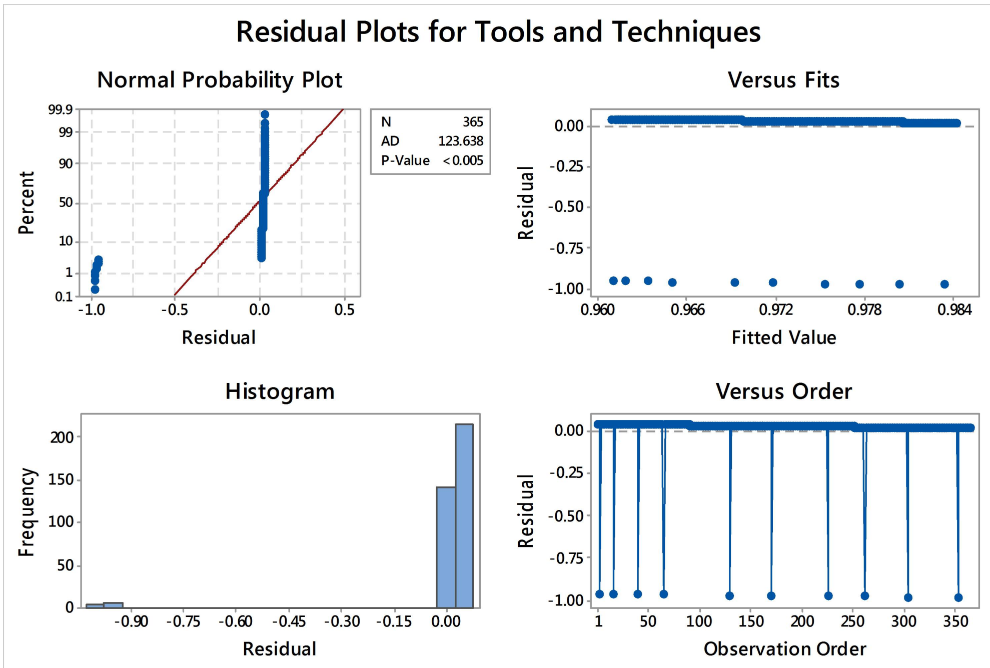

Figure 5.18: Residual plots for tools and techniques

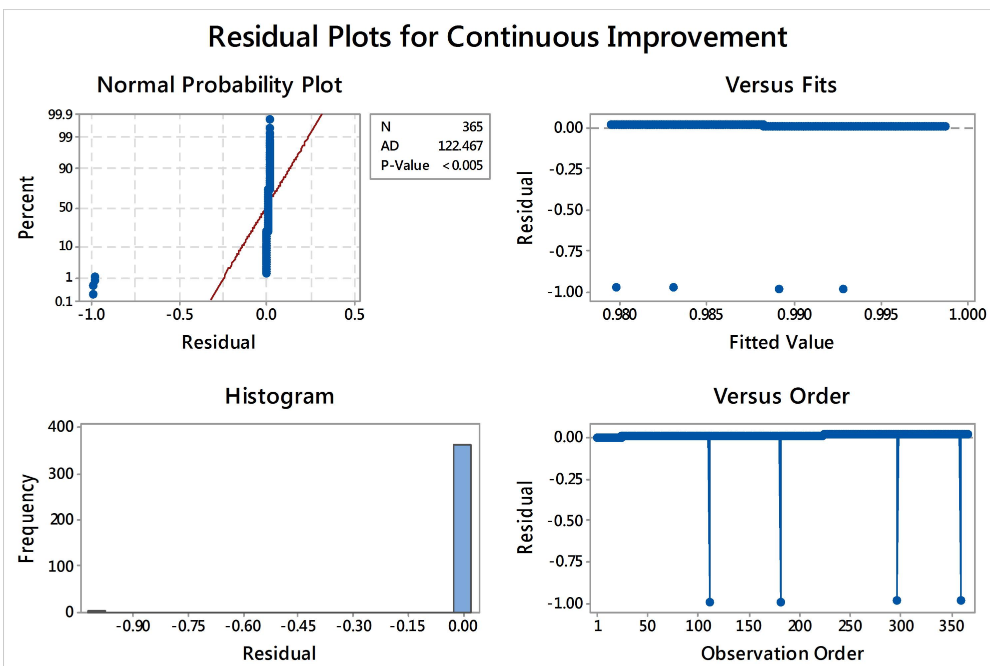

Figure 5.19: Residual plots for continuous improvement

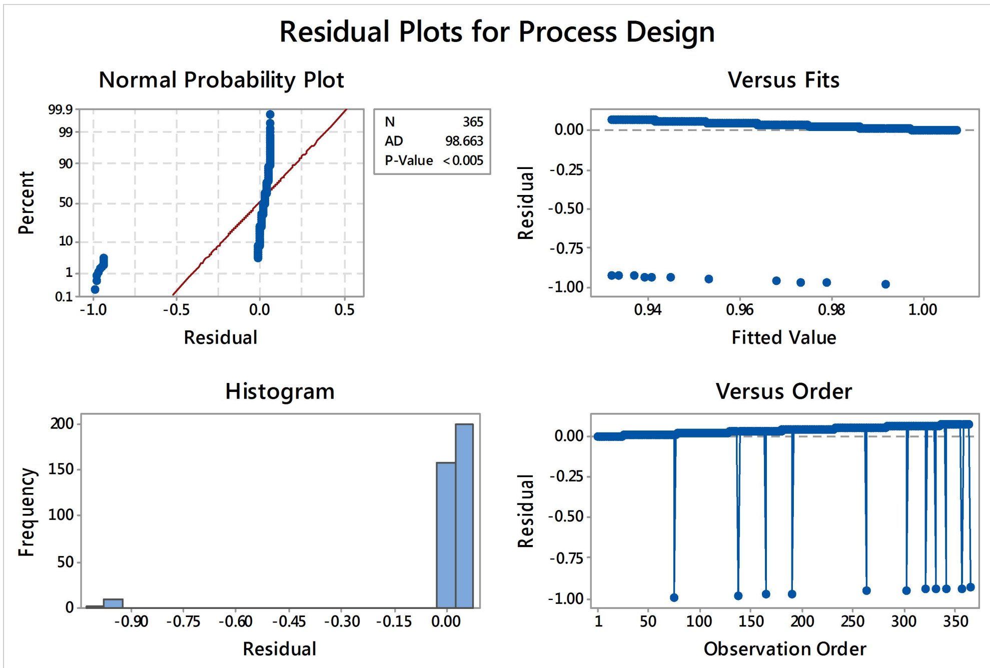

Figure 5.20: Residual plots for process design

tains Test and CI for one proportion: D41, D42, D43 for Customer focus/Customer Centricity factors.

5.3.5 Hypothesis-V

Statement: Performance of TQM is positively related with Supplier partnership/ Supplier's management factors (D_5) (a) Cooperation with suppliers (D_{51}) (b) Supplier quality management (D_{52})(c) Supplier relationship (D_{53}).

(H_0):*TQM is not positively related with Supplier partnership Supplier's management factors (a) Cooperation with suppliers (b) Supplier quality management (c) Supplier relationship*

(H_a): *TQM is positively related with Supplier partnership/ Supplier's management factors (a) Cooperation with suppliers (b) Supplier quality management(c) Supplier relationship*

After developing null and alternative hypothesizes, Anderson-darling normality test

Table 5.9: Descriptive statistics for process management factors

Variable	Count	N	N*	Cum N	%	Cum Pct	Mean	SE Mean	Tr Mean	Std. Dev	V
D31	365	365	0	365	100	100	0.97	0.01	1	0.16	0.02
D32	365	365	0	365	100	100	0.98	0.01	1	0.10	0.01
D33	365	365	0	365	100	100	0.96	0.01	1	0.17	0.02
Variable	**CoefVar**	**Sum**	**SS**	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Range**		
D31	16.81	355	355	0	1	1	1	1	1		
D32	10.54	361	361	0	1	1	1	1	1		
D33	17.65	354	354	0	1	1	1	1	1		
Variable	**Inter Quartile Range**	**Mode**	**Mode**	**Skew-ness**	**Kurt-osis**	**MSSD**					
D31	0	1	355	-5.81	31.98	0.027					
D32	0	1	361	-9.43	87.47	0.0109					
D33	0	1	354	-5.52	28.62	0.0288					

Table 5.10: Correlation matrix between process management factors

	D31	D32
D31	-0.018	0.737
D33	-0.030	-0.019
	0.573	0.724

Table 5.11: Covariance matrix between process management factors

Variable	D31	D32	D33
D31	0.0267199		
D32	-0.0003011	0.0108686	
D33	-0.0008279	-0.0003312	0.0293090

has been carried out. The results of that test are shown in Fig. 5.27, 5.28 and 5.29. The results confirmed that the p-value for all four factors is less than 0.05 and rejected the null hypothesis. Figure 5.30, 5.31 and 5.32 shows the residual plots

Table 5.12: Test and CI for One Proportion: D31, D32, D33

Variable	X	N	Sample p	95% CI	Z-Value	P-Value
Test of p = 0.05 vs p ≠ 0.05						
Event = 1						
D31	365	365	0.972603	(0.955856, 0.989349)	80.88	0
D32	361	365	0.989041	(0.978361, 0.999722)	82.32	0
D33	354	365	0.969863	(0.952324, 0.987402)	80.63	0
Using the normal approximation.						

Figure 5.21: Anderson-Darling normality test graph for customer and market focus

for all four factors. All tests were performed at 95% confidence intervals. Tables 5.17, 5.18 & 5.19 contain the results of descriptive statistical analysis, correlation matrix and covariance matrix for Supplier partnership/ Supplier's management factors.Table 5.20 contains Test and CI for one proportion: D51, D52, D53 for Supplier partnership/ Supplier's management factors.

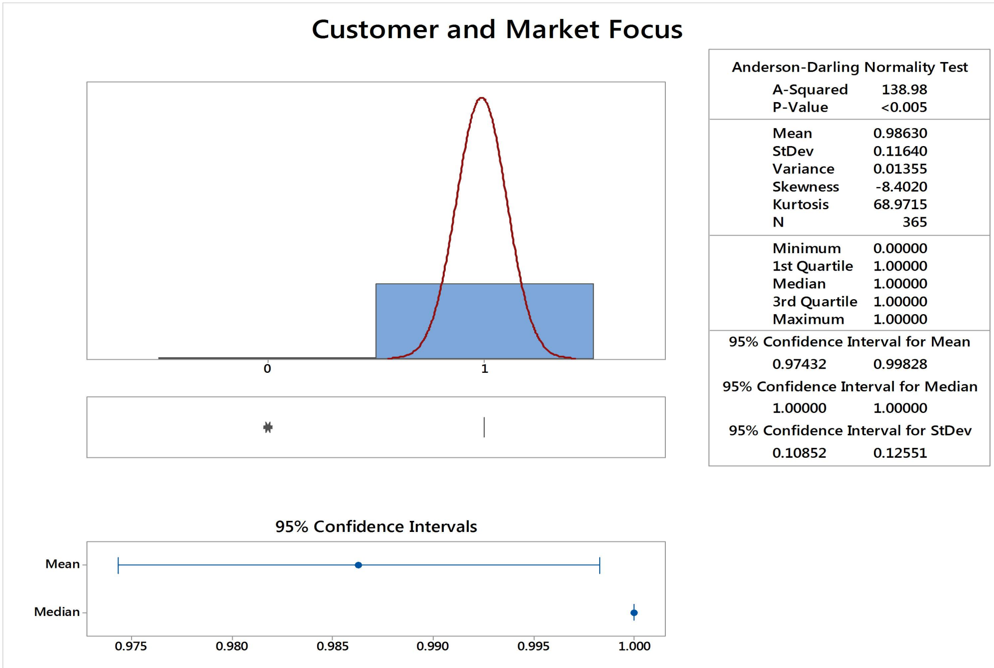

Figure 5.22: Residuals plots forAnderson-Darling normality test graph for customer satisfaction

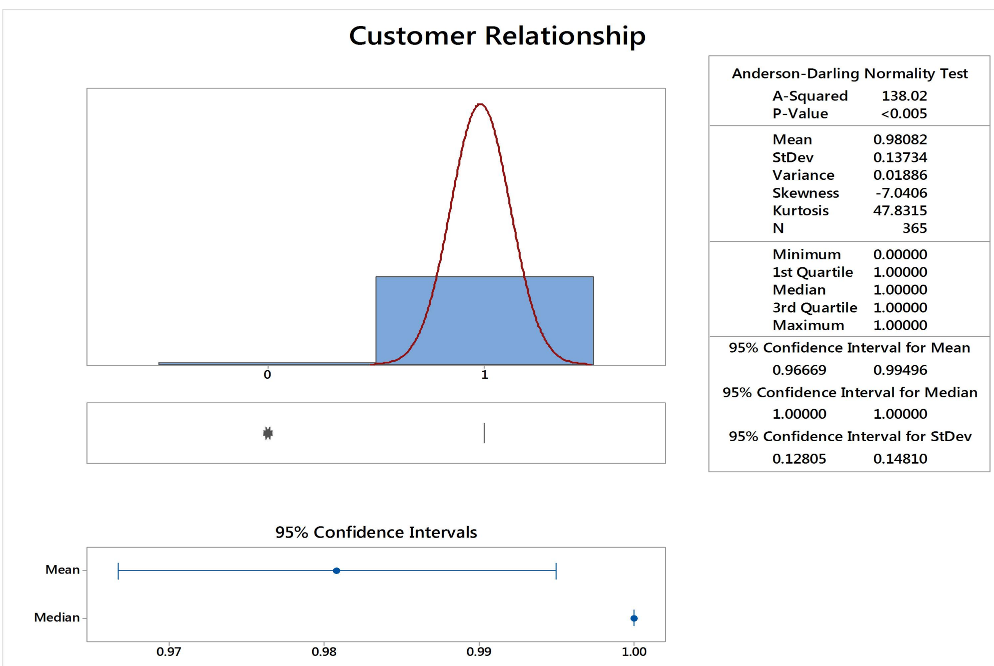

Figure 5.23: Anderson-Darling normality test graph for customer relationship

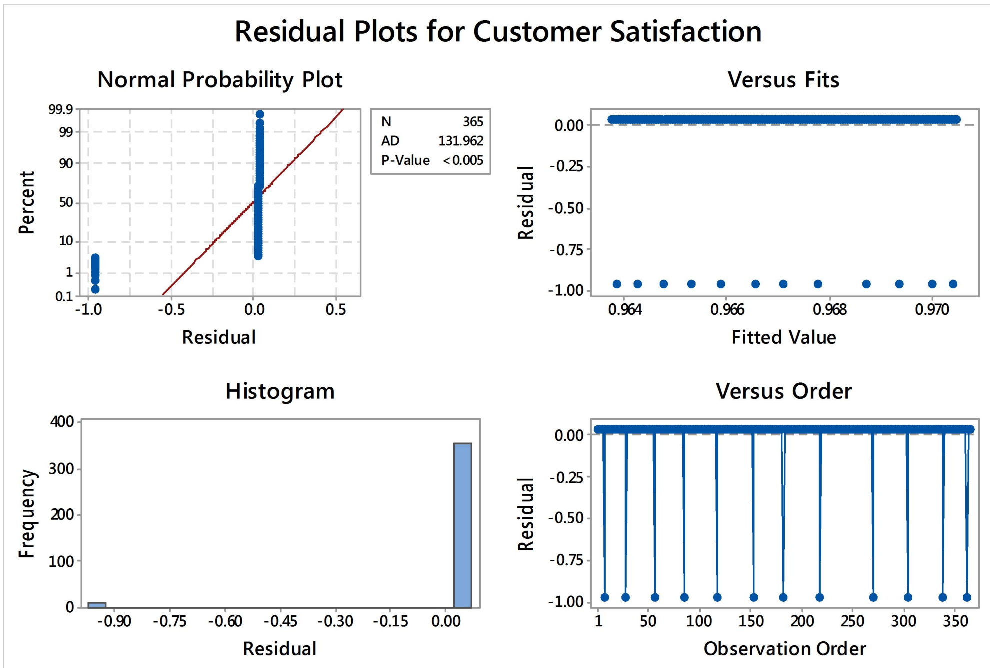

Figure 5.24: Residual plots for customer and market focus

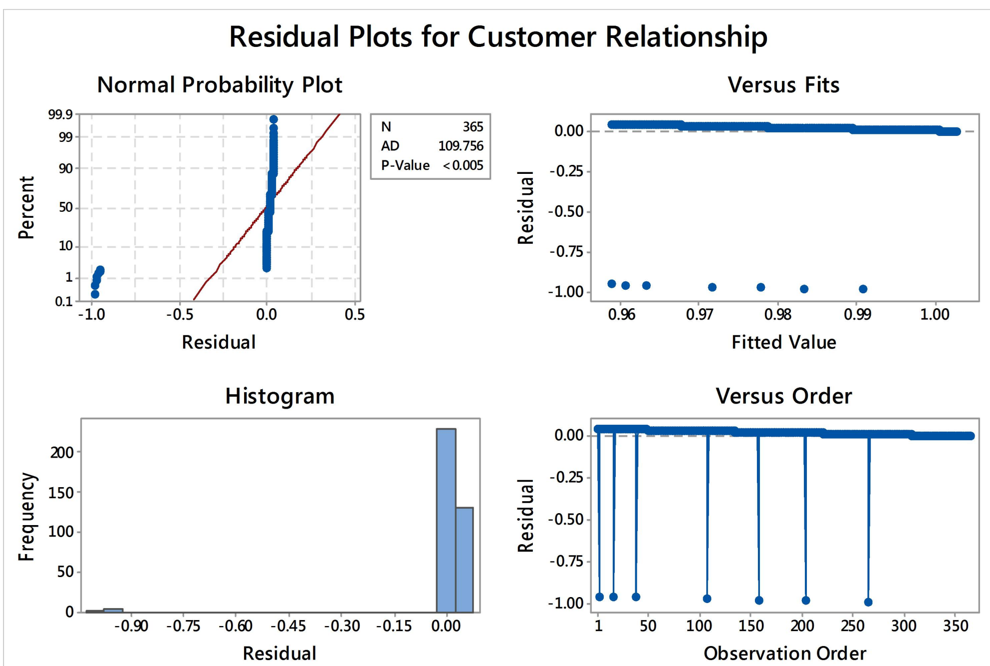

Figure 5.25: Residual plots for customer satisfaction

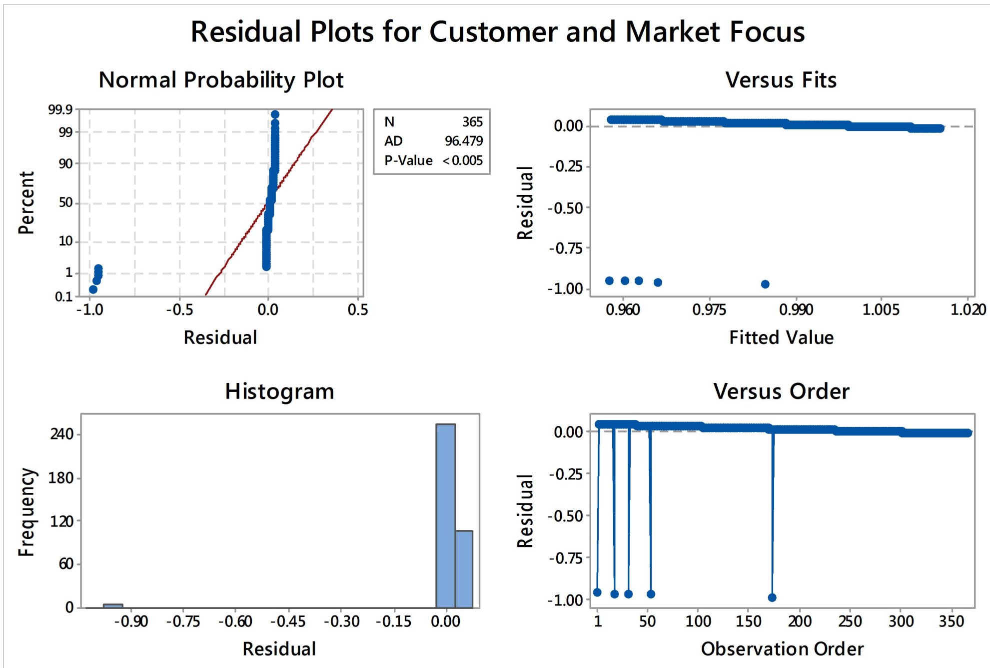

Figure 5.26: Residual plots for customer relationship

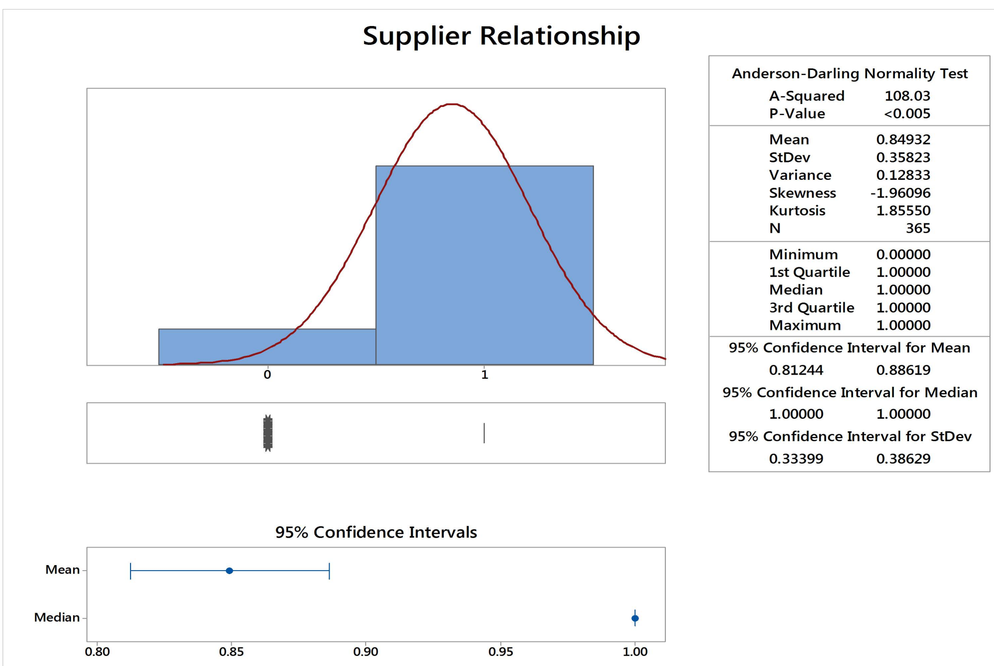

Figure 5.27: Anderson-Darling normality test graph for employee involvement

Table 5.13: Descriptive statistics for customer focus/customer centricity factors

Variable	**Count**	**N**	**N***	**Cum N**	**%**	**Cum Pct**	**Mean**	**SE Mean**	**Tr Mean**	**Std. Dev**	**V**
D41	365	365	0	365	100	100	0.98	0.01	1	0.11	0.01
D42	365	365	0	365	100	100	0.96	0.01	0.99	0.17	0.03
D43	365	365	0	365	100	100	0.98	0.01	1	0.13	0.1
Variable	**CoefVar**	**Sum**	**SS**	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Range**		
D41	11.80	360	360	0	1	1	1	1	1		
D42	18.46	353	353	0	1	1	1	1	1		
D43	14.00	358	358	0	1	1	1	1	1		
Variable	**Inter Quartile Range**	**Mode**	**Mode**	**Skew-ness**	**Kurt-osis**	**MSSD**					
D41	0	1	360	-8.40	68.97	0.0126					
D42	0	1	353	-5.26	25.82	0.0329					
D43	0	1	358	-7.04	47.83	0.01923					

Table 5.14: Correlation matrix between customer focus/customer centricity factors

	D41	D42
D42	-0.022	0.679
D43	-0.016	-0.026
	0.754	0.623

Table 5.15: Covariance matrix between customer focus/customer centricity

Variable	D41	D42	D43
D41	0.0135481		
D42	-0.0004516	0.03118832	
D43	-0.0002634	-0.0006322	0.0188620

5.3.6 Hypothesis-VI

Statement: Performance of TQM is positively related with Training and education (D_6) factors (a) Learning (D_{61}) (b) Knowledge (D_{62}) and (c) Education & training

Table 5.16: Test and CI for One Proportion: D41, D42, D43

Test of p = 0.05 vs p ≠ 0.05						
Event = 1						
Variable	X	N	Sample p	95% CI	Z-Value	P-Value
D41	360	365	0.986301	(0.974377, 0.998226)	82.08	0
D42	353	365	0.967123	(0.948830, 0.985416)	80.39	0
D43	358	365	0.980822	(0.966752, 0.994892)	81.6	0
Using the normal approximation.						

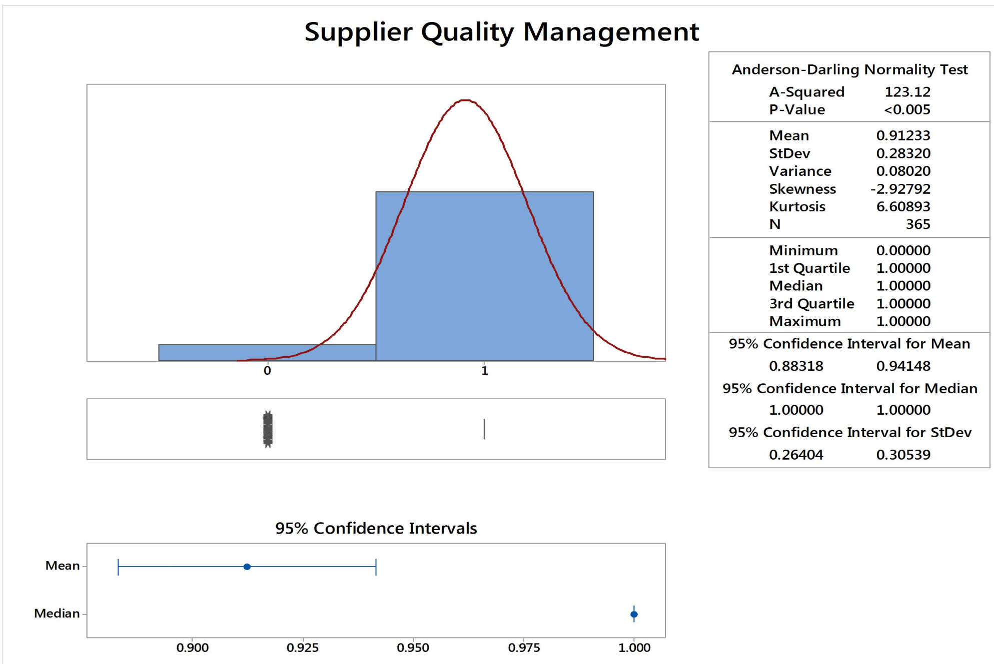

Figure 5.28: Anderson-Darling normality test graph for employee empowerment

(D_{63}).

(H_0): *TQM is not positively related with Training and education factors (a) Learning (b) Knowledge and (c) Education & training*

(H_a): *TQM is positively related with Training and education factors (a) Learning (b) Knowledge and (c) Education & training*

After developing null and alternative hypothesizes, Anderson-darling normality test has been carried out. The results of that test are shown in Fig. 5.33, 5.34 and

Table 5.17: Descriptive statistics for supplier partnership/ supplier's management factors

Variable	**Count**	**N**	**N***	**Cum N**	**%**	**Cum Pct**	**Mean**	**SE Mean**	**Tr Mean**	**Std. Dev**	**V**
D51	365	365	0	365	100	100	0.86	0.02	0.90	0.33	0.11
D52	365	365	0	365	100	100	0.91	0.01	0.95	0.28	0.08
D53	365	365	0	365	100	100	0.84	0.02	0.88	0.35	0.12
Variable	**CoefVar**	**Sum**	**SS**	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Range**		
D51	38.97	317	317	0	1	1	1	1	1		
D52	31.04	333	333	0	1	1	1	1	1		
D53	42.18	310	310	0	1	1	1	1	1		
Variable	**Inter Quartile Range**	**Mode**	**Mode**	**Skew-ness**	**Kurt-osis**	**MSSD**					
D51	0	1	317	-2.19	2.81	0.093					
D52	0	1	333	-2.93	6.61	0.0879					
D53	0	1	310	-1.96	1.86	0.1401					

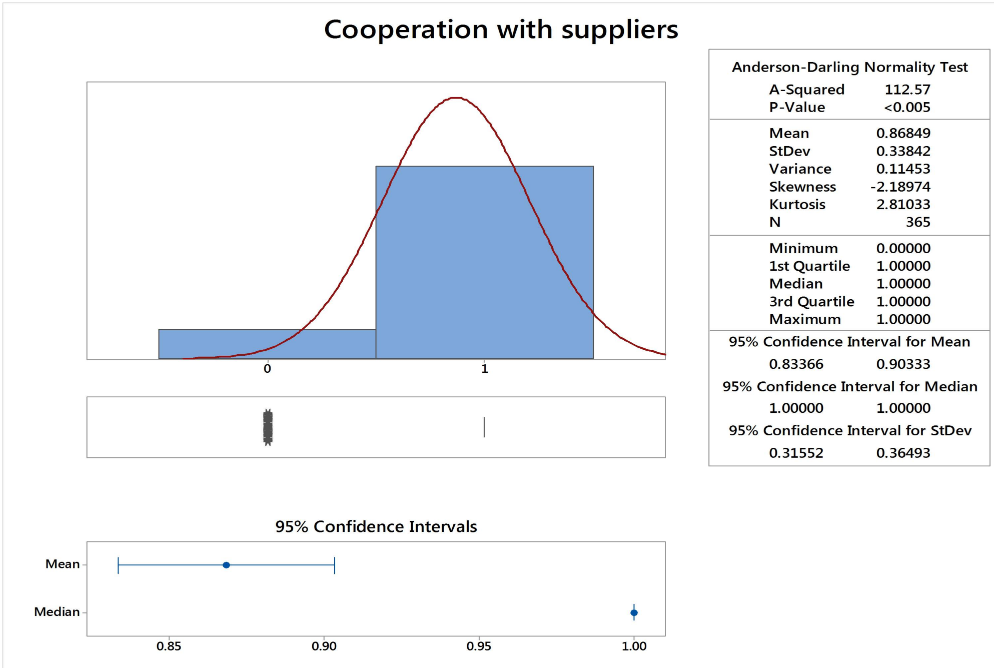

Figure 5.29: Anderson-Darling normality test graph for rewards & recognition

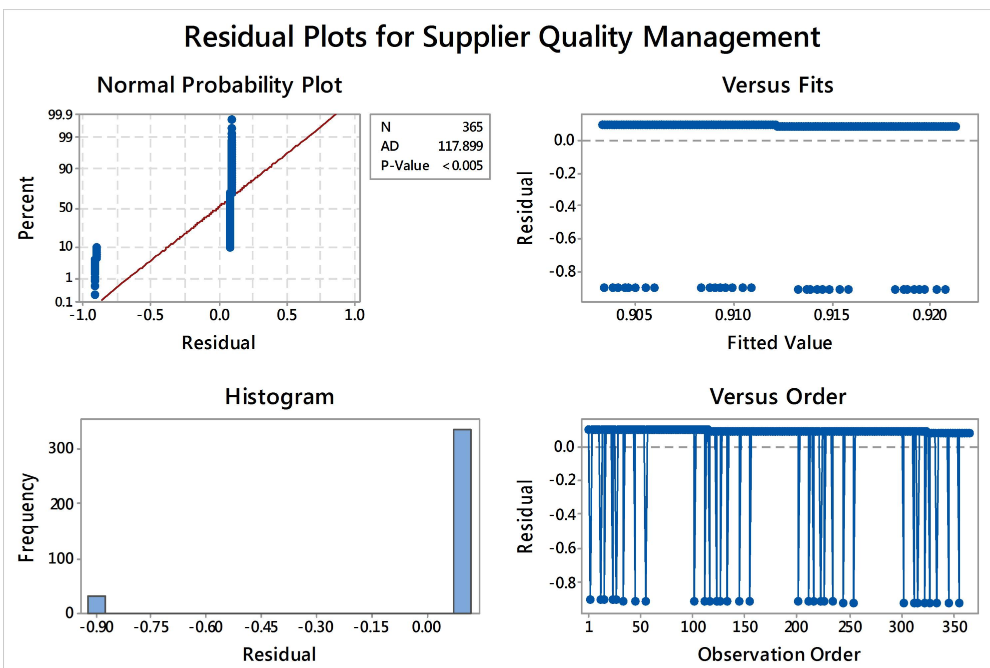

Figure 5.30: Anderson-Darling normality test graph for team work

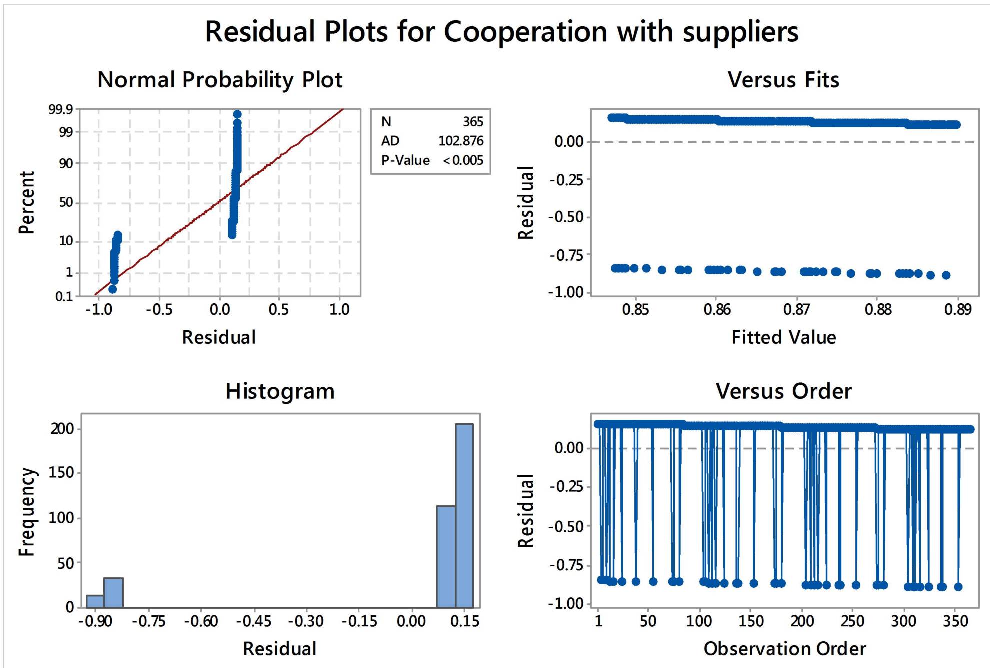

Figure 5.31: Residual plots for employee involvement

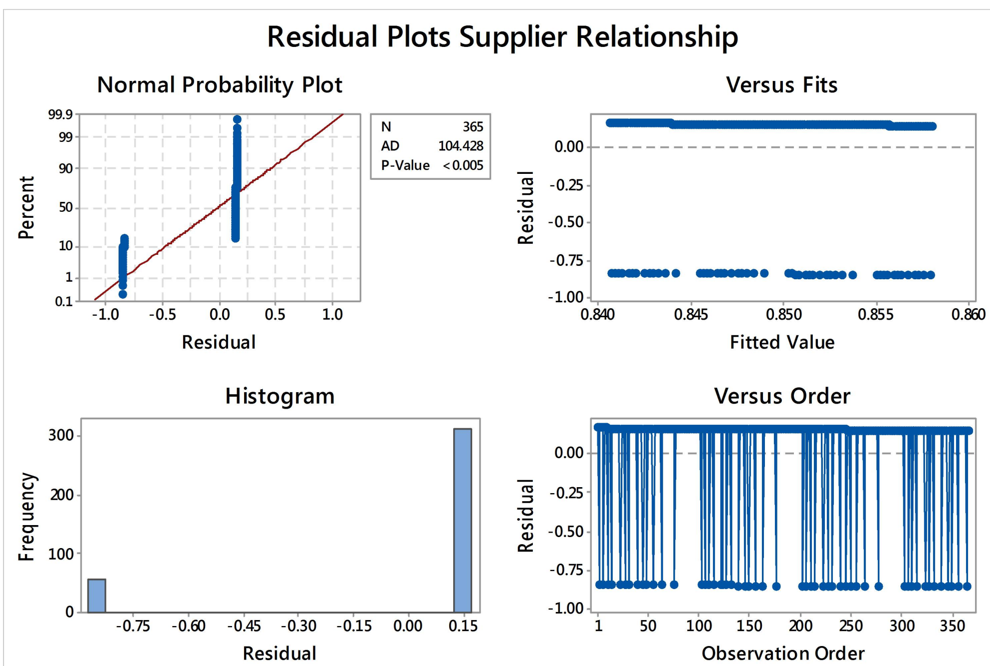

Figure 5.32: Residual plots for employee empowerment

Table 5.18: Correlation matrix between supplier partnership/ supplier's management factors

	D51	D52
D52	0.109	0.038
D53	-0.164	0.411
	0.002	0.000

Table 5.19: Covariance matrix between supplier partnership/ supplier's management factors

Variable	D51	D52	D53
D51	0.1145266		
D52	0.0104170	0.0802047	
D53	-0.0198705	0.0416980	0.1283306

Table 5.20: Test and CI for One Proportion: D51, D52, D53

Test of p = 0.05 vs p ≠ 0.05						
Event = 1						
Variable	X	N	Sample p	95% CI	Z-Value	P-Value
D51	317	365	0.868493	(0.833823, 0.903164)	71.75	0
D52	333	365	0.912329	(0.883315, 0.941343)	75.59	0
D53	310	365	0.849315	(0.812615, 0.886015)	70.07	0
Using the normal approximation.						

5.35. The results confirmed that the p-value for all four factors is less than 0.05 and rejected the null hypothesis. Figure 5.36, 5.37 and 5.38 shows the residual plots for all four factors. All tests were performed at 95% confidence intervals. Tables 5.21, 5.22 & 5.23 contain the results of descriptive statistical analysis, correlation matrix and co-variance matrix for Training and education factors.Table 5.24 contains Test and CI for one proportion: D61, D62, D63 for Training and education factors.

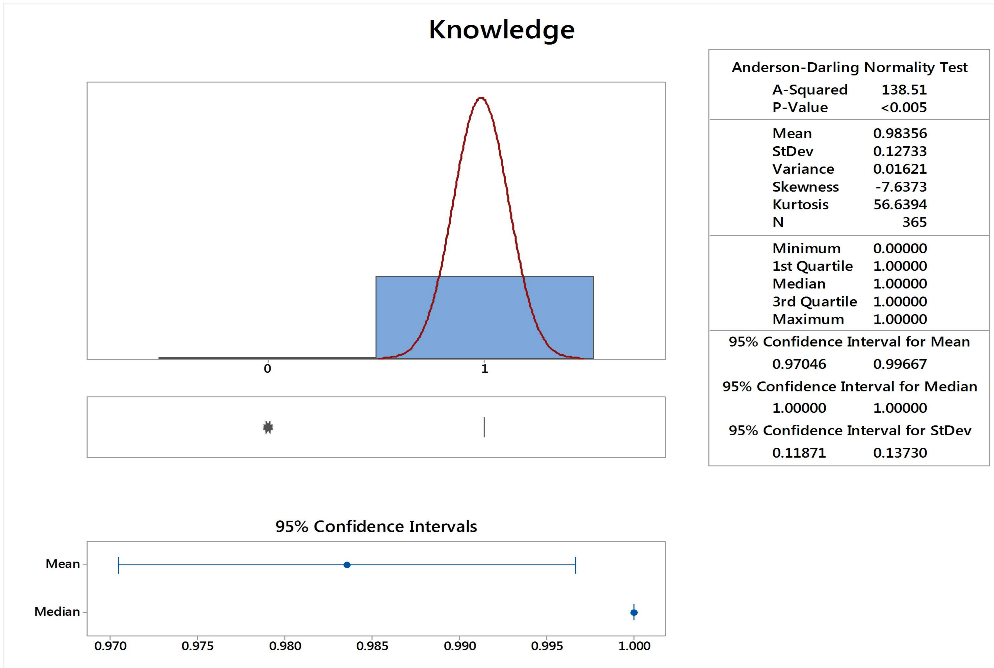

Figure 5.33: Anderson-Darling normality test graph for employee involvement

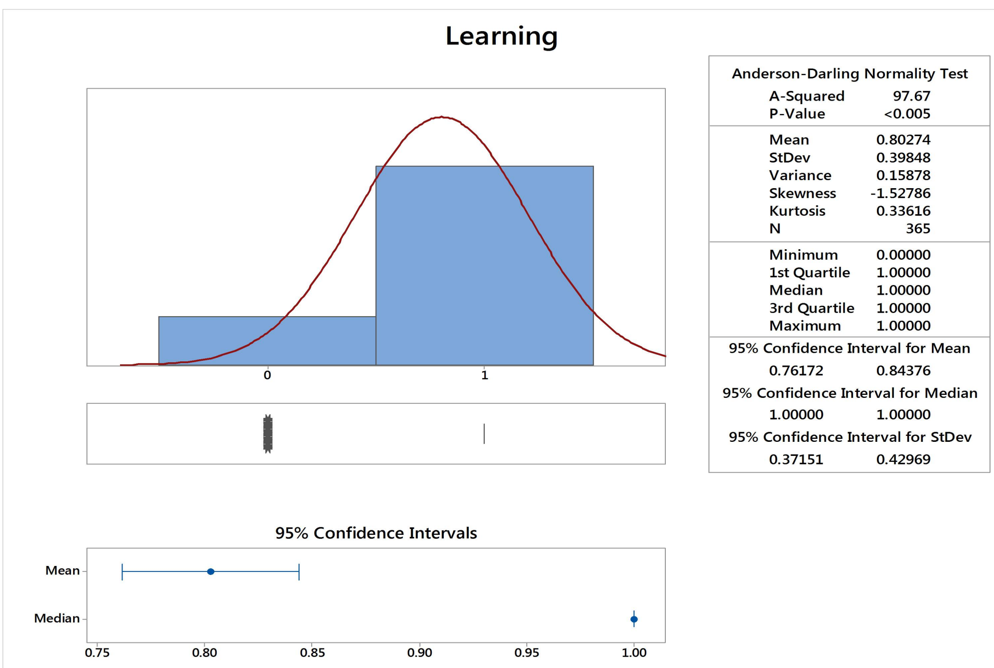

Figure 5.34: Anderson-Darling normality test graph for employee empowerment

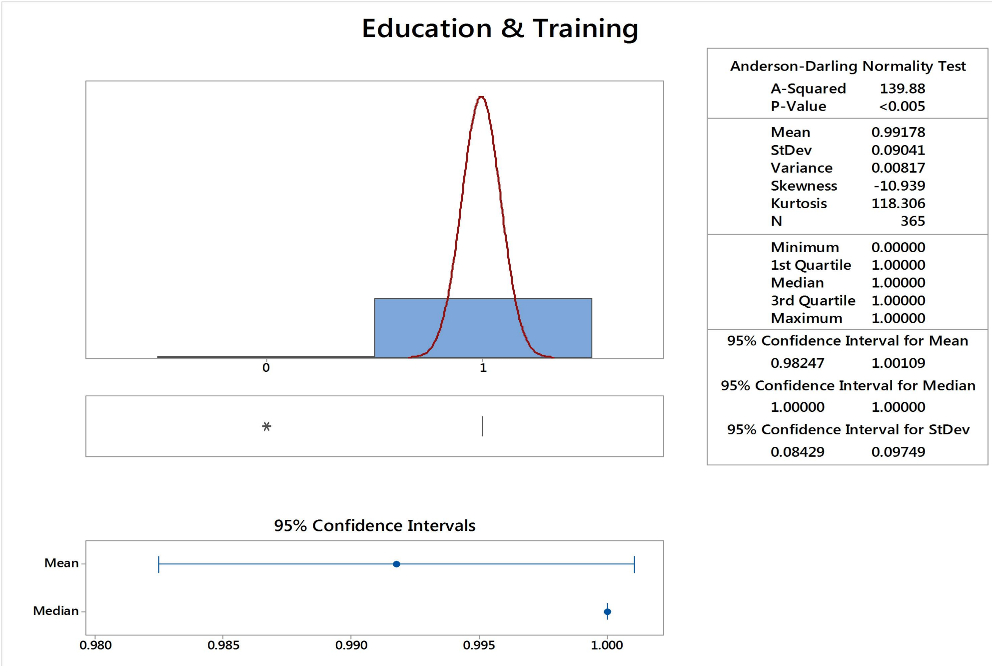

Figure 5.35: Anderson-Darling normality test graph for rewards & recognition

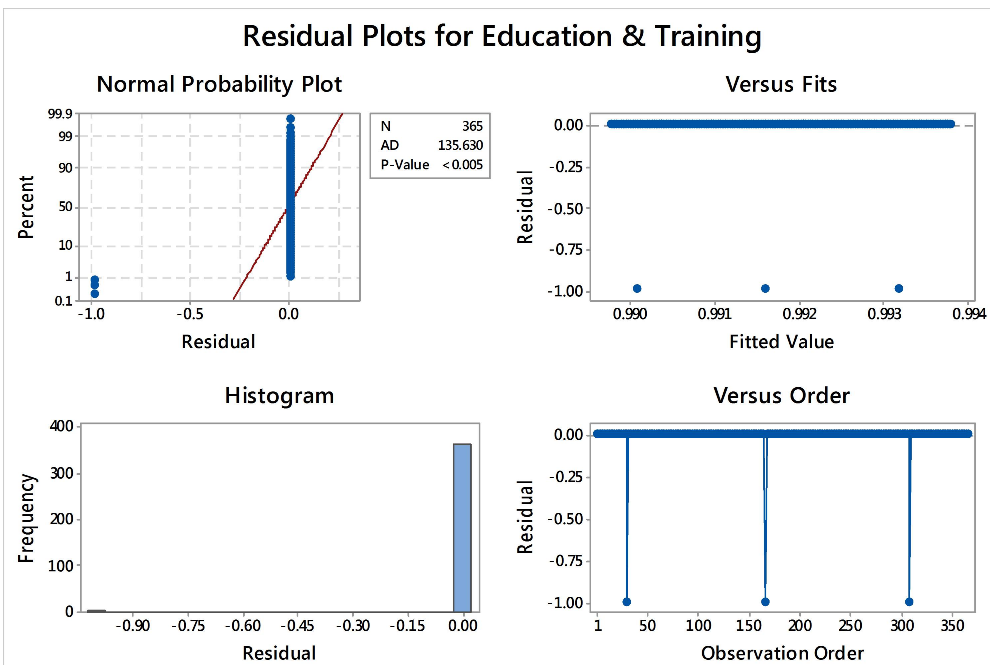

Figure 5.36: Anderson-Darling normality test graph for team work

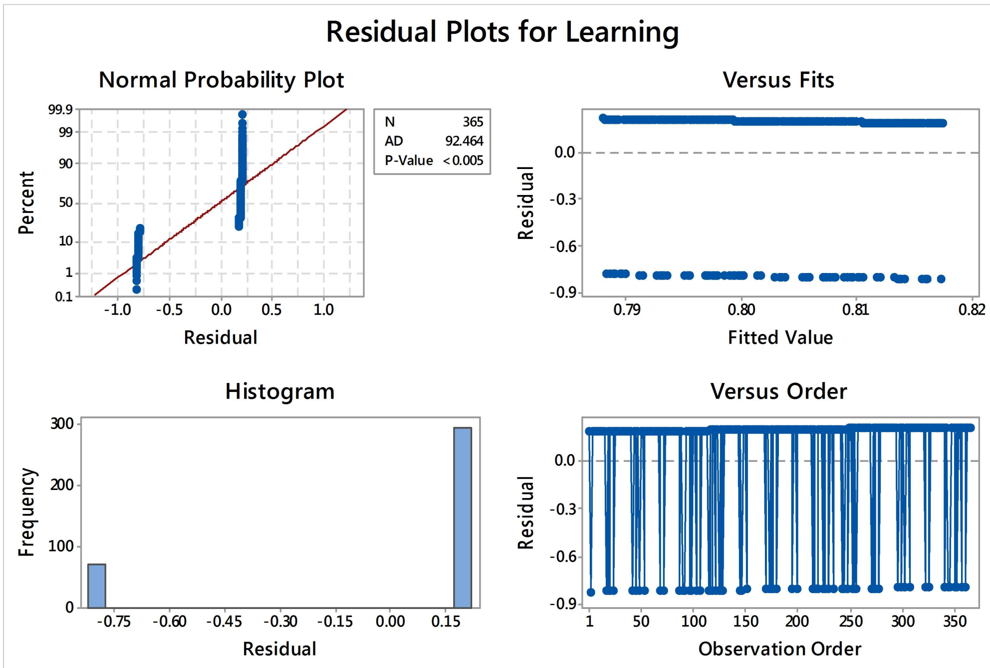

Figure 5.37: Residual plots for employee involvement

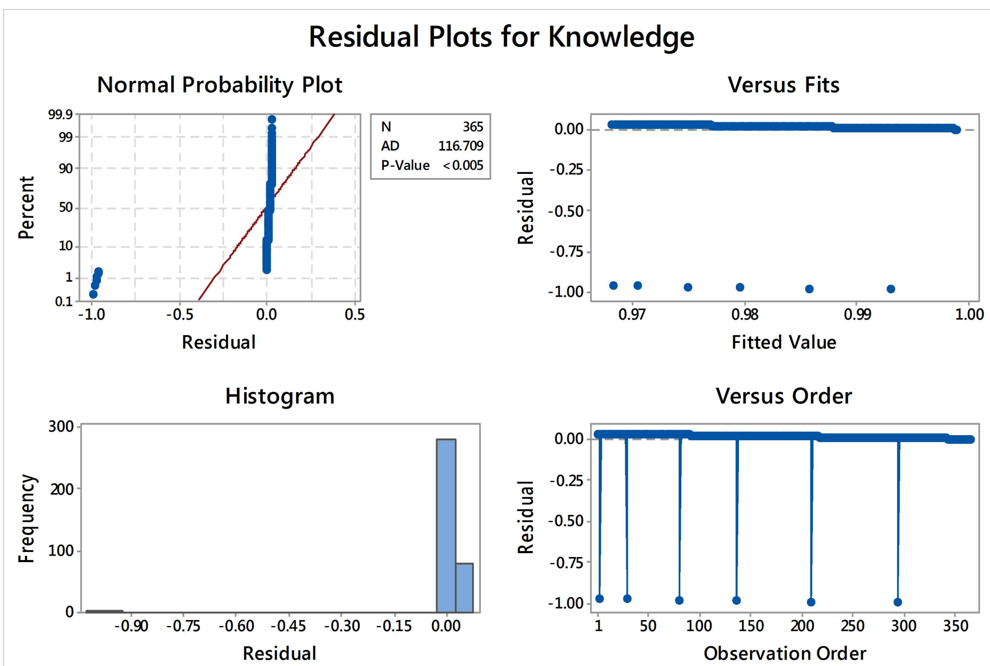

Figure 5.38: Residual plots for employee empowerment

Table 5.21: Descriptive statistics for training and education factors

Variable	**Count**	**N**	**N***	**Cum N**	**%**	**Cum Pct**	**Mean**	**SE Mean**	**Tr Mean**	**Std. Dev**	**V**
D61	365	365	0	365	100	100	0.80	0.02	0.83	0.39	0.15
D62	365	365	0	365	100	100	0.98	0.01	1	0.12	0.02
D63	365	365	0	365	100	100	0.99	0.01	1	0.09	0.1
Variable	**CoefVar**	**Sum**	**SS**	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Range**		
D61	49.64	293	293	0	1	1	1	1	1		
D62	12.95	359	359	0	1	1	1	1	1		
D63	9.12	362	362	0	1	1	1	1	1		
Variable	**Inter Quartile Range**	**Mode**	**Mode**	**Skew-ness**	**Kurt-osis**	**MSSD**					
D61	0	1	293	-1.53	0.34	0.159					
D62	0	1	359	-7.64	56.64	0.0164					
D63	0	1	362	-10.94	118.31	0.0082					

Table 5.22: Correlation matrix between training and education factors

	D61	D62
D62	-0.064	0.222
D63	-0.045	-0.012
	0.390	0.823

Table 5.23: Covariance matrix between training and education factors

Variable	D61	D62	D63
D61	0.15878368		
D62	-0.00325154	0.01621255	
D63	-0.00162577	-0.00013548	0.00817402

5.3.7 Hypothesis-VII

Statement: Performance of TQM is positively related with Quality Information/Information Quality (D_7) factors (a) Quality data and reporting (D_{71}) (b) Internal quality in-

Table 5.24: Test and CI for One Proportion: D61, D62, D63

Test of p = 0.05 vs p ≠ 0.05						
Event = 1						
Variable	X	N	Sample p	95% CI	Z-Value	P-Value
D61	293	365	0.80274	(0.761916, 0.843563)	65.98	0
D62	359	365	0.983562	(0.970517, 0.996606)	81.84	0
D63	362	365	0.991781	(0.982518, 1.000000)	82.56	0
Using the normal approximation.						

formation usage (D_{72}).

(H_0): *TQM is not positively related with Quality Information/Information Quality factors (a) Quality data and reporting (b) Internal quality information usage.*

(H_a): *TQM is positively related with Quality Information/Information Quality factors (a) Quality data and reporting (b) Internal quality information usage.*

After developing null and alternative hypothesizes, Anderson-darling normality test has been carried out. The results of that test are shown in Fig. 5.39 and 5.40. The results confirmed that the p-value for all four factors is less than 0.05 and rejected the null hypothesis. Figure 5.41 and 5.42 shows the residual plots for all four factors. All tests were performed at 95% confidence intervals. Tables 5.25, 5.26 & 5.27 contain the results of descriptive statistical analysis, correlation matrix and co-variance matrix for Quality Information factors.Table 5.28 contains Test and CI for one proportion: D71, D72 for Quality Information factors.

5.3.8 Hypothesis-VIII

Statement: Performance of TQM is positively related with Strategic quality planning (E_1) factors (a) Quality policy (E_{11})(b)Quality planning (E_{12}) (c) Vision & plan statement (E_{13}).

(H_0): *TQM is not positively related with Strategic quality planning factors (a) Quality policy (b) Quality planning (c) Vision & plan statement*

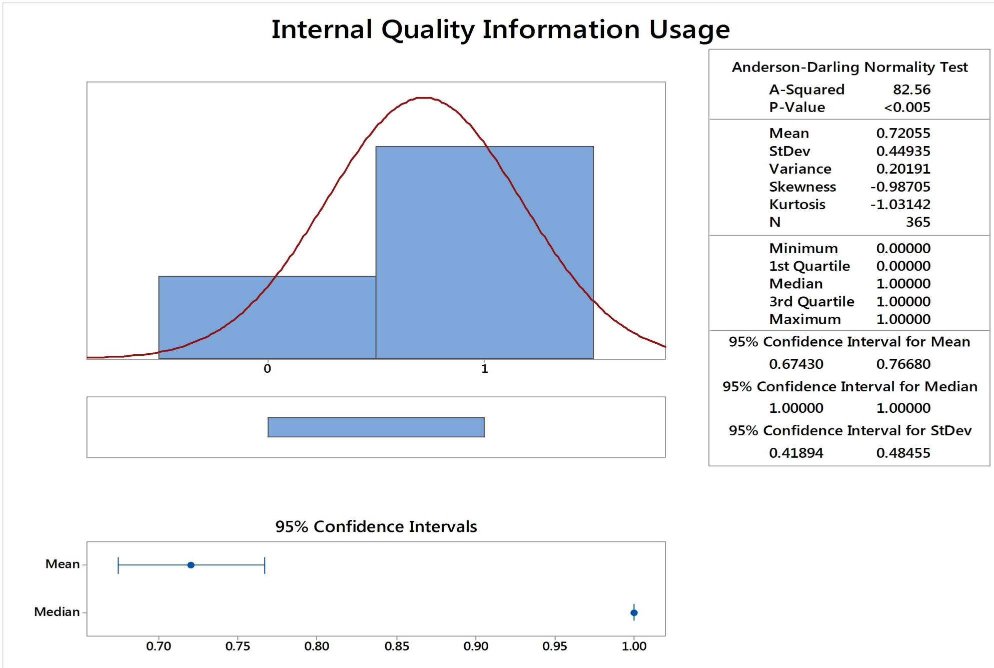

Figure 5.39: Anderson-Darling normality test graph for employee involvement

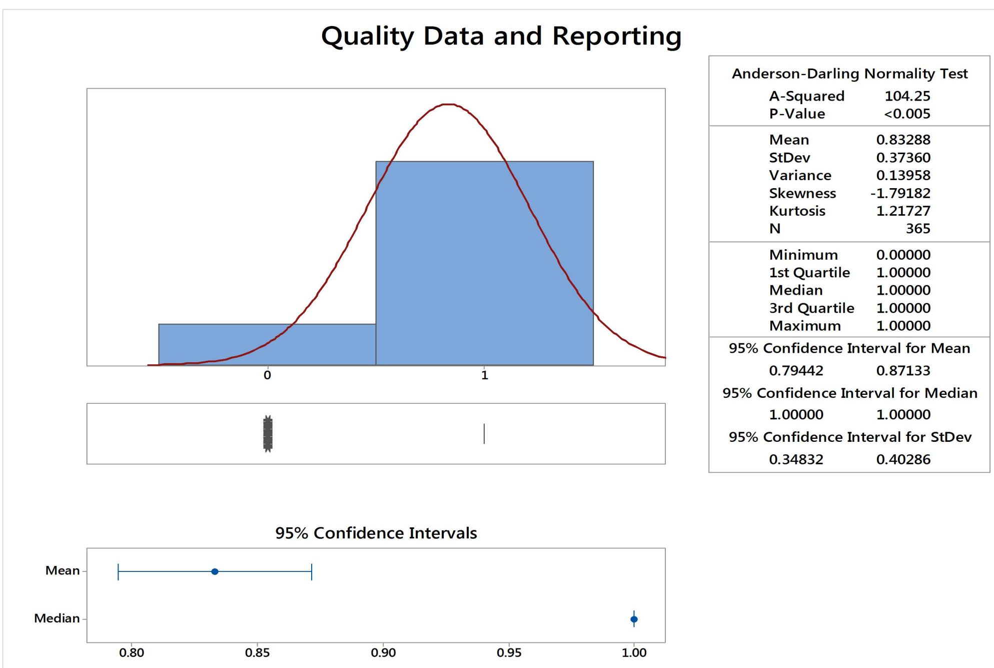

Figure 5.40: Anderson-Darling normality test graph for employee empowerment

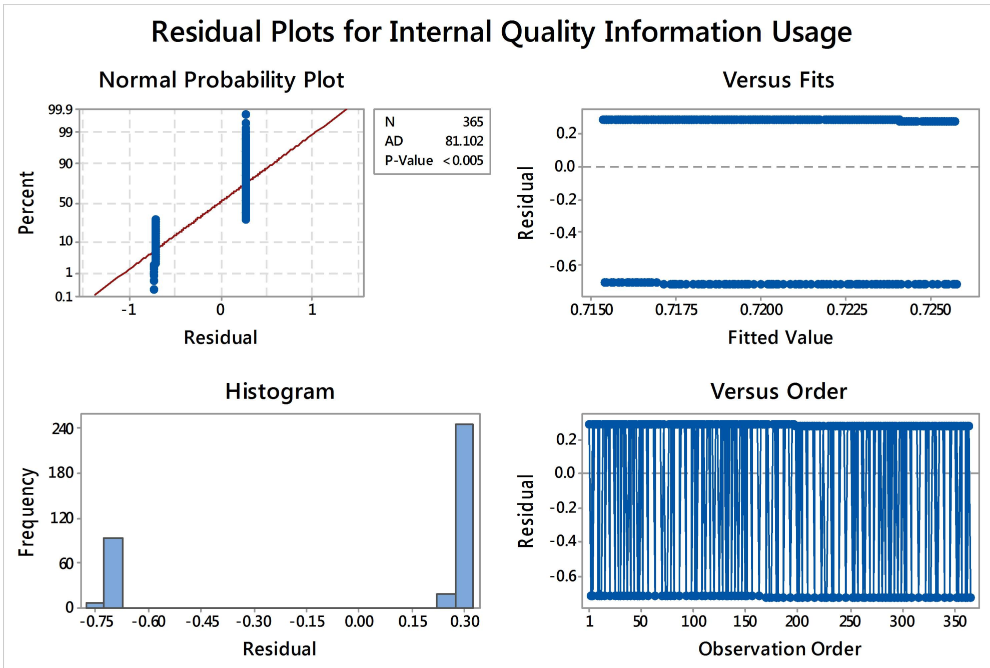

Figure 5.41: Anderson-Darling normality test graph for rewards & recognition

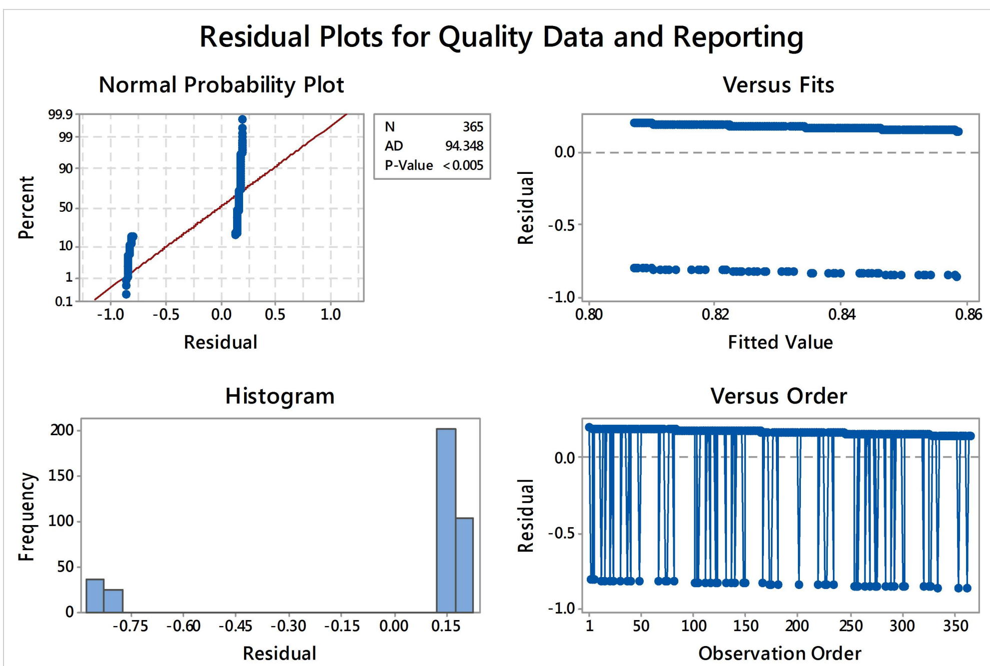

Figure 5.42: Anderson-Darling normality test graph for team work

Table 5.25: Descriptive statistics for quality information factors

Variable	**Count**	**N**	**N***	**Cum N**	**%**	**Cum Pct**	**Mean**	**SE Mean**	**Tr Mean**	**Std. Dev**	**V**
D71	365	365	0	365	100	100	0.83	0.02	0.87	0.37	0.14
D72	365	365	0	365	100	100	0.72	0.02	0.74	0.44	0.20
Variable	**CoefVar**	**Sum**	**SS**	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Range**		
D71	44.86	304	304	0	1	1	1	1	1		
D72	62.36	263	263	0	1	1	1	1	1		
Variable	**Inter Quartile Range**	**Mode**	**Mode**	**Skew-ness**	**Kurt-osis**	**MSSD**					
D71	0	1	304	-1.79	1.22	0.123					
D72	0	1	263	-0.99	-1.03	0.2486					

Table 5.26: Correlation matrix between quality information factors

Pearson correlation of E71 and E72 = 0.376
P-Value = 0.000

Table 5.27: Covariance matrix between quality information factors

Variable	D71	D72
D71	0.139575	
D72	0.063059	0.201912

Table 5.28: Test and CI for One Proportion: D71, D72

Test of p = 0.05 vs p ≠ 0.05						
Event = 1						
Variable	X	N	Sample p	95% CI	Z-Value	P-Value
D71	304	365	0.832877	(0.794602, 0.871151)	68.63	0
D72	263	365	0.720548	(0.674513, 0.766583)	58.78	0
Using the normal approximation.						

(H_a): *TQM is positively related with Strategic quality planning factors (a) Quality policy (b) Quality planning (c) Vision & plan statement*

After developing null and alternative hypothesizes, Anderson-darling normality test has been carried out. The results of that test are shown in Fig. 5.43, 5.44 and 5.45. The results confirmed that the p-value for all four factors is less than 0.05 and rejected the null hypothesis. Figure 5.46, 5.47 and 5.48 shows the residual plots for all four factors. All tests were performed at 95% confidence intervals. Tables 5.29, 5.30 & 5.31 contain the results of descriptive statistical analysis, correlation matrix and co-variance matrix for Strategic quality planning factors.Table 5.32 contains Test and CI for one proportion: E11, E12, E13 for Strategic quality planning factors.

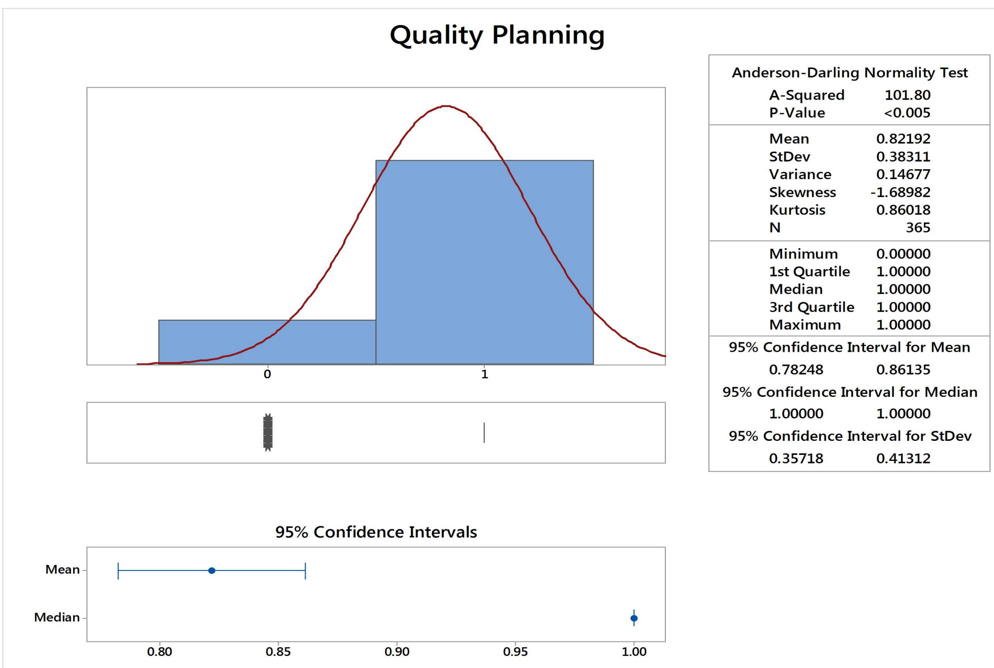

Figure 5.43: Anderson-Darling normality test graph for employee involvement

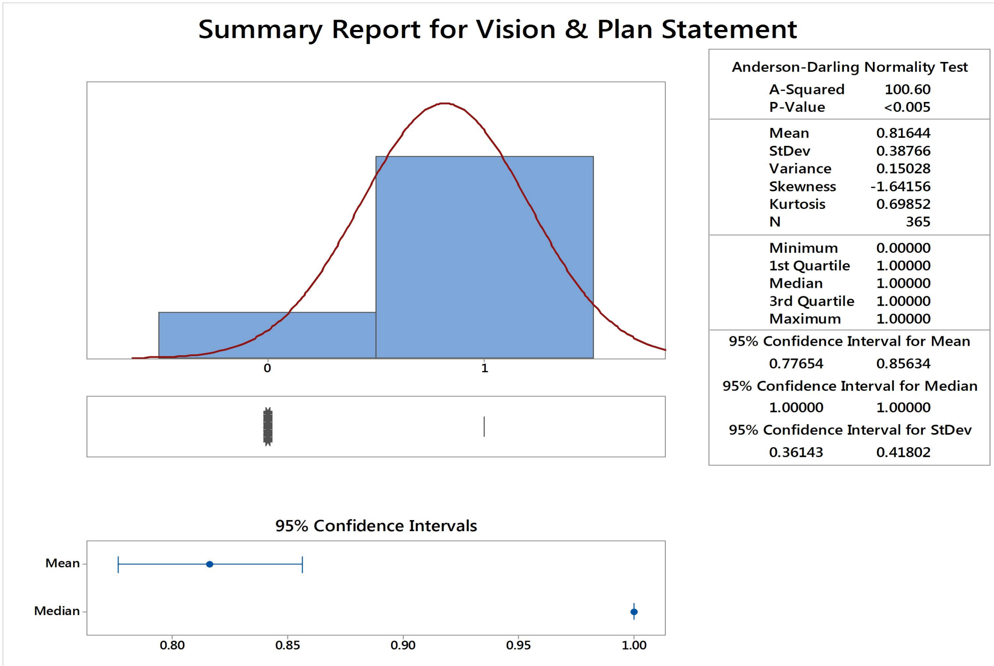

Figure 5.44: Anderson-Darling normality test graph for employee empowerment

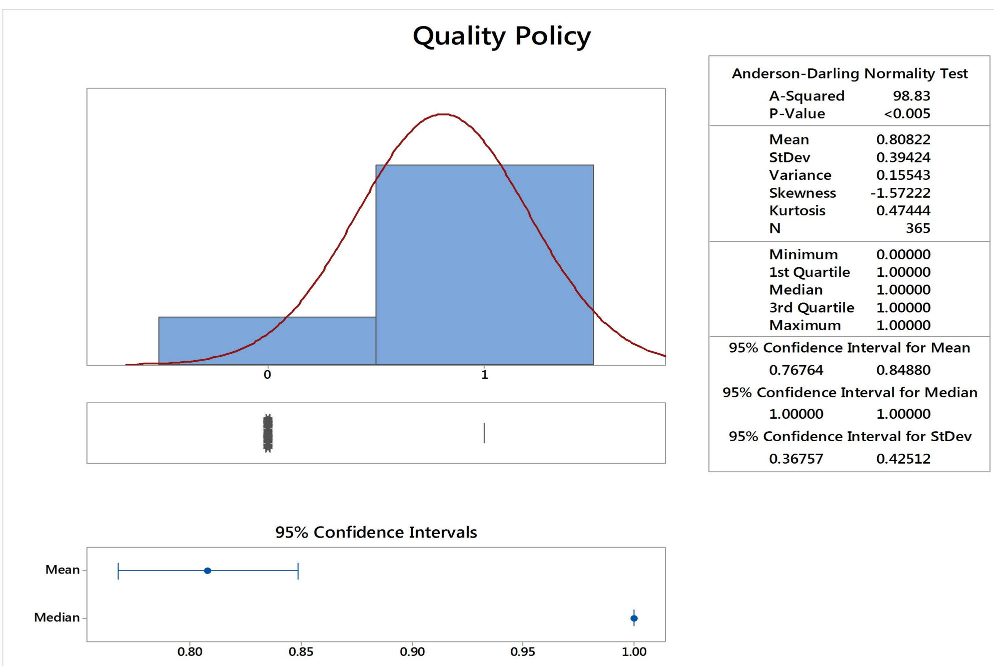

Figure 5.45: Anderson-Darling normality test graph for rewards & recognition

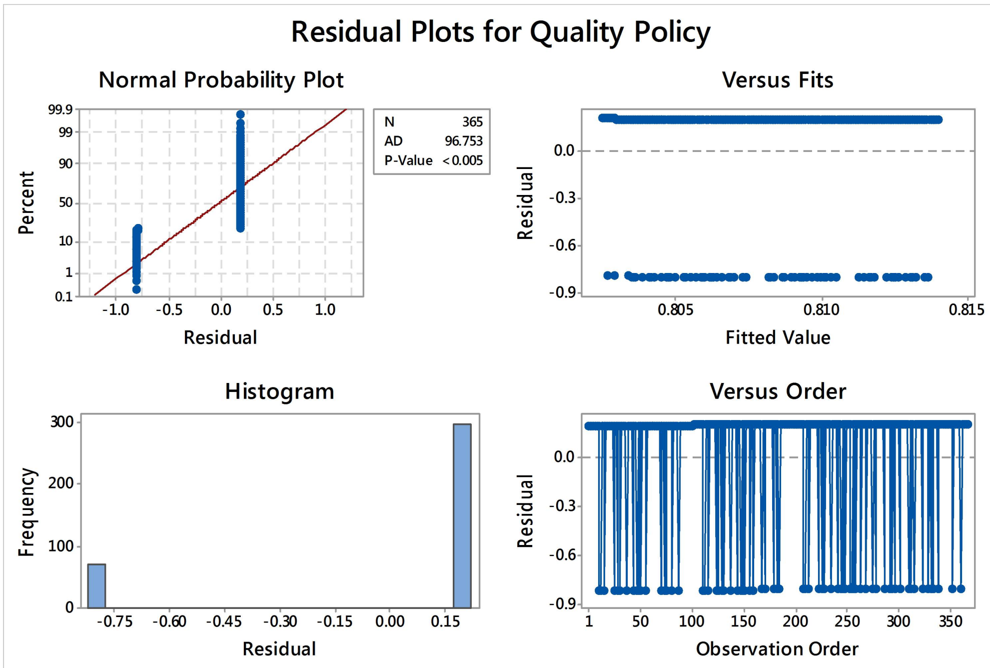

Figure 5.46: Anderson-Darling normality test graph for team work

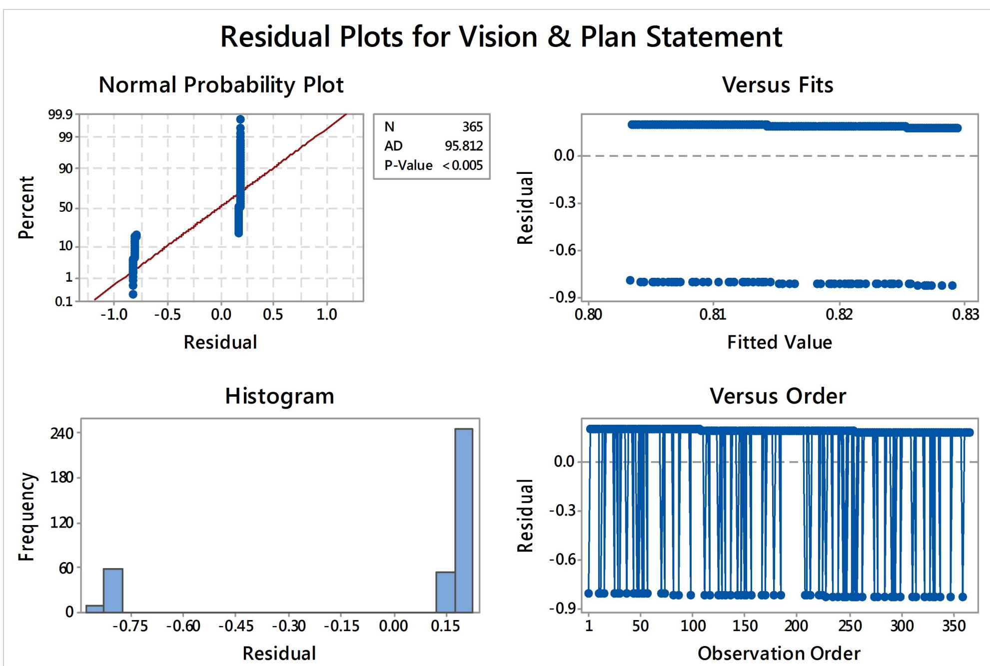

Figure 5.47: Residual plots for employee involvement

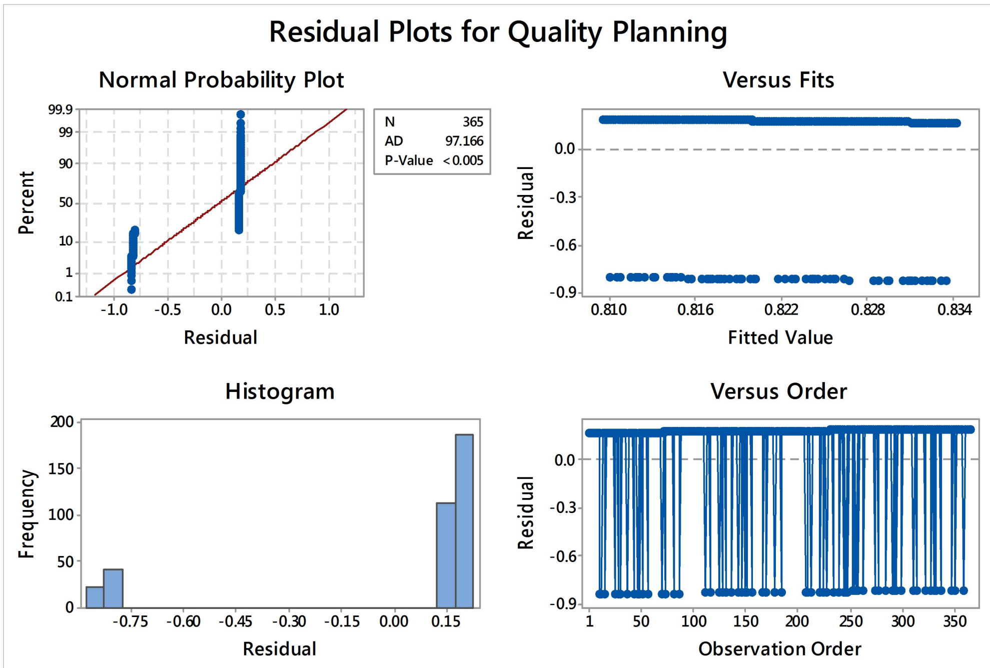

Figure 5.48: Residual plots for employee empowerment

5.3.9 Hypothesis-IX

Statement: Performance of TQM is positively related with Culture and communication (E_2) factors (a) Trust (E_{21}) and (b) Cultural change (E_{22}).

(H_0): *TQM is not positively related with Culture and communication factors (a) Trust (b) Cultural change*

(H_a): *TQM is positively related with Culture and communication factors (a) Trust (b) Cultural change*

After developing null and alternative hypothesizes, Anderson-darling normality test has been carried out. The results of that test are shown in Fig. 5.49 and 5.50. The results confirmed that the p-value for all four factors is less than 0.05 and rejected the null hypothesis. Figure 5.51 and 5.52 shows the residual plots for all four factors. All tests were performed at 95% confidence intervals. Tables 5.33, 5.34 & 5.35 contain the results of descriptive statistical analysis, correlation matrix and co-variance matrix for factors of Culture and communication. Table 5.36 contains test and CI

Table 5.29: Descriptive statistics for strategic quality planning

Variable	**Count**	**N**	**N***	**Cum N**	**%**	**Cum Pct**	**Mean**	**SE Mean**	**Tr Mean**	**Std. Dev**	**V**
E11	365	365	0	365	100	100	0.80	0.02	0.084	0.39	0.15
E12	365	365	0	365	100	100	0.82	0.02	0.85	0.38	0.14
E13	365	365	0	365	100	100	0.81	0.02	0.85	0.38	0.15
Variable	**CoefVar**	**Sum**	**SS**	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Range**		
E11	48.78	295	295	0	1	1	1	1	1		
E12	46.61	300	300	0	1	1	1	1	1		
E13	47.48	298	298	0	1	1	1	1	1		
Variable	**Inter Quartile Range**	**Mode**	**Mode**	**Skew-ness**	**Kurt-osis**	**MSSD**					
E11	0	1	295	-1.57	0.47	0.1813					
E12	0	1	300	-1.69	0.86	0.1676					
E13	0	1	298	-1.64	0.70	0.1717					

Table 5.30: Correlation matrix between strategic quality planning

	E11	**E12**
E12	0.937	
E13	0.901	0.963

Table 5.31: Covariance matrix between strategic quality planning

Variable	E11	E12	E13
E11	0.155427		
E12	0.141578	0.146771	
E13	0.137777	0.143045	0.150278

for one proportion: E21, E22 for culture and communication factors.

Table 5.32: Test and CI for One Proportion: E11, E12, E13

Test of p = 0.05 vs p ≠ 0.05						
Event = 1						
Variable	X	N	Sample p	95% CI	Z-Value	P-Value
E11	295	365	0.808219	(0.767830, 0.848609)	66.47	0
E12	300	365	0.821918	(0.782669, 0.861167)	67.67	0
E13	298	365	0.816438	(0.776723, 0.856153)	67.19	0
Using the normal approximation.						

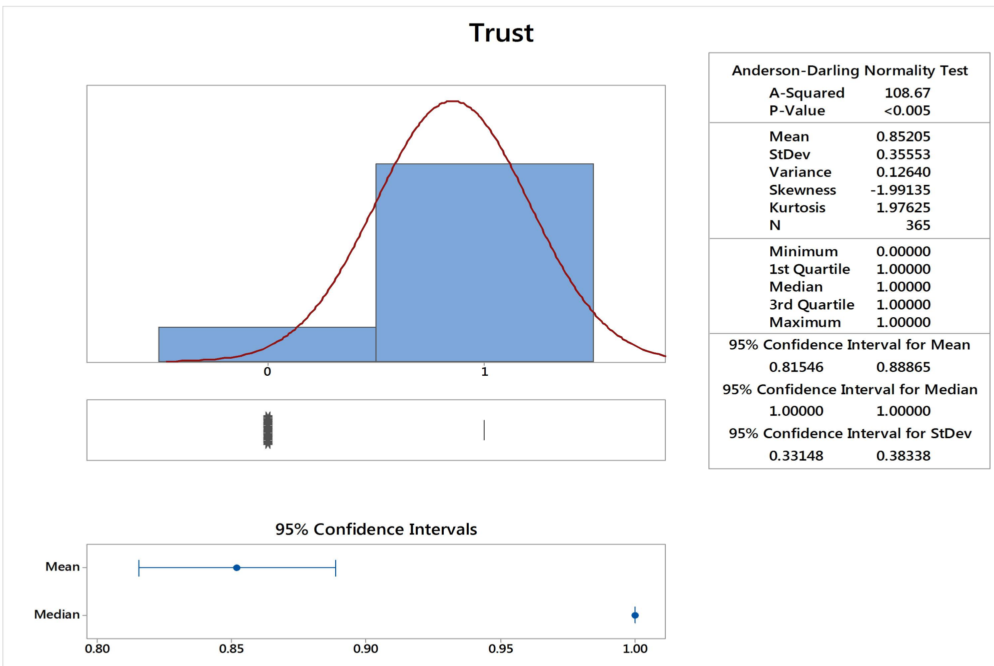

Figure 5.49: Anderson-Darling normality test graph for cultural changes

5.3.10 Hypothesis-X

Statement: Performance of TQM is positively related with Benchmarking (E_3) (a) Competitors (E_{31}).

(H_0): *TQM is not positively related with Benchmarking (a) Competitors*

(H_a): *TQM is positively related with Benchmarking (a) Competitors*

After developing null and alternative hypothesizes, Anderson-darling normality test

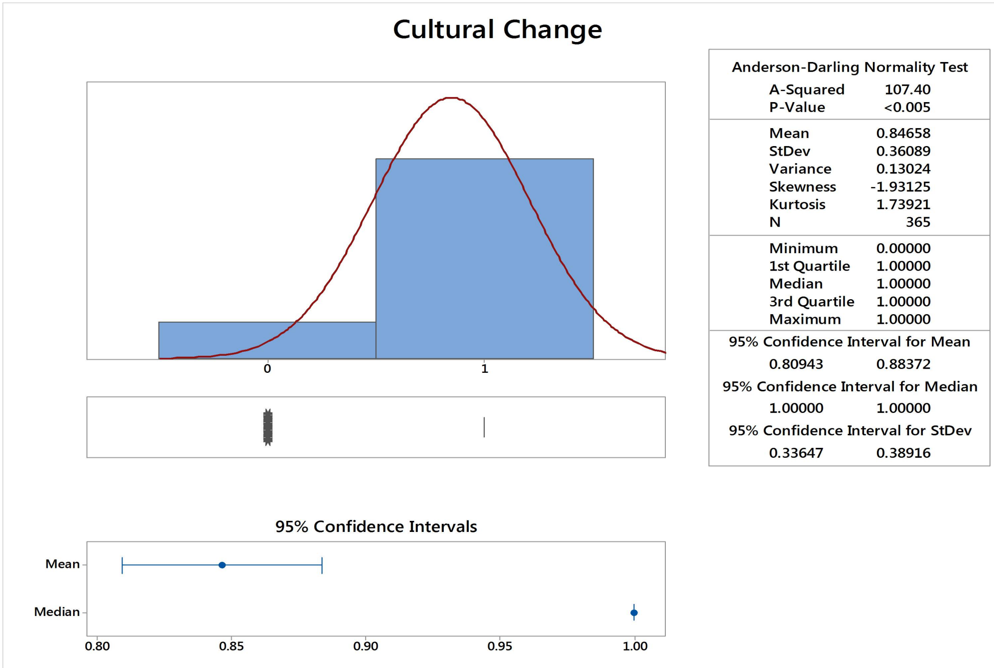

Figure 5.50: Anderson-Darling normality test graph for trust

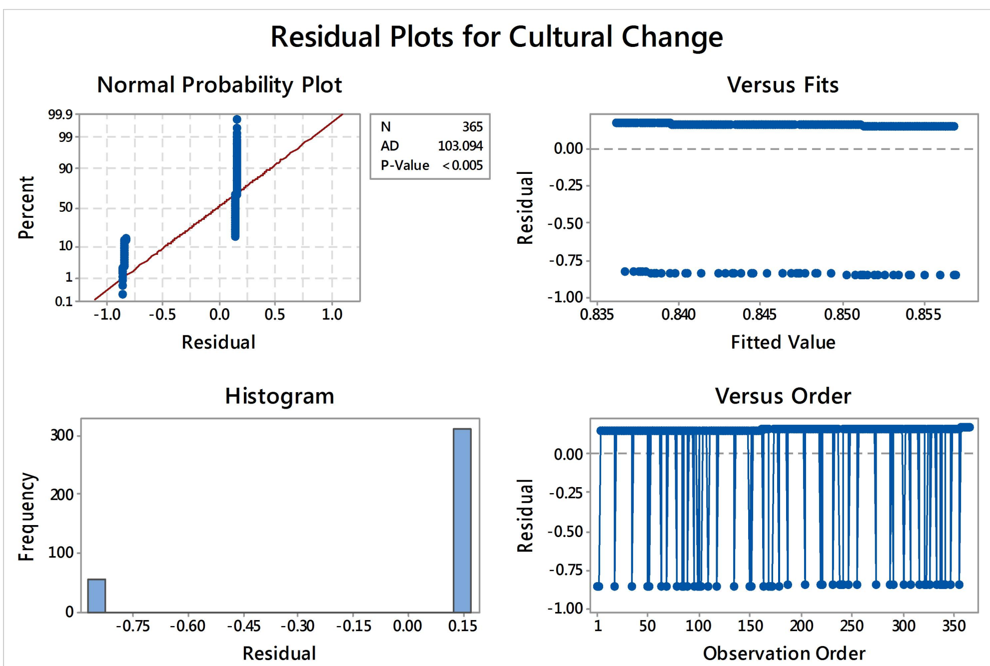

Figure 5.51: Residual plots for cultural changes

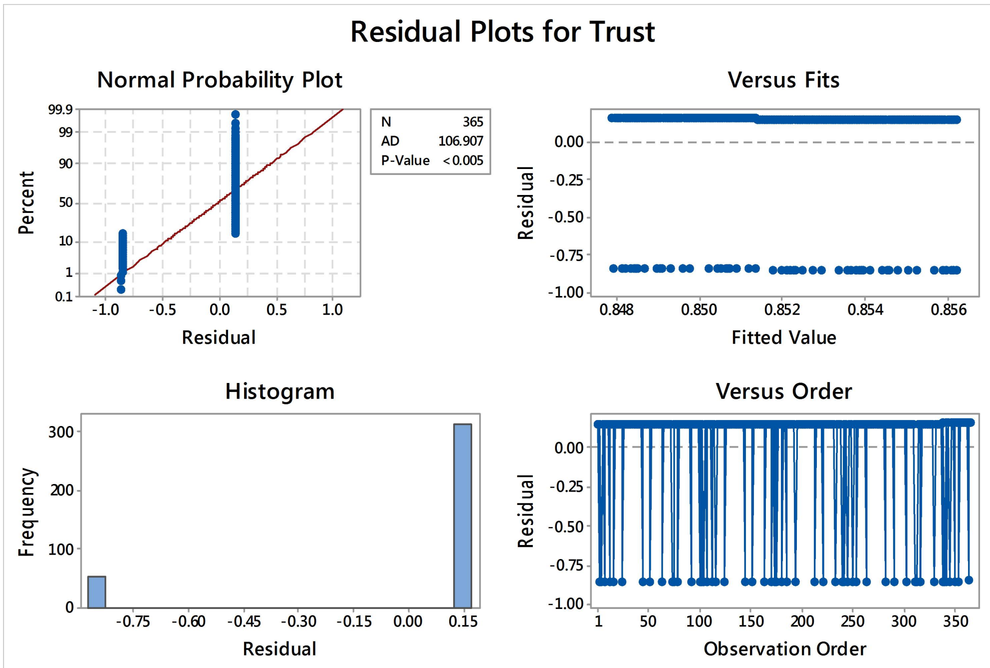

Figure 5.52: Residual plots for trust

has been carried out. The results of that test are shown in Fig. 5.53. The results confirmed that the p-value for all four factors is less than 0.05 and rejected the null hypothesis. Figure 5.54 shows the residual plots for all four factors. All tests were performed at 95% confidence intervals. Table 5.37 contains the results of descriptive statistical analysis for factor Benchmarking.

5.3.11 Hypothesis-XI

Statement: Performance of TQM is positively related with Social and environmental responsibility (E_4) factors (a) wider community (E_{41}) and (b) Quality citizenship (E_{42}).

(H_0): *TQM is not positively related with Social and environmental responsibility factors (a) wider community (b) Quality citizenship*

(H_a): *TQM is positively related with Social and environmental responsibility factors (a) wider community (b) Quality citizenship*

Table 5.33: Descriptive statistics for culture and communication factors

Variable	**Count**	**N**	**N***	**Cum N**	**%**	**Cum Pct**	**Mean**	**SE Mean**	**Tr Mean**	**Std. Dev**	**V**
E21	365	365	0	365	100	100	0.85	0.01	0.89	0.35	0.12
E22	365	365	0	365	100	100	0.84	0.01	0.88	0.36	0.13
Variable	**CoefVar**	**Sum**	**SS**	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Range**		
E21	41.73	311	311	0	1	1	1	1	1		
E22	42.63	309	309	0	1	1	1	1	1		
Variable	**Inter Quartile Range**	**Mode**	**Mode**	**Skew-ness**	**Kurt-osis**	**MSSD**					
E21	0	1	311	-1.99	1.98	0.1374					
E22	0	1	309	-1.93	1.74	0.1140					

Table 5.34: Correlation matrix between culture and communication factors

Pearson correlation of E21 and E22 = 0.015
P-Value = 0.771

Table 5.35: Covariance matrix between culture and communication factors

	E21	**E22**
E21	0.126404	
E22	0.001964	0.130242

Table 5.36: Test and CI for One Proportion: E21, E22

Test of p = 0.05 vs p ≠ 0.05						
Event = 1						
Variable	X	N	Sample p	95% CI	Z-Value	P-Value
E21	311	365	0.852055	(0.815631, 0.888479)	70.31	0
E22	309	365	0.846575	(0.809603, 0.883548)	69.83	0
Using the normal approximation.						

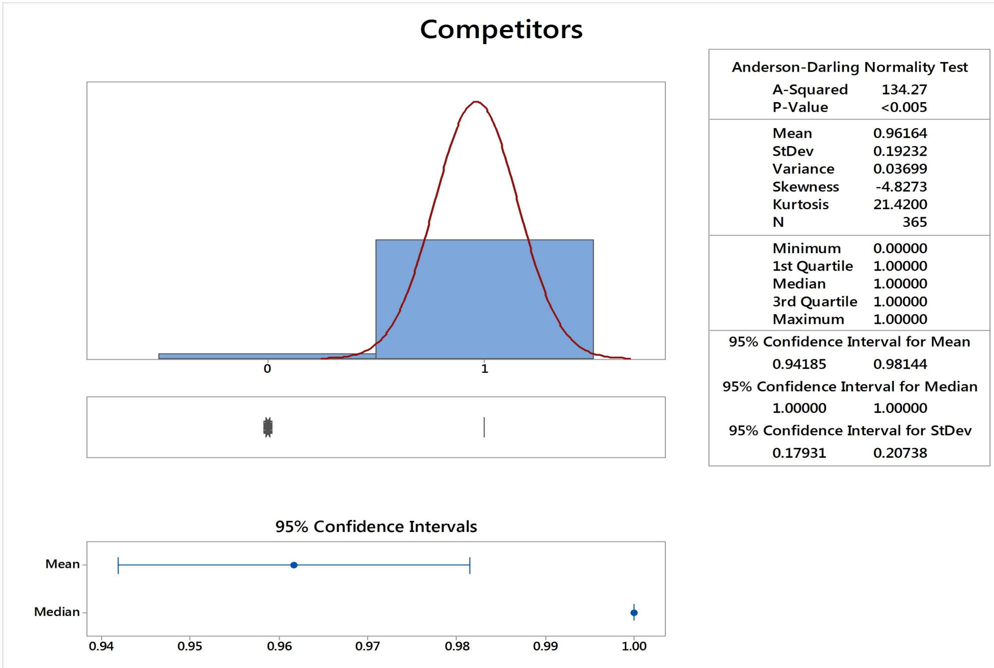

Figure 5.53: Anderson-Darling normality test graph for competitors

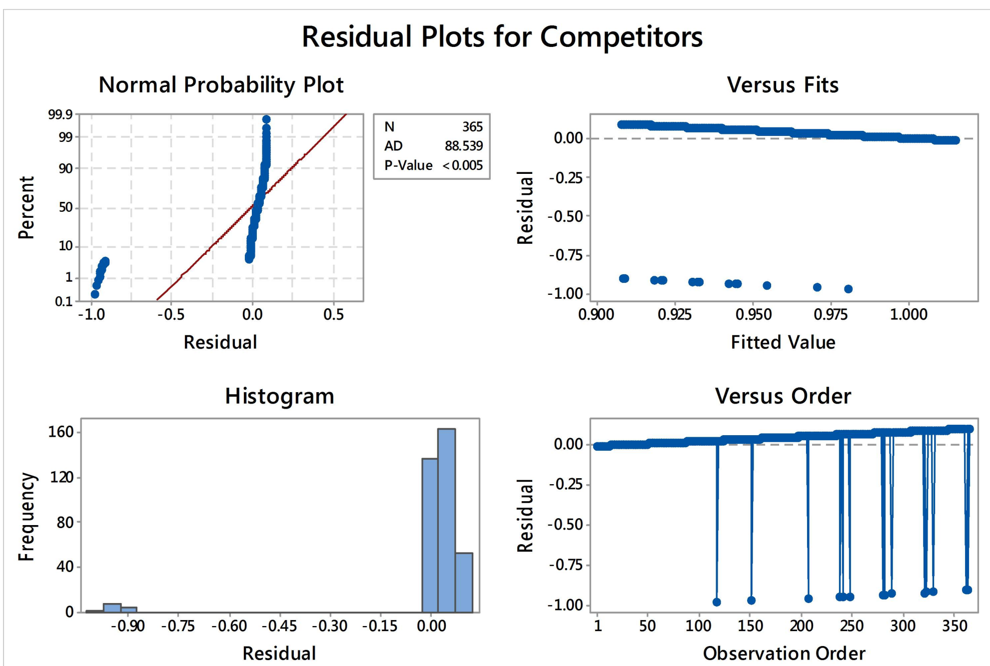

Figure 5.54: Residual plots for competitors

Table 5.37: Descriptive statistics for benchmarking factors

Variable	**Count**	**N**	**N***	**Cum N**	**%**	**Cum Pct**	**Mean**	**SE Mean**	**Tr Mean**	**Std. Dev**	**V**
E31	365	365	0	365	100	100	0.96	0.01	1	0.19	0.03
Variable	**CoefVar**	**Sum**	**SS**	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Range**		
E31	20	351	351	0	1	1	1	1	1		
Variable	**Inter Quartile Range**	**Mode**	**Mode**	**Skew-ness**	**Kurt-osis**	**MSSD**					
E31	0	1	351	-4.83	21.42	0.03					

After developing null and alternative hypothesizes, Anderson-darling normality test has been carried out. The results of that test are shown in Fig. 5.55 and 5.56. The results confirmed that the p-value for all four factors is less than 0.05 and rejected the null hypothesis. Figure 5.57 and 5.58 shows the residual plots for all four factors. All tests were performed at 95% confidence intervals. Tables 5.38, 5.39 & 5.40 contain the results of descriptive statistical analysis, correlation matrix and co-variance matrix for Social and environmental responsibility factors. Table 5.41 contains Test and CI for one proportion: E41, E42 for social and environmental responsibility factors.

5.3.12 Hypothesis-XII

Statement: Performance of TQM is positively related with Innovation (E_5) factor (a) Product innovation (E_{51}).

(H_0)*: TQM is not positively related with Innovation factor (a) Product innovation*

(H_a)*: TQM is positively related with with Innovation factor (a) Product innovation*

After developing null and alternative hypothesizes, Anderson-darling normality test has been carried out. The results of that test are shown in Fig. 5.59. The results confirmed that the p-value for all four factors is less than 0.05 and rejected the null

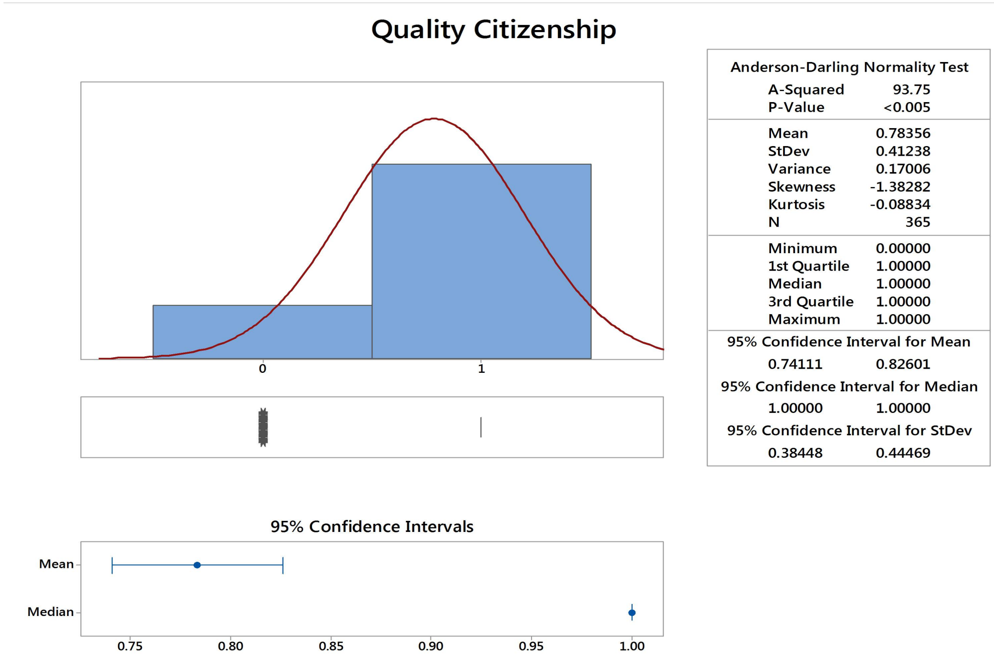

Figure 5.55: Anderson-Darling normality test graph for quality citizenship

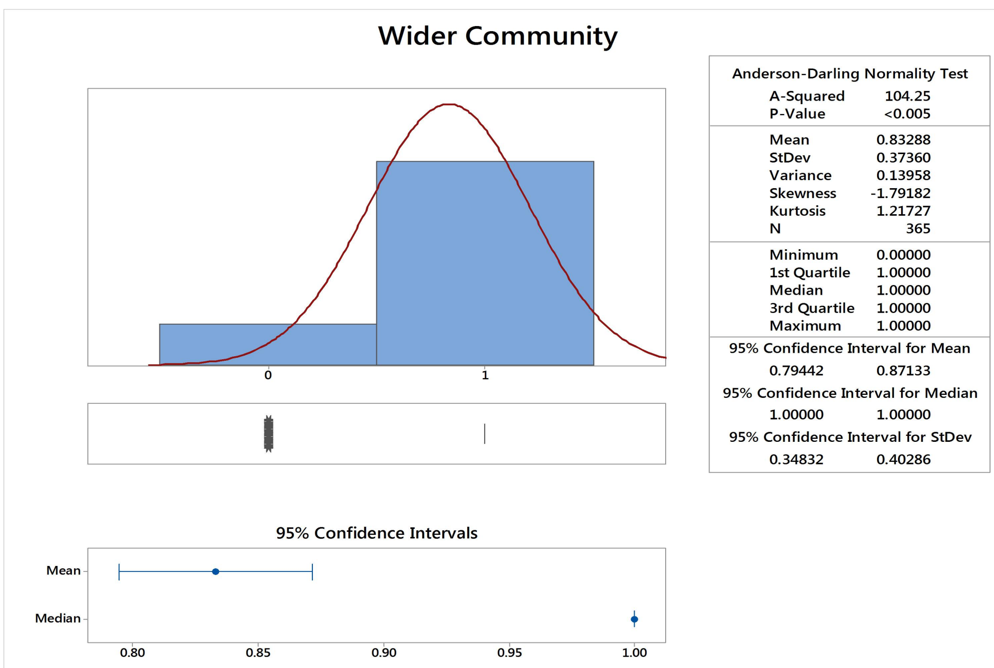

Figure 5.56: Anderson-Darling normality test graph for wider community

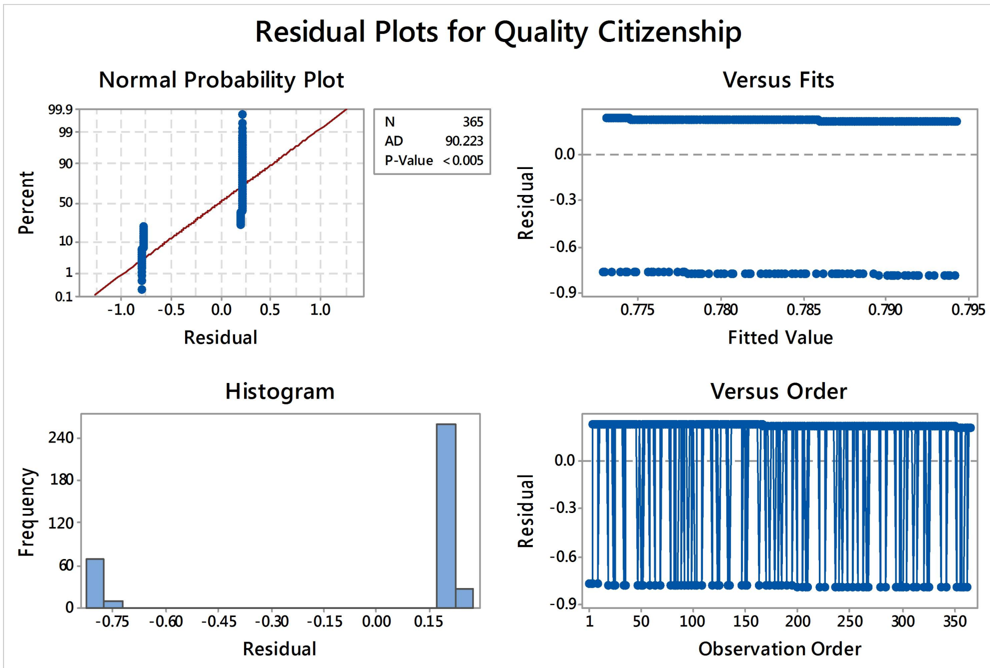

Figure 5.57: Residual plots for quality citizenship

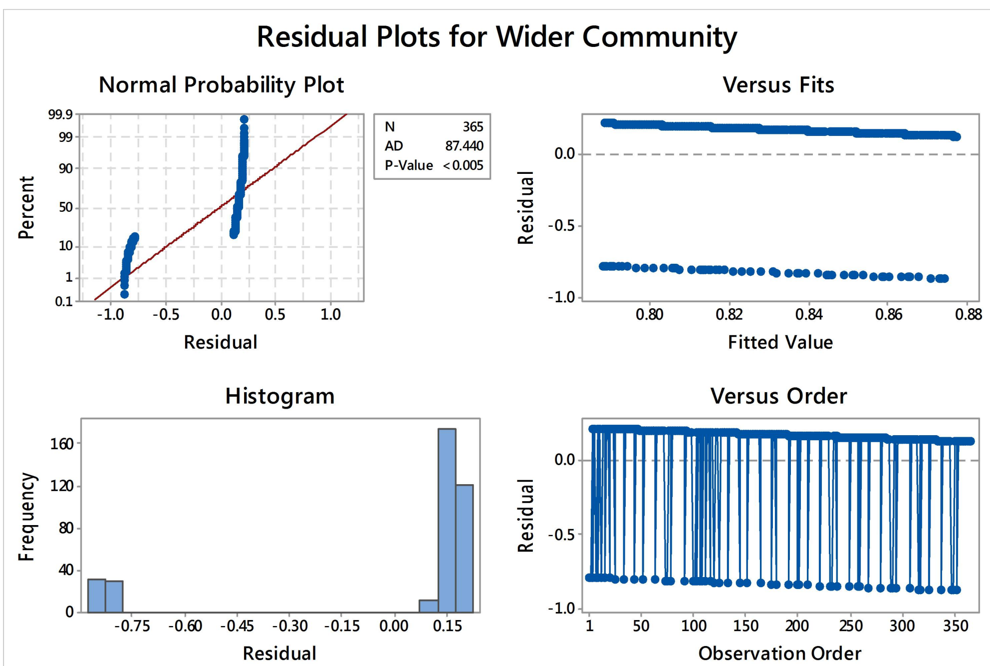

Figure 5.58: Residual plots for wider community

Table 5.38: Descriptive statistics for social and environmental responsibility factors

Variable	**Count**	**N**	**N***	**Cum N**	**%**	**Cum Pct**	**Mean**	**SE Mean**	**Tr Mean**	**Std. Dev**	**V**
E41	365	365	0	365	100	100	0.83	0.02	0.87	0.37	0.14
E42	365	365	0	365	100	100	0.78	0.02	0.81	0.41	0.17

Variable	**CoefVar**	**Sum**	**SS**	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Range**
E41	44.86	304	304	0	1	1	1	1	1
E42	52.63	286	286	0	1	1	1	1	1

Variable	**Inter Quartile Range**	**Mode**	**Mode**	**Skew-ness**	**Kurt-osis**	**MSSD**
E41	0	1	304	-1.79	1.22	0.136
E42	0	1	286	-1.38	-0.09	0.1909

Table 5.39: Correlation matrix between social and environmental responsibility factors

Pearson correlation of E41 and E42 = -0.004
P-Value = 0.945

Table 5.40: Covariance matrix between social and environmental responsibility factors

	E41	**E42**
E41	0.139575	
E42	-0.00056	0.170059

hypothesis. Figure 5.60 shows the residual plots for all four factors. All tests were performed at 95% confidence intervals. Table 5.42 contains the results of descriptive statistical analysis for product innovation factor.

Table 5.41: Test and CI for One Proportion: E41, E42

Test of p = 0.05 vs p ≠ 0.05						
Event = 1						
Variable	X	N	Sample p	95% CI	Z-Value	P-Value
E41	304	365	0.832877	(0.794602, 0.871151)	68.63	0
E42	286	365	0.783562	(0.741314, 0.825810)	64.3	0
Using the normal approximation.						

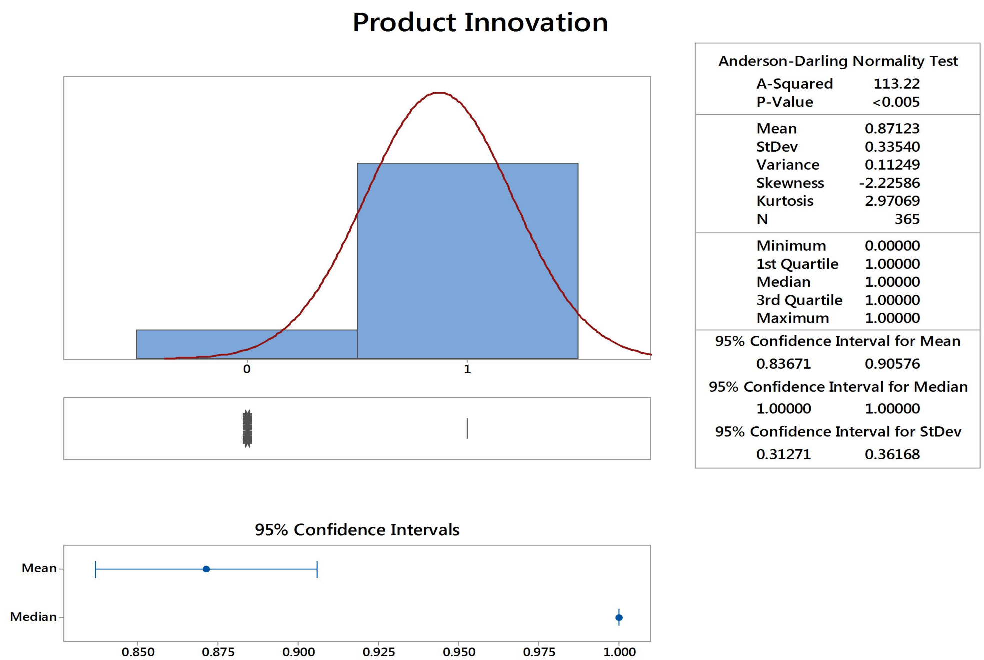

Figure 5.59: Anderson-Darling normality test graph for product innovation

5.4. Summary

In this chapter, a detailed statistical analysis for the developed hypothesizes for their testing and validation is provided. Anderson-Darling Normality test has been used for this purpose. Results indicate that all developed hypothesizes are true and all null hypothesizes are rejected. Among the tests, Anderson-Darling (AD) has been widely applied to test the normality of the data. The AD test is applied to test the

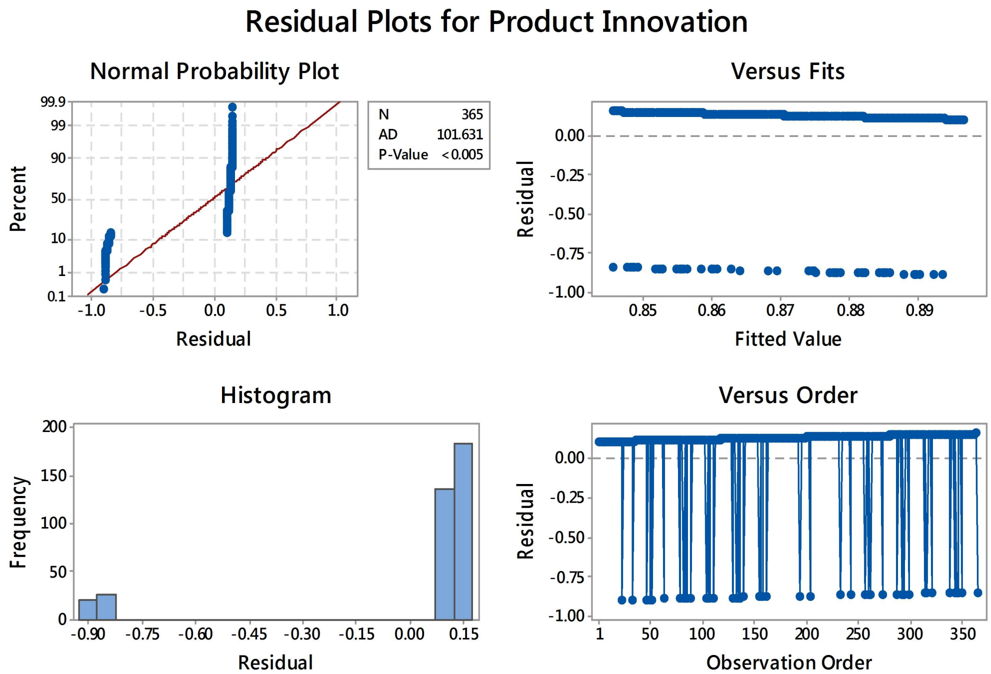

Figure 5.60: Residual plots for product innovation

null hypothesis that the data follows the normal distribution versus the alternative hypothesis that the normal distribution is not a good choice for the data. The summary of Anderson-Darling normality tests for all 12 hypothesis are tabulated in Table 5.43.

5.5. Discussion

To attain the research objectives, the study employed a mixed methods research design. For the practical investigation data were collected by employing tools such as questionnaire, key informant semi-structured interview, group discussions and observational data. The findings show that performance measurement of TQM is very limited.This study has used descriptive statistics as a method of data analysis with concurrent triangulation. Quantitative data collected through survey questionnaires have been organized and entered into the MINITAB software to result in

Table 5.42: Descriptive statistics for product innovation

Variable	Count	N	N*	Cum N	%	Cum Pct	Mean	SE Mean	Tr Mean	Std. Dev	V
E51	365	365	0	365	100	100	0.87	0.02	0.91	0.33	0.11
Variable	**CoefVar**	**Sum**	**SS**	**Min**	**Q1**	**Median**	**Q3**	**Max**	**Range**		
E51	38.5	318	318	0	1	1	1	1	1		
Variable	**Inter Quartile Range**	**Mode**	**Mode**	**Skew-ness**	**Kurt-osis**	**MSSD**					
E51	0	1	318	-2.23	2.97	0.1085					

descriptive statistics and to examine the problem under study. In addition, qualitative data gathered through focus group discussion and key informant interview were described qualitatively to corroborate the questionnaire data. MINITAB gives us a p-value with both tests, and so we can automatically compare this value to our stated alpha level without having to bother looking up values in a table.

Furthermore, this study showed that the critical success factors of TQM which were responsible for effectiveness of TQM and the performance level of TQM is not known. This poses difficulty in taking mitigation measures and measuring the performance of TQM. Hence, the consequences of critical success factors from FMCGs industries of the TQM cannot be clearly identified.

5.6 Conclusion

In this chapter, a detailed statistical analysis for the developed hypothesizes for their testing and validation is provided. Anderson-Darling Normality test has been used for this purpose. Results indicate that all developed hypothesizes are true and all null hypothesizes are rejected.

Table 5.43: Summary of Anderson-Darling normality tests for all hypothesis

S.N	**Hypothesis**	**Statistical test used**	**Result**
H1	Performance of TQM is positively related with HRM factors	Anderson-Darling Normality test and t-test	Accepted
H2	Performance of TQM is positively related with Top management commitment factors	-do-	Accepted
H3	Performance of TQM is positively related with Process management factors	-do-	Accepted
H4	Performance of TQM is positively related with Customer focus/Customer Centricity factors	-do-	Accepted
H5	Performance of TQM is positively related with Supplier partnership Supplier's management factors	-do-	Accepted
H6	Performance of TQM is positively related with Training and education factors	-do-	Accepted
H7	Performance of TQM is positively related with Quality Information factors	-do-	Accepted
H8	Performance of TQM is positively related with Strategic quality planning factors	-do-	Accepted
H9	Performance of TQM is positively related with Culture and communication factors	-do-	Accepted
H10	Performance of TQM is positively related with Benchmarking	-do-	Accepted
H11	Performance of TQM is positively related with Social and environmental responsibility factors	-do-	Accepted
H12	Performance of TQM is positively related with Innovation factor	-do-	Accepted

Chapter 6

Case Study of An Indian Fast-Moving Consumer Goods (FMCGs) Industry

6.1 Introduction

Case study is an established research design that is used extensively in a wide variety of disciplines, particularly in the industrial engineering. It is a research approach that is used to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context. Stake (1995) define "A case study is both the process of learning about the case and the product of our learning" (p.237). A case study can be defined in a variety of ways, in the words of Miles and Huberman [23] "...a phenomenon of some sort occurring in a bounded context" (p. 25). It is the the central tenet being the need to explore an event or phenomenon in depth and in its natural context. Eisenhardt, K. M. (1989) states that the case study is a research strategy which focuses on understanding the dynamics present within single settings. Yin (1981, 1984) has defined the case study as a research strategy, developed a typology of case study designs, and described the replication logic which is essential to multiple case analysis. His approach also stresses bringing the concerns of validity and reliability in experimental research design to the design of case study research.Case study research is more existentially oriented than survey research because it includes the context of the three phenomenon as part of the object of study. It doesn't assume that the phenomenon under study can be isolated from the context or that the facts or observations are independent of the laws and theories used to explain them as is the case for survey research (Meredith et al., 1989). Classification of the case study establishes Yin (2013) regarding the research objective as descriptive, exploratory and explanatory. The descriptive about describing the phenomenon within its context, exploratory for dealing with little known problems, aiming at defining hypotheses or propositions for future researches; and explanatory intending to explain the relations of cause and effect from a theory.Yin (2013), also suggested two types of case studies: single-case study and multi-case studies; the unit of analysis is only one case in single-case study; and multi-case studies, in which several cases are analyzed in order to allow comparisons. The author also classifies the single-case study as holistic or incorporated. The holistic type has a unit of analysis considered in a specific context. On the other hand, the incorporated type has more than one unit of analysis for each case, i.e. it has sub-units of analysis.

Therefore, according to Yin's parameters, this study is presented as single-case, holistic, exploratory, mainly due to the rare nature of finding cases to apply the KBPM for TQM. An exploratory research is essential to develop and provide new ideas and discoveries also. Keeping in view the advantages of case study, the specific manufacturing area chosen for study is Indian FMCGs industry's (Food industry) performance of TQM have been tackled in this chapter with the objective (a) to have an understanding of total quality management measures of the Indian FMCGs industries with reference to use of the total quality management performance measurement system, and (b) to identify the problems faced by the company in their efforts towards the management of quality.

As a case study, we consider a performance measurement model of a TQM system consisting of an experimental CSFs as drivers and enablers. The model was never originally described in earlier work and we developed a simplified version of a TQM system. That version of the model is used in the XYZ FMCGs manufacturing industry, it is representative of real challenges and allows the application of formal methods for its development. Computing the performance of TQM for this simplified model takes less time using a state-of-the-art tool. With our approach we are able to analyze the model in less than others.

6.2 Case Methodology

The case study method was developed as an appropriate research design for this study. The case study method allows the researcher to investigate a contemporary phenomenon within its real-life context when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used (Yin, 1989). Case studies provide a special way of collecting, organizing, and analyzing data to gather comprehensive, systematic, and in-depth information about each case of interest. The case study method allows people being interviewed to describe experiences in their own language, rather than the researchers Kuo, C. et al. (1999). The particular relations among theory, practice, and research will be shaped by the context in which they are located. This could include factors such as the actual situation, the purpose of the activity, the people involved, and the resources available (Rule & John (2015)). Crowe et al. (2011) suggest, case study research approachis used to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context.The present case study is an intrinsicbecause of its uniqueness, which is of genuine interest to the researcher.Bent Flyvbjerg (2006) suggest that the case study produces the type of context-dependent knowledge which research on learning shows to be necessary to allow people to develop from rule-based beginners to virtuoso experts. It was clear to me that in order to understand a complex issue like this, in-depth case-study research was necessary.

As in present case, measurement of the performance of TQM in an Indian FMCGs industry. Our focus was on how effectively the TQM is performing to achieve the intended goal. However, if the primary research interest had been on the inter and intra-organisational dimensions of implementation, we might have defined our case differently as a grouping of employees (e.g. top level, middle level and low level employees). The effectiveness of TQM can be achieved by the involvement of the employees, their actions towards the goal and their relationship among the actors to achieve the TQM goal. However, the precise beginning and end of the case may prove difficult to define.

To critically examine the case company Sushil (2000) has recommended to map the system (organizational) or sub-system (TQM system in the present case) to be study and for this use of two step is there the use of situation, actor, process-learning, action, performance (SAP-LAP) methodology. First step is the SAP analysis, the dynamic parameters of a case are highlighted through the three dynamic interfaces (situation (S), actors (A) and processes (P)) of any organizational system. The next step is LAP synthesis consists three components, learning issues (L), action recommended (A) and anticipated improvement in performance (P). The actor consistently evaluates the situation, follow processes and take actions to improve their performance and depending on the results of performance either the processes are modified or same processes are followed in Fig.6.1. SAP-LAP analysis is learning and interpretive framework of investigation into the problem under consideration for that SAP-LAP model incorporates both learning and action in symbolic manner coupled with performance. It not only takes into consideration optimization of processes, but also incorporates multiple perspectives of various participating actors in a managerial process. Therefore, for the organization, which are in the process of adopting new and intricate technologies, SAP-LAP framework provides one of the most useful methodologies of analysis and synthesis. To improve TQM performance organizations are not only adopting latest tools and techniques, but also the new management practices in the form of TQM, SAP-LAP analysis is a fit tool for the analysis of the cases.

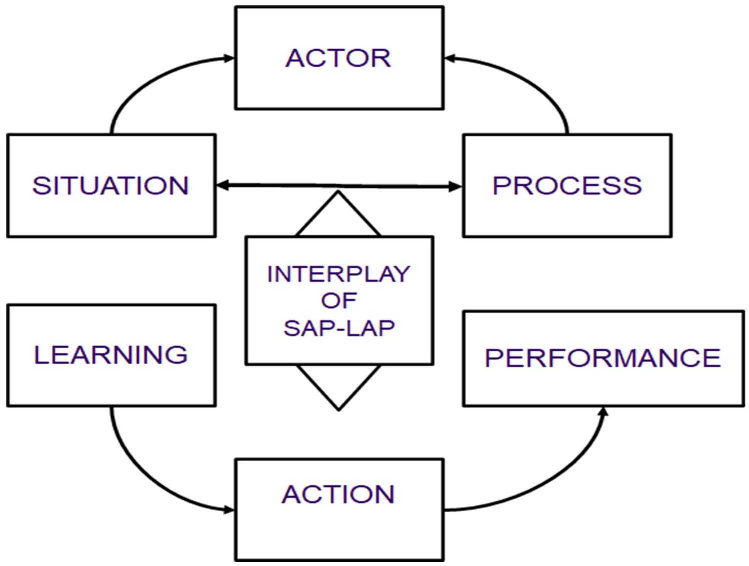

Figure 6.1: SAP-LAP model for TQM CSFs analysis

6.2.1 Scheme for case development

Based on Eisenhardt (1989), a scheme for case development is given in Table 6.1. The case dealt in this chapter have been investigated with a focus on the use of TQM performance measures and systems by companies in their TQM. The case followed by their SAP-LAP analysis are discussed in the next section.

6.3 Case study

6.3.1 Background of Company

To maintain the confidentiality, the company is termed "XYZ FMCGs LTD" throughout the study. The company was established of the year 1892 and turned as a public limited company in 1918 on 21st March as a one of India's leading food companies. The product portfolio includes Biscuits, Bread, Cakes, Rusk, and Dairy products including Cheese, Beverages, Milk and Yoghurt. In India company's plants are situ-

Table 6.1: Steps in a case development

Sr. No.	Steps	Comments
1	Definition of Research Questions	How the company in selected sectors on Indian Fast-Moving Consumer Goods industry has adopted TQM performance measure and systems to improve the performance of its TQM
2	Objectives	The case company would be evaluated on SAP-LAP paradigm with focus on TQM performance measurement practices of the company
3	Selection of a case	A FMCGs manufacturing industry has been selected and analyzed
4	Crafting Research Instruments	Structured questionnaire was used to capture the various issues related to the TQM practices. Perception of the company was recorded on various issues related to TQM performance
5	Entering the field	Portal survey method was used for administration of the questionnaire. Further the company was contacted with concern TQM officials.
6	Analyzing the data	Various issues related to the TQM measures and its system were studied and analyzed. Some hypotheses on common and performance specific TQM issues have also been formulated.
7	Shaping Hypothesis	The data collected through questionnaire have been used in the testing of hypotheses
8	Reaching Closure	Based on learning from survey and case a Knowledge-Based approach has been presented to measure the TQM performance and for identifying the barriers for increasing the TQM effectiveness and efficiency.

ated in Delhi, Chennai, Mumbai, Kolkata and Uttarakhand. XYZ FMCGs Ltd.has presence in more than 60 countries across the globe. XYZ FMCGs Ltd.focuses more importantly for quality and value in global market. At present the company's share market holds more than 60 percent. As this company is FMCGs industry so falls under small industry. Company XYZ FMCGs Ltd.was rated by Forbes global ranking among Top 300 small companies during the year 2000. The company's product was winner of the various awards for packaging in the year 2002.In the year 2007 XYZ FMCGs Ltd.was rated number 1 most trusted food brand in a survey conducted AC Nielsen ORGO-MARG and published in Economic Times with 11,245 employees, 900 vendors, 80000 shareholders, 30000 salesman and 4000 distributers.

The manufacturing facilities of XYZ FMCGs Ltd.are equipped with world's latest and most advanced machineries. The Company is constantly upgrading its technology and also acquiring new technology to meet the ever-increasing demands of its customers. In addition to the state-of-the-art in-house R&D center recognized by the Department of food and safety Research, Government of India, XYZ FMCGs Ltd.also acquires new technology through technical collaboration agreements with leading international bakery manufacturers.

6.3.2 Present Situation

XYZ FMCGs Ltd.is a major player in the Indian Foods market with leadership position in bakery category. The company operates in two business segments- bakery products and dairy products. Bakery products includes Biscuits, Bread, Cakes, Rusk, and Dairy products including Cheese, Beverages, Milk and Yoghurt. Biscuits have been one of the fastest growing categories in the FMCGs segment, with an annual volume growth rate of 12-15% in the last five years. XYZ FMCGs Ltd.continues towards innovating aggressively on the value-added products.

Being a food manufacture commitment to food safety is paramount of ABC. To keep consumers healthy and safe from the harm of food-borne illnesses is the primary task of ABC business operations. XYZ FMCGs Ltd.is well equipped with components, processing machines, and systems used to handle, prepare, cook, store, and package food and food products. Although this equipment is primarily aimed toward the transformation (i.e., increasing the palatability, consumability, and digestibility) or preservation (i.e., extending the shelf life-of food), some pieces of equipment are also employed to perform preliminary or auxiliary functions, such as handling, preparation, and packaging.

Reliable product designs, working components, and assemblies are essential for the food safety industry, which are the first line of defense against potentially dangerous illnesses.Considering perishability is important because product freshness is one of the primary concerns for consumers when buying food products. Consumers can judge the freshness of a product either by evaluating the sensory qualities of the product or by the Best-Before-Date (BBD) listed on the packaging while quality control is always a top priority for FMCGs manufacturers. Having a process in place mitigates problems and prevents mistakes, defects, and flaws in manufactured products. It can also strongly influence a manufacturer's reputation and overall business success. Top FMCGs manufacturing companies integrate quality control throughout the entire manufacturing process.The demand for FMCGs products is high in India, giving ample room for food manufacturers to target consumers with such labels. The relentless drive to innovate and develop new products to meet the changing needs of customers has led XYZ FMCGs Ltd. to create a network of Global Technology & Innovation Centres and Regional Development & Applications Centres. These centres house more than 200 highly skilled food scientists and nutritionists, and teams of market researchers who provide insights to drive product development. The centres provide unique leading-edge solutions at an unrivalled speed to market, helping to shape the future of food required by customers.

Quality Management activities at company

Quality must be tracked through a variety of internal and external audits, as well as inspections. Improvements can be explored and tested through periodic assessments.XYZ FMCGs Ltd. uses quality metrics for all projects and processes, covering customer satisfaction, on time delivery, final quality control and test first pass yields.Thorough testing detects non-conformance within the products and helps reveal the real variances in products, but procedural variances are realized and remedied through extensive audits and managed and maintained within the Total Quality Management System. XYZ FMCGs Ltd. having setup of automated manufacturing systems, and being a food manufacturer, have in-house development of test systems to ensure the quality and reliability of the final product. The operations team of XYZ FMCGs Ltd. is made up of highly skilled process, quality, systems integration, customer, and test engineers that have long years of experience of manufacturing bakery and dairy products. XYZ FMCGs Ltd. continuously try to foster better relationships throughout the organization with belief that by working together in a supportive environment, will achieve more and have greater impact.The company XYZ FMCGs Ltd. understand the rigorous technical requirements for each functional area and the demand for reliable, quality products, and as we know that performance deals with the operational characteristics of the system or subsystem.A manufacturer must prove quality assurance to guarantee that the product will not only be made to specifications, and tested thoroughly, but also will adhere to established quality standards. Quality Assurance team of XYZ FMCGs Ltd. ensures products are adhering to quality assurance procedures, while auditing of the system ensures consistency.

To maximize customer support, XYZ FMCGs Ltd. have created five separate engineering departments: process, test, customer, system integration, and quality engineering. These departments offer world class engineering support and product development. XYZ FMCGs Ltd. ensure quality products at a competitive cost. The XYZ FMCGs Ltd. is fully integrated with ERP system, allowing for superior corrective action tracking, reporting and historical data retention.

The consistent relationship between quality management procedures and testing processes is evident in the company XYZ FMCGs Ltd.team. The XYZ FMCGs Ltd.'s Manufacturing Execution System (MES) is state of the art and geared specifically for the FMCGs industry. Unlike other providers of similar size, XYZ FMCGs Ltd.has an outstanding level of tracking and interlocking of processes. The MES is advantageous for XYZ FMCGs Ltd.in the manner that: (i) It makes it easy to track production and quality (ii) It helps reduce waste and scrap (iii) It tracks quality standards for long-term data (iv) It has scheduling capabilities, and (v) It allows in-house communication.

Innovative engineers and support staff of XYZ FMCGs Ltd.carry some of the highest certifications in the trade and are committed to continuous improvement and extensive testing of all products. Combined with a level of customer support, loyalty, and professional rarely seen in the industry.Value addition comes in the form of flexible timings and perfect work-life balance offered by XYZ FMCGs Ltd. and ensure best practice, innovative approaches, and continuous improvement in product development.The company XYZ FMCGs Ltd. was awarded the Global Performance Excellence Award (GPEW) by Asia Pacific Quality organization (APQO). Company XYZ FMCGs Ltd. is a leader in taste and nutrition. The innovations at XYZ FMCGs Ltd. lead to quality products customers satisfied about consuming.

In the process of data collection, we met the Head of Corporate Quality Assurance of XYZ FMCGs Ltd. whose role and responsibility are to develop, establish, maintain the food safety and quality systems for products and businesses. Also, equally responsible for the delivered quality. Developing capability of vendors, manufacturing facilities, process and infrastructure, laboratories, people to deliver safe and quality products. He is also engaged in developing work programs for continuous improvements as-well-as supporting cost efficiency programs, ensuring compliance to regulatory and internal food safety & quality management standards, benchmarking and improving systems for addressing consumer feedback. Working with R&D and manufacturing on innovation projects for development of Hazard Analysis Critical

Control Point(HACCP) plans, certifying the readiness of manufacturing facilities for commercialization and commercializing re-staged and innovation products. Regional Manufacturing Heads were responsible for post-production tasks such as, to deliver biscuits, cakes and rusks to meet the sales requirements as per the monthly plans of each region through manufacturing units, develop capacity and capabilities well in advance to meet the increasing demand. They are also assigned to work with manufacturing excellence, R&D to improve the quality, efficiencies and other costs.

6.3.3 SAP-LAP analysis of company in context of TQM

This section focuses on the company case to analyze using SAP-LAP (Situation Actor Process- Learning Action Performance) framework. This analysis is conducted in the context of performance of total quality management in the company.

Situation

As per the SAP-LAP approach, the situation represents the present status of the company XYZ FMCGs Ltd.in terms of quality management, R&D and innovation, customer focus, competitive advantage and performance measures.

The employees of this organization were interviewed to gauge the following situational parameters about the status of TQM performance.

- XYZ FMCGs Ltd. is one of the established an Indian food products corporation. The company has an estimated market share of 38% across the food products category in year 2020.
- TQM of XYZ FMCGs Ltd.is in the sense that it will improve quality holistically as it has obtained Food Safety System Certification (FSSC).
- XYZ FMCGs Ltd.has a professional management set up, which emphasizes

on continuous improvement and upgrading the product range.

- Intense competition exists in the FMCGs industry especially in bakery and dairy products, due to the frequent changing demand of the customer.
- Gradually decreasing market share is a matter of concern for XYZ FMCGs Ltd.
- There is increasing pressure to improve the quality, throughput time, less defects and minimize wastes.
- XYZ FMCGs Ltd.is focusing on reducing costs and new product development time.
- High volume of production offers benefits of economies of scale I procurement, production and distribution.
- In XYZ FMCGs Ltd., the members from various functional departments are well coordinated and share information regarding their respective functional area. The shared information helps in joint planning of quality related tasks. The concept of information sharing and collaboration between different functional department is extended to inter-organizational systems to improve the performance of TQM.
- The biggest strength of XYZ FMCGs Ltd.lies in its vast and strong retail network.
- XYZ FMCGs Ltd.is committed to use e-business technologies to enhance cost competitiveness of its products.
- XYZ FMCGs Ltd.have a comprehensive and structured planning process
- XYZ FMCGs Ltd.use to communicate mission statement and support of employees.

- There is no reward system to the employees for their better performance at XYZ FMCGs Ltd.

Actor

The employees of XYZ FMCGs Ltd.are motivated and creative. XYZ FMCGs Ltd.believes in continuous improvement and encourage the active participation of whole employee. Following views were gathered about TQM, based on industrial visit and structured interviews with employees of XYZ FMCGs Ltd.

- Management of XYZ FMCGs Ltd., (Managing Director and General Managers)
- Employees of XYZ FMCGs Ltd.(in general and those in quality department in particular)
- Suppliers, dealers and customers of XYZ FMCGs Ltd.
- Employees from cross functional department plans the operational activities. They use conventional as-well-as latest quality control tool for problem analysis and solving.
- Employees are committed for work and flexible in adopting new tools and techniques. The team work is very evident at work.
- XYZ FMCGs Ltd. forms long-term partnership with their suppliers and retailers. To keep update, XYZ FMCGs Ltd. regularly organize meetings with members of supply chain. These meetings are considered to be very important. These meetings give information to suppliers related to quality.
- The vision of long-term relationship makes all the members of supply chain more aligned while dealing with quality.

- It is believed that the good relationship may result from the trust and commitment between the members developed with time. The commitment is visible from fact that the supplier always send the committed quality to XYZ FMCGs Ltd.in time, which in turn has streamlined the production of XYZ FMCGs Ltd..
- For a better relationship and understanding the suppliers are invited for training sessions/demonstrations so that the design requirements are better understood and meet.

Process

- XYZ FMCGs Ltd. is focusing on continuous improvement. For this purpose they have implemented KAIZEN in 2009-10
- Company encourages sharing of views through meeting, with personnel from marketing, finance, material management, quality assurance and IT.
- Some initiatives takenlike lean manufacturing, KAIZEN, JIT which helps XYZ FMCGs Ltd.in reducing cost and wastes.
- To control all food safety hazard, HACCP is implemented and FSSC to control food fraud and food defense.
- Intranet connects its intra-departmental activities with activity heads and their operators to ease the coordination and flow of work.
- XYZ FMCGs Ltd.established local area network (LAN) for technical data
- Tracking of products in outbound side is being done only by conventional means of phone, e-mail etc.
- Procurement is done through e-tendering and lowest bidder is selected.

- XYZ FMCGs Ltd.has implemented Enterprise Resource Planning (ERP) for the best utilization of its resources
- For uninterrupted functioning of the machines, XYZ FMCGs Ltd.gives training to employee on quality and maintenance.
- XYZ FMCGs Ltd.leadership understands the strong relationship between an effective quality management system (QMS) and customer satisfaction, and focuses on the consistency needed to provide both in today's FMCGs industry.

Learning

- To retain its leadership, quality is important. This may be achieved by making TQM more integrated and efficient.
- E-commerce has created new opportunities and challenges to sustain in the global market.
- Total material costs in the finished product are between 70-75 percent in the company XYZ FMCGs Ltd. The company outsourced about 75-80 percent of its raw materials and components requirement. Therefore, efficient management of inbound logistics and materials procurement are the critical issues in the better management of its supply chain.
- Quality products and competitive price would attract customers, as Indian consumers are highly adaptable to new and innovative products.
- Due to the short shelf life of the products, XYZ FMCGs Ltd. have a short manufacturing lead time and purchase lead time.
- Flow of information is important for quality improvement. Therefore, to maximize the benefits of information technology in TQM all the suppliers should be willing to invest in the information technology.

- Absence of real time information sharing with the field offices results in carrying high level of inventory.

- Trust is necessary for information sharing among the various partners of a manufacturing and supply chain.

- Inefficient information system, disparity in trading partner's capabilities, inadequate strategic planning and reluctant of support of suppliers are identified as the main barriers in the TQM improvement efforts.

- E-business usage is not at all there.

- Inventory is managed at the XYZ FMCGs Ltd.'s end.

- Standardization and modularization can result in reducing the average inventory levels.

- XYZ FMCGs Ltd. very infrequently hold meeting with its suppliers.

- Quality becomes a governing part of operations, with decisions that impact on quality, rejected immediately, despite perceived cost-savings involved.

Action

- XYZ FMCGs Ltd. being the Original Product Manufacturer (OPM) and major stake holder in its quality initiative encourage its employees to proactively participate in quality improvement.

- Accord vendor management a thrust area as the cost of material alone accounts for 70-75 percent of the total cost of components and the vendors supply about 75-80 percent of the total raw materials used in XYZ FMCGs Ltd.'s product.

- Make strategic use of information technology in inhouse for TQM performance improvement. And measure operational performance on performance matrices.

- Enhance the process capability by technological assistance,
- To reduce manufacturing lead time, more state of art machinery needs to be procured. And effective use of JIT philosophy should be done.
- To maintain its leadership in the food segment and also for delivering value for money to its customers and stakeholders, it should deploy e-business technologies for online management for entire value chain.
- Value engineering/ value analysis will help in standardization of the products, thereby reducing cost of inventory and increasing the productivity.
- The website should be more user friendly, thereby allowing the customers to directly place order for product needed.
- At present XYZ FMCGs Ltd. maintains inventory at its end. This policy should be replaced by introducing VMI system.
- Effectively use modularization using real time information sharing with field maintenance offices.
- Make online all the authorized field maintenance offices and sub-field maintenance offices and link these with intranet.
- TQM specific software should be used to integrate its quality management and leverage its benefits. Food software like Food Safety Plan Builder (FSPB), Food Defense Plan Builder (FDPB) will help in enhancing the quality of the products, new indicators should be developed to reflect their performance.
- Seminar and workshops on the benefits of total quality management practices can be arranged for employees as well as suppliers.
- The company should periodically call for joint meeting of all the supply chain partners as well as employees of the organization and try to fix the problem related to quality.

- The E-commerce segment is forecast to contribute 11% to the overall FMCG sales by 2030
- XYZ FMCGs Ltd. implementing technologyelectronic data interchange (EDI) to improve analytics, quality control and increase speed to market.
- XYZ FMCGs Ltd. investing in energy-efficient plants to benefit society and to lower their costs in the long term.
- XYZ FMCGs Ltd. enables their employee to provide superior products and services to its customers.
- XYZ FMCGs Ltd. use to asking questions and making changes based on metrics and feedback.
- The company FMCGs Ltd. partner with an organization which has clear processes, has a mindset for risk-based thinking, and is looking for options when failures occur.

Performance

- VMI at XYZ FMCGs Ltd.will reduce inventory levels long with inventory holding and carrying costs.
- Performance measurement and benchmarking of TQM would provide the company an opportunity to identify the gaps in its TQM practices.
- Change management and an exposure to e-learning would let feel employees motivated even in changed scenario.
- Reducing quality defects through implementation of Good Housekeeping (GHK) practices.
- Developed the skills of employee at Contract Manufacturing through continuous focus on Quality,

- Periodic discussion with employees and the supply chain partners will help achieve better quality.
- XYZ FMCGs Ltd.Work closely with suppliers to improve each others' processes
- Suppliers work closely with XYZ FMCGs Ltd. in product development
- Suppliers have an effective system for measuring their quality
- Employees were recognized for their quality work and rewarded.

The company XYZ FMCGs Ltd. had an involved approach to their manufacturing relationships, spending countless hours in quality planning, quality assurance, quality control and continuous improvement, which helps XYZ FMCGs Ltd.stand out in the industry. XYZ FMCGs Ltd. provides high quality products and services by meeting applicable requirements and continually improving processes with the goal of exceeding customer expectations.

6.4 Interpretive Structural Modelling (ISM) and Matrix of Cross-Impact Multiplication

Applied to Classification (MICMAC) analysis of TQM CSFs. This study will help to understand the TQM CSFs in terms of their interdependence and their driving and dependence power with the help of MICMAC analysis.

ISM is one of the interactive management tools, which is identifying and summarizing the relationship between specific elements. ISM methodology suggests use of expert opinions based on management techniques such as brainstorming to develop contextual relationship among the variables. It is used by researchers and practitioners to understand the direct and indirect relationships among various variables states Ravi & Shankar (2017). According to Chander et al. (2013), ISM technique is to identify and depict relationship among various components of an issue or a problem. ISM is interpreted according to Singh and Kant (2007),as based on group's judgment and decision whether and how the system's elements are linked. Mostly ISM is used to determine the influence of enablers or inhibitors on a system as well as to examine their interweaving relationships Sagheer et al., (2009). Raj et al., (2008) conducted a case study and applied ISM approach for modelling the enablers of flexible manufacturing system. Faisal et al., (2006) used ISM in supply chain mitigation to understand dynamic between various enablers where Hasan et al.,(2007) used this technique to establish a relationship among the barriers in agile manufacturing.

MICMAC analysis, classification helps to clarify how a variable will behave in the system and how it should be managed.

6.4.1 ISM Methodology

An extensive literature review and expert opinion from organization and academia were collected for this research work. A total of 15 participants, including 07 quality experts, 05 industrialists from the FMCGs sector and 03 from academia were consulted. After the end of three brainstorming session a total of 12 variables, including seven TQM enablers and five TQM drivers were identified in this paper. Figure 6.2 depicts the steps followed in modelling ISM;

- Identification of enablers/ resources relevant to issues or problem with the help of expert opinion and literature review.
- A contextual relationship is established between TQM CSFs and examined pairwise enablers.
- A structural self-interaction matrix (SSIM) is developed for TQM CSFs and

shown relationship between pairwise TQM CSFs.

- Construct reachability matrix (RM) from the SSIM.
- After construction of RM partition into different levels.
- Revised RM again: make the transitivity. relationship between TQM CSFs and obtained the FRM (final reachability matrix).
- Based on the FRM developed an ISM model and the transitive links are removed.
- Develop ISM digraph.
- Apply MICMAC analysis on the model.

Christine V. Bullen and John F. Rockart,1981 defines Critical Success Factors (CSFs)are the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department or organization. CSFs are the few key areas where "things must go right" for the business to flourish and for the manager's goals to be attained. Every organizational strategy or approach which is implemented for the success enlist its own critical success factors. These critical success factors were decided on the basis of goal, i.e. termed as constructs or factors. Like goals and objectives, CSFs appear at various levels in the management hierarchy, Christine V. Bullen and John F. Rockart,1981. CSFs are the combination of its drivers and enabler depends upon the capability. The strategies implemented have their individual goal, but linked with organizational goal. The CSFs and other managerial terms such as "strategy," "goals," and "objectives," defined, compared and contrasted by Christine V. Bullen and John F. Rockart,1981. Although every strategic approach is implemented as per the requirement of improvement of the organization performance. When these strategic approaches get implemented, creates a virtual continuum within the organizational system and then

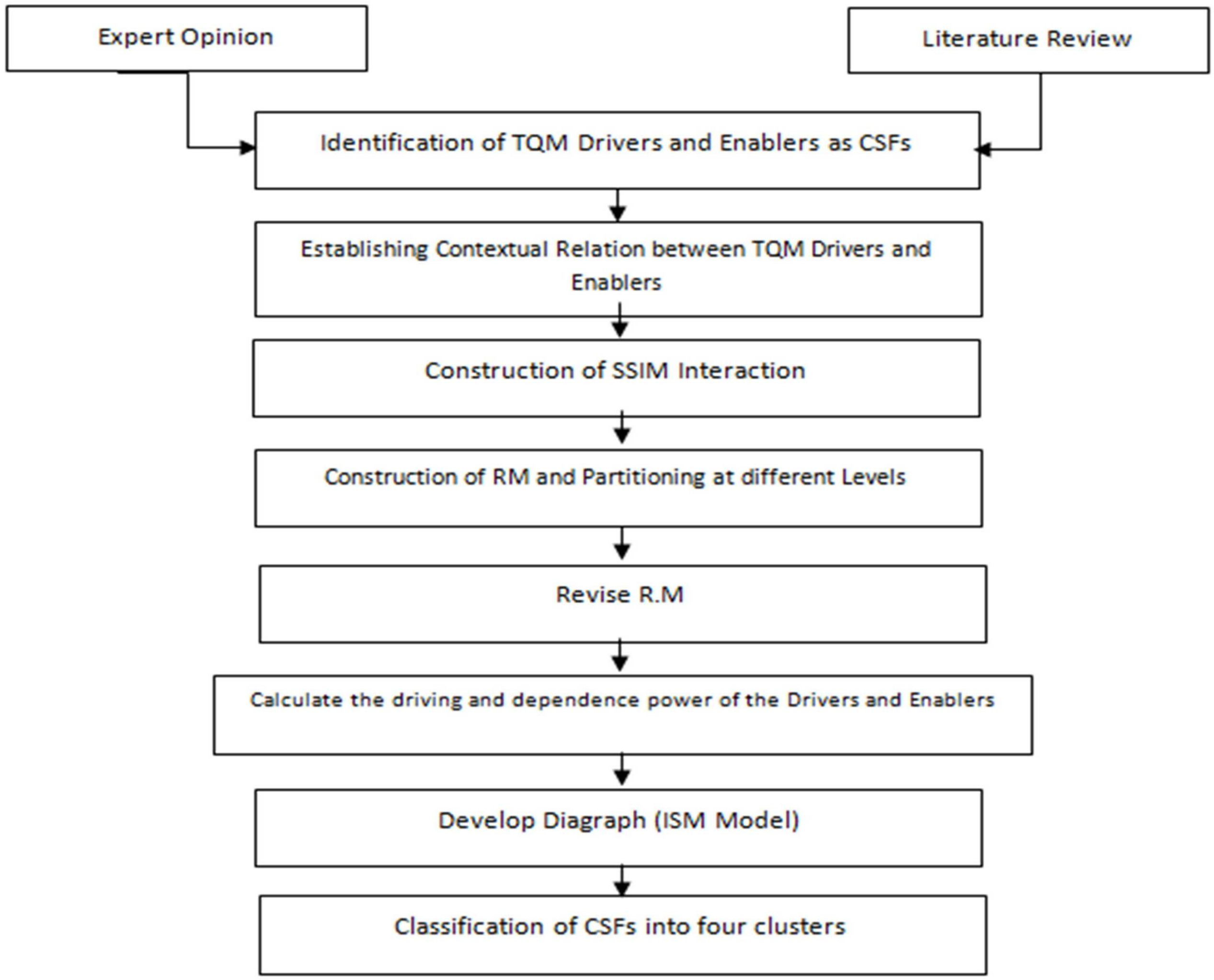

Figure 6.2: Procedural diagram for ISM and MICMAC

act for the intended target. As each strategic approach having its own success factors, similarly having different implementation criteria also as per the principles and policy. Managers at each of the organizational levels will have an individual set of CSFs which depend heavily upon their particular roles and on temporal factors, and less heavily upon the industry and the environment, Christine V. Bullen and John F. Rockart,1981. On the other hand, barriers are the byproduct of success factors, in case if CSFs not performed positively and procreate. Without measuring the performance of the strategic approach, it is not possible to recognize or identify the barriers.Bullen and Rockart (1981) mentioned the importance of CSFs that Critical success factors are the few key areas of activity in which favourable results are absolutely necessary for a particular manager to reach his goals.Because these areas of activity are critical, the manager should have the appropriate information to allow him to determine whether events are proceeding sufficiently well in each area.

Success factors are the relatively small number of truly important matters on which a manager should focus attention. For this reason, the term "critical success factors" is aptly chosen. They represent the few "factors" which are "critical" to the "success" of the manager concerned. Barriers not remains barriers for ever. Whenever they are identified and the problem related to the particular factor when shorten out, then that barrier becomes the success factor of that particular strategy, approach or system. There are two kind of situations for the TQM; pre-implementation and post-implementation. In this study our concern is post-implementation, so our focus is performance of TQM. The nature and characteristics of pre-implementation CSFs are entirely different from Post-implementation CSFs. The post-implementation TQM CSFs were decided on the basis of TQM goal and the pre-implementation CSFs were decided on the basis of the present environment of the organization. The pre-implementation CSFs talks about whether the present environment, condition and culture of the organization is ready to adopt the strategy or not. Most of the authors discussed about the pre-implementation CSFs of TQM. Table 6.2 consists the Identified TQM CSFs. Pre-implementation CSFs are probabilistic in nature. Thus, in this present research for identifying the contextual relationship among the CSFs of TQM experts from academia and from FMCGs industry were consulted. These experts were well conversant with quality management and its effect on TQM performance. Keeping in mind the contextual relationship for each dependent variable only, the existence of a relation between any two CSFs (i and j) is questioned. Four symbols are used to mark the relationship among the CSFs.

- V CSF i fortify j

Table 6.2: Identified TQM CSFs

	Drivers and Enablers of CSFs	Sub attributes
TQM DRIVERS	Human Resource Management (D1)	Employee involvement (D11)
		Employee empowerment (D12)
		Recognition & reward (D13)
		Teamwork (D14)
	Top management commitment (D2)	Top management support(D 21)
		Executive commitment(D 22)
		Leadership(D 23)
	Process management (D3)	Tools and techniques(D 31)
		Continuous improvement(D 32)
		Process design(D 33)
	Customer focus and satisfaction (D4)	Customer and market focus (D 41)
		Customer satisfaction (D 42)
		Customer relationship (D 43)
	Supplier partnership (D5)	Cooperation with suppliers (D 51)
		Supplier quality management (D 52)
		Supplier relationship (D 53)
	Training and learning (D6)	Learning (D 61)
		Knowledge (D 62)
		Education & training (D 63)
	Information/analysis/data (D7)	Quality data and reporting(D 71)
		Internal quality information usage(D 72)
TQM ENABLERS	Strategic quality planning (E1)	Quality policy (E11)
		Quality planning (E 12)
		Vision & plan statement (E 13)
	Culture and communication (E2)	Trust (E 21)
		Cultural change (E 22)
	Benchmarking (E3)	Competitors (E 31)
	Social and environmental responsibility (E4)	Wider community (E 41)
		Quality citizenship (E 42)
	Innovation (E5)	Product innovation (E 51)

- X CSF i and j fortify each other; and
- O CSF i and j are unrelated

6.4.2 Reachability Matrix (R.M)

The ISM method is based on macro approach (0, 1). The use of binary variables is a restriction in the interest of simplicity, the variables being regarded either as computing the presence or absence of input variables or as thresholding input variables-the canonical matrix makes the same assumption.

The Structural Self-Interaction Matrix (SSIM) is transformed into binary matrix called the initial reachability matrix by substituting V,A,X,and O by either 1 or 0 as per the case.

The rules for substitution are as:
If entry in SSIM of (i,j) = V, then entry of R.M of (i,j) becomes 1 and (j,i) becomes 0.
If entry in SSIM of (i,j) = A, then entry of R.M of (i,j) becomes 0 and (j,i) becomes 1.
If entry in SSIM of (i,j) = X, then entry of R.M of both (i,j) and (j,i) becomes 1.
If entry in SSIM of (i,j) = O, then entry of R.M of both (i,j) and (j,i) becomes 0.

Following the above rules, the contextual Relationship of TQM CSFs is shown in Table 6.3. Table 6.4 shows the initial reachability matrix for the TQM CSFs. Some authors endorse it in theoretical way like Zeng, J., et al. (2014) focuses on the impact of quality management on innovation (E5) performance mentioned that TQM performance is as an intended consequence of its implementation, further also examined as a potential mediator between TQM and innovation. Prajogo and Sohal (2004) termed organic and mechanistic, the two dimensions of TQM. Organic dimension encompasses leadership and people management, means the human re-

Table 6.3: Contextual Relationship of TQM CSFs

	TQM CSFs		E5	E4	E3	E2	E1	D7	D6	D5	D4	D3	D2
1	Human Resource Management	D1	V	V	V	V	V	V	V	V	V	V	V
2	Top management commitment	D2	V	V	V	V	V	V	V	V	V	V	
3	Process management	D3	V	V	V	V	V	V	V	O	V		
4	Customer focus and satisfaction	D4	V	V	V	V	V	O	V	O			
5	Supplier partnership	D5	V	V	V	O	V	O	O				
6	Training and learning	D6	V	V	V	V	V	X					
7	Information/analysis/data	D7	V	V	V	V	V						
8	Strategic quality planning	E1	V	V	V	A							
9	Culture and communication	E2	V	V	O								
10	Benchmarking	E3	V	V									
11	Social and environmental responsibility	E4	O										
12	Innovation	E5											

source (D1) related factors and mechanistic covers process management (D3) and customer focus (D4). Process management (D3) is the key to achieving a consistent, desired outcome. While it is often multiple interrelated processes that are required to achieve the ideal outcome, these all must function consistently and as a unit to thrive.Top management commitment (D2)is necessary at all levels to reinforce the goals and purpose of an organization, product, or service. Leadership at the top is needed to set the mission and vision of the organization and to promote support, efficiency, and open communication by encouraging a unified and attainable approach to reach objectives via pre-set process/policies. Engagement of employee which is ensured by Human Resource Management (D1) at all ranks is essential to reach the objective of an organization, product, or service. FMCGs industries are built on the strength and commitment of its people. It is ideal to have enthusiastic

Table 6.4: Structural Self-Interaction Matrix (SSIM)

	TQM CSFs		D1	D2	D3	D4	D5	D6	D7	E1	E2	E3	E4	E5
1	Human Resource Management	D1	1	1	1	1	1	1	1	1	1	1	1	1
2	Top management commitment	D2	0	1	1	1	1	1	1	1	1	1	1	1
3	Process management	D3	0	0	1	1	0	1	1	1	1	1	1	1
4	Customer focus and satisfaction	D4	0	0	0	1	0	1	0	1	1	1	1	1
5	Supplier partnership	D5	0	0	0	0	1	0	0	1	0	1	1	1
6	Training and learning	D6	0	0	0	0	0	1	1	1	1	1	1	1
7	Information/analysis/data	D7	0	0	0	0	0	1	1	1	1	1	1	1
8	Strategic quality planning	E1	0	0	0	0	0	0	0	1	0	1	1	1
9	Culture and communication	E2	0	0	0	0	0	0	0	1	1	0	1	1
10	Benchmarking	E3	0	0	0	0	0	0	0	0	0	1	1	1
11	Social and environmental responsibility	E4	0	0	0	0	0	0	0	0	0	0	1	0
12	Innovation	E5	0	0	0	0	0	0	0	0	0	0	0	1

workers who are competent in their particular role within the process. However, supply chains (supplier partnership-D5) are managed by people, and these include leaders and managers who have diverse orientations in their practice. Because supply chain networks are becoming more demanding, leadership within them has to become less arduous and more methodical (Cruz & Wang 2018). The final reachability matrix (Table 6.5) is obtained by incorporating the transitivites as enumerated in step 6 of the ISM methodology. The driver and the dependence of each CSFs are presented. Both of these powers are applied in MICMAC examination.

The level partition is carried out to know the placement of elements level-wise (Warfield, 1973), which determine the reachability and antecedent sets for all the elements. Where Reachability set CSFs itself and other elements which it may help to achieve and Antecedent set consists of the element itself and the other elements,

Table 6.5: Final reachability matrix

	TQM CSFs		D1	D2	D3	D4	D5	D6	D7	E1	E2	E3	E4	E5	DP
1	Human Resource Management	D1	1	1	1	1	1	1	1	1	1	1	1	1	12
2	Top management commitment	D2	0	1	1	1	1	1	1	1	1	1	1	1	11
3	Process management	D3	0	0	1	1	0	1	1	1	1	1	1	1	9
4	Customer focus and satisfaction	D4	0	0	0	1	0	1	0	1	1	1	1	1	8
5	Supplier partnership	D5	0	0	0	0	1	0	0	1	0	1	1	1	5
6	Training and learning	D6	0	0	0	0	0	1	1	1	1	1	1	1	7
7	Information/analysis data	D7	0	0	0	0	0	1	1	1	1	1	1	1	7
8	Strategic quality and communication	E1	0	0	0	0	0	0	0	1	0	1	1	1	4
9	Culture and communication	E2	0	0	0	0	0	0	0	1	1	0	1	1	5
10	Benchmarking	E3	0	0	0	0	0	0	0	0	0	1	1	1	3
11	Social and environmental responsibility	E4	0	0	0	0	0	0	0	0	0	0	1	0	1
12	Innovation	E5	0	0	0	0	0	0	0	0	0	0	0	1	1
	Dependence power		1	2	3	4	3	6	6	9	7	10	11	11	73

which may help in achieving it. The reachability set includes the variables itself and the other variables that they may influence. Therefore, for every variable i.e TQM CSFs, reachability can be defined by setting Ras the set of variables reachable from TQM CSFs. Table 6.6-6.15 shows the various iterations of the analysis. The Levels of TQM CSFs are tabulated in Table 6.16.

Table 6.6: Iteration I

Sr. No.	Drivers and Enablers as CSFs	Reachability Sets (R)	Antecedent Set (A)	Interaction Set (R∩A)	Level
1	D1	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1	D1	
2	D2	D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1, D2	D2	
3	D3	D3, D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3	D3	
4	D4	D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4	D4	
5	D5	D5, E1, E3, E4, E5	D1, D2, D5	D5	
6	D6	D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7	D6, D7	
7	D7	D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7	D6, D7	
8	E1	E1, E3, E4, E5	D1, D2, D3, D4, D5, D6, D7, E1, E2	E1	
9	E2	E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7, E2	E2	
10	E3	E3, E4, E5	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3	E3	
11	E4	E4	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E4	E4	
12	E5	E5	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E5	E5	I

Table 6.7: Iteration II

Sr. No.	Drivers and Enablers as CSFs	Reachability Sets (R)	Antecedent Set (A)	Interaction Set (R∩A)	Level
1	D1	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1	D1	
2	D2	D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1, D2	D2	
3	D3	D3, D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3	D3	
4	D4	D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4	D4	
5	D5	D5, E1, E3, E4, E5	D1, D2, D5	D5	
6	D6	D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7	D6, D7	
7	D7	D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7	D6, D7	
8	E1	E1, E3, E4, E5	D1, D2, D3, D4, D5, D6, D7, E1, E2	E1	
9	E2	E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7, E2	E2	
10	E3	E3, E4, E5	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3	E3	
11	E4	E4	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E4	E4	II

Table 6.8: Iteration III

Sr. No.	Drivers and Enablers as CSFs	Reachability Sets (R)	Antecedent Set (A)	Interaction Set (R∩A)	Level
1	D1	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1	D1	
2	D2	D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1, D2	D2	
3	D3	D3, D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3	D3	
4	D4	D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4	D4	
5	D5	D5, E1, E3, E4, E5	D1, D2, D5	D5	
6	D6	D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7	D6, D7	
7	D7	D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7	D6, D7	
8	E1	E1, E3, E4, E5	D1, D2, D3, D4, D5, D6, D7, E1, E2	E1	
9	E2	E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7, E2	E2	
10	E3	E3, E4, E5	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3	E3	III

Table 6.9: Iteration IV

Sr. No.	Drivers and Enablers as CSFs	Reachability Sets (R)	Antecedent Set (A)	Interaction Set (R∩A)	Level
1	D1	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1	D1	
2	D2	D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1, D2	D2	
3	D3	D3, D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3	D3	
4	D4	D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4	D4	
5	D5	D5, E1, E3, E4, E5	D1, D2, D5	D5	
6	D6	D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7	D6, D7	
7	D7	D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7	D6, D7	
8	E1	E1, E3, E4, E5	D1, D2, D3, D4, D5, D6, D7, E1, E2	E1	
9	E2	E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7, E2	E2	IV

Table 6.10: Iteration V

Sr. No.	Drivers and Enablers as CSFs	Reachability Sets (R)	Antecedent Set (A)	Interaction Set (R∩A)	Level
1	D1	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1	D1	
2	D2	D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1, D2	D2	
3	D3	D3, D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3	D3	
4	D4	D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4	D4	
5	D5	D5, E1, E3, E4, E5	D1, D2, D5	D5	
6	D6	D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7	D6, D7	
7	D7	D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7	D6, D7	
9	E2	E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7, E2	E2	V

Table 6.11: Iteration VI

Sr. No.	Drivers and Enablers as CSFs	Reachability Sets (R)	Antecedent Set (A)	Interaction Set (R∩A)	Level
1	D1	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1	D1	
2	D2	D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1, D2	D2	
3	D3	D3, D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3	D3	
4	D4	D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4	D4	
5	D5	D5, E1, E3, E4, E5	D1, D2, D5	D5	VI
6	D6	D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7	D6, D7	VI
7	D7	D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4, D6, D7	D6, D7	VI

Table 6.12: Iteration VII

Sr. No.	Drivers and Enablers as CSFs	Reachability Sets (R)	Antecedent Set (A)	Interaction Set (R∩A)	Level
1	D1	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1	D1	
2	D2	D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1, D2	D2	
3	D3	D3, D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3	D3	
4	D4	D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3, D4	D4	VII

Table 6.13: Iteration VIII

Sr. No.	Drivers and Enablers as CSFs	Reachability Sets (R)	Antecedent Set (A)	Interaction Set (R∩A)	Level
1	D1	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1	D1	
2	D2	D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1, D2	D2	
3	D3	D3, D4, D6, D7, E1, E2, E3, E4, E5	D1, D2, D3	D3	VIII

Table 6.14: Iteration IX

Sr. No.	Drivers and Enablers as CSFs	Reachability Sets (R)	Antecedent Set (A)	Interaction Set (R∩A)	Level
1	D1	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1	D1	
2	D2	D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1, D2	D2	IX

Table 6.15: Iteration X

Sr. No.	Drivers and Enablers as CSFs	Reachability Sets (R)	Antecedent Set (A)	Interaction Set (R∩A)	Level
1	D1	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E4, E5	D1	D1	X

Table 6.16: Levels of TQM CSFs

Level	Drivers and Enablers as CSFs	codes	Reachability Sets	Antecedent Set	Interaction Set
I	Innovation	E5	E5	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E5	E5
II	Social and environmental responsibility	E4	E4	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3, E4	E4
III	Benchmarking	E3	E3	D1, D2, D3, D4, D5, D6, D7, E1, E2, E3	E3
IV	Strategic quality planning	E1	E1	D1, D2, D3, D4, D5, D6, D7, E1, E2	E1
V	Culture and communication	E2	E2	D1, D2, D3, D4, D6, D7, E2	E2
VI	Supplier partnership	D5	D5	D1, D2, D5	D5
VI	Training and learning	D6	D6, D7	D1, D2, D3, D4, D6, D7	D6, D7
VI	Information/analysis/data	D7	D6, D7	D1, D2, D3, D4, D6, D7	D6, D7
VII	Customer focus and satisfaction	D4	D4	D1, D2, D3, D4	D4
VIII	Process management	D3	D3	D1, D2, D3	D3
IX	Top management commitment and leadership	D2	D2	D1, D2	D2
X	HRM/recognition /teamwork	D1	D1	D1	D1

6.4.3 MICMAC analysis

Matrice d'Impacts croises-multiplication applique an classment (cross-impact matrix multiplication applied to classification) is abbreviated as MICMAC. The purpose of MICMAC analysis is to analyze the driving power and dependence power of factors. MICMAC principle is based on multiplication properties of matrices. It is done to identify the key factors that drive the system in various categories. Based on their drive power and dependence power, the factors, have been classified into four categories i.e. autonomous, linkage, dependent and independent.

MICMAC is a basic classifier system based on multiplication properties of matrices. MICMAC, has points of analytical contact with variables studied under the heading of TQM, and appears to provide a viable foundation for building toward the aims of TQM performance measurement framework.

The next chapter of this thesis presents a description of Knowledge-Based Performance Measurement (KBPM) model sufficient to allow implementation.

Autonomous: The CSFs that have weak driving power and weak dependency lie in autonomous category and are generally disconnected from the system, with which they have few links, which may be very strong

Linkage factors: These factors have both strong drive power as well as strong dependence power. These factors are unstable in the fact that any action on these factors will have an effect on others and also a feedback effect on themselves.

Dependent factors: These factors have weak drive power but strong dependence power.

Independent factors: These factors have strong drive power but weak dependence power.

A factor with a very strong drive power, called the 'key factor' falls into the category of independent or linkage factors. Fig.6.3 shows the ISM model of TQM CSFs. In total quality organizations, as individuals are empowered their increased autonomy

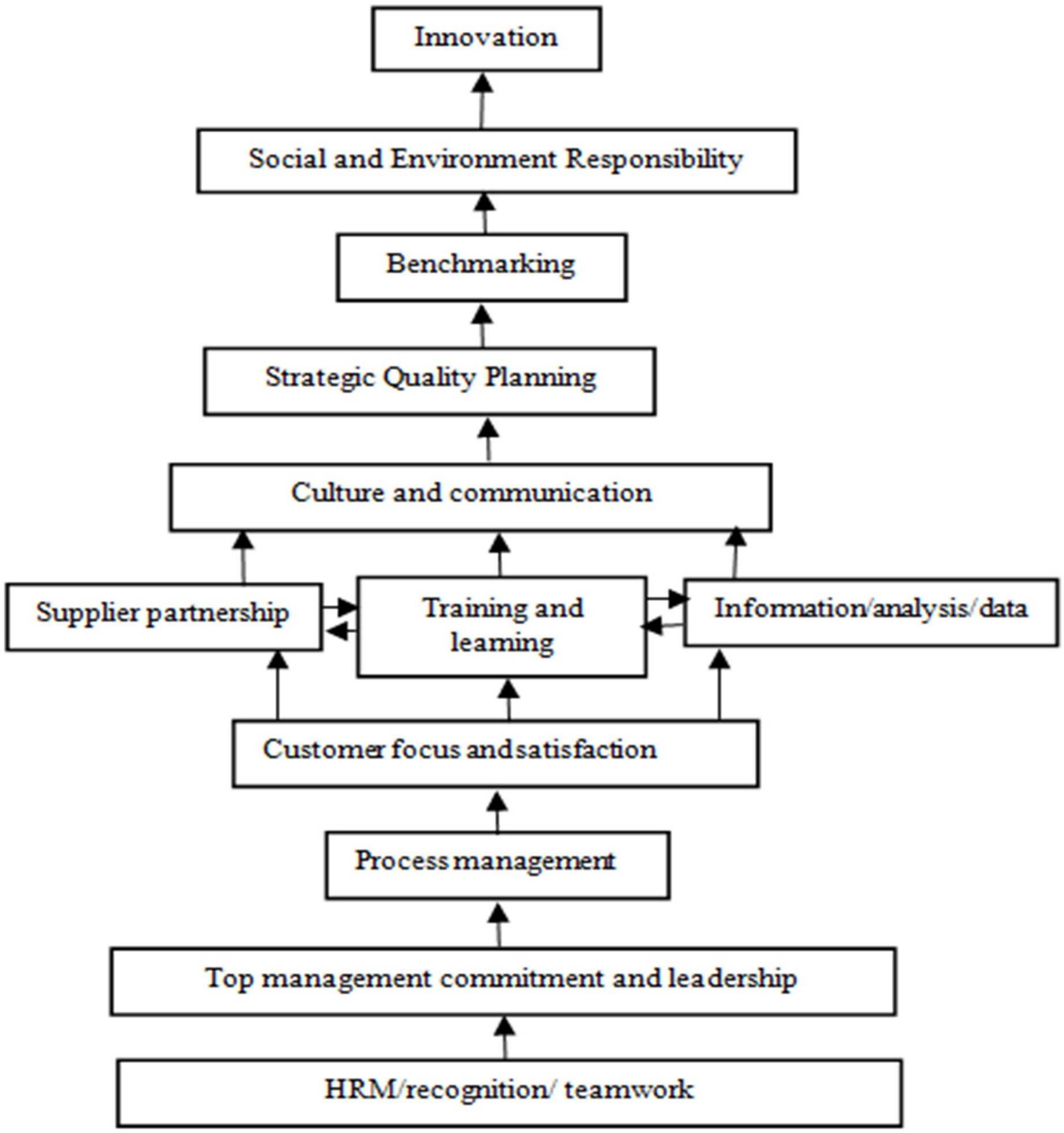

Figure 6.3: ISM model of TQM CSFs

can lead to heightened personal work performance and can reciprocally reduce the effects of system constraints and demands.Fellows and Liu (2008) revealed that QMP is associated with some interrelated factors like top management, training and development, customer focus, knowledge and information management, process management, supplier quality, benchmarking, information management etc.The research by Dubey and Kumar (2017) used Top Management Skill, Technology factor, Consumer factor, Teamwork, Communication factor, Competitive Advantage, Economic factor, Market Orientation, Government Policy and Financial factor to quantify the level of QMP implementation in Indian SMEs. The study by Panuwatwanich and Nguyen (2018) evaluated internal quality of the firm based on following eight quality constructs namely: top management support for quality management; training on quality; product/service design,quality data and reporting, process management, continuous improvement, problem-solving and rewards. The important driving and dependence powers' graph forcritical success factors which affect the performance of TQM are shown in Fig. 6.4.

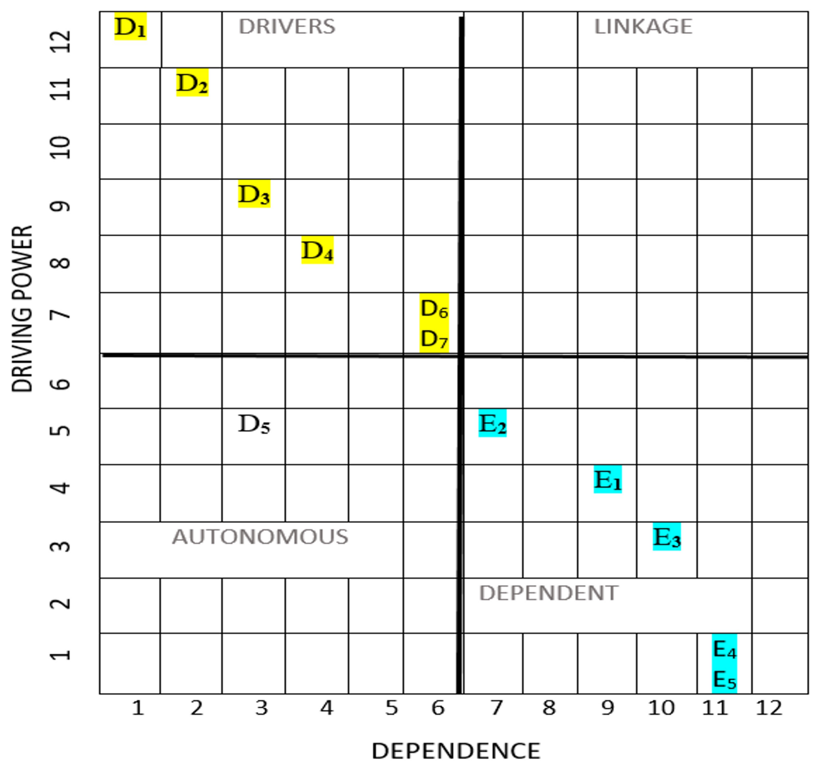

Figure 6.4: Driving and dependence powers' graph forcritical success factors which affect the performance of TQM

6.5 Conclusion

In this study, the SAP-LAP linkages framework was developed by making specific enquiries related to CSFs of TQM in FMCGs industry to establish the effectiveness and efficiency of TQM CSFs. A 5-point Likert scale has been used with an average of these responses calculated to determine the values in the assessment matrix. Thereafter, the observations are then analysed with the help of SAP-LAP methodology in order to finally arrive at the result.Performance management focuses on aligning the individual goals with the goals of the organization and ensures that the employees work on the right tasks and do the right things.The results obtained in this study will make a significant contribution towards the development of performance measurement plan of TQM system. Since, the issue is focused upon the performance measurement of TQM which is indeed a dire requirement in many industries. The output of this study will make an effective contribution towards the performance measurement of TQM literature. The organizations may work upon these TQM CSFs as well as barriers and come up with some huge changes in their strategy making to deal with the strategic management issue from its roots.The characteristics of the organization must be understood first before attempting to introduce or adopt new initiatives such as TQM. Through ISM methodology the contextual relationship among the identified TQM CSFs is established. In the hierarchy, innovation (E5) is on level I. Subsequently, the reachability set for a higher level element (TQM CSFs) consists of the element itself and any other elements within the same level which the element may reach, such as the components of a strongly connected subset.Afterward, the intersection of these sets of TQM CSFs is obtained for the entire CSFs and the levels of different variables are determined. The variables for which the sets of reachability and the intersection are the same is captured at the higher level of the ISM hierarchy.The higher level variables are those variables that do not influence the other variables above their level in the hierarchy. Subsequently, the intersection of the sets of reachability and the antecedent is the same as the set of reachability is at the higher level.As soon as the higher level factors are recognized, it is detached from the matrix. After, a similar process is repeated to identify the factors in the coming level. The procedure is continued until the level of each factors is developed, as can be seen in Tables 6.6, to Table 6.15. These levels are useful in establishing the graph and the ISM Model.From the MICMAC matrix, it is observed four TQM enablers namely Innovation, Social and environmental responsibility, Benchmarking and Strategic quality planning are the dependent variables and have strong dependency and weak driving power. They are at the top of the ISM model, therefore management should give high priority to tackle these variables.

Chapter 7

Knowledge Based Performance Measurement (KBPM) of TQM System

7.1 Introduction

The models of any system originate during the extensive investigation of its physical process. As in this present investigation, the TQM system of a FMCGs manufacturing industry is investigated to measure the performance. The work begins with the identification of the CSFs of TQM with respect to its goal through information gathered by self-administered bunch of questionnaires in linguistic form. Physical processes produce data and the data describe the relationship between variables in the process. A mathematical model of the process provides a way to organize, recognize, and represent the information. Even though many models are created in this way, existing models often fulfill these functions quite well for more than one process. The recommendation to keep a model as simple as possible has repeatedly been expressed in both science (e.g., Haidvogel and Bryan, 1992) and at the interface between science and management (e.g., Cotter et al., 2004).

What does a model provide? First the model adapts the data/information and make them viable with the manipulative procedures to be utilized. Numerous models are proposed in parametric structure, and the data or information are utilized to identify the parameters, this procedure of identification is known as search. In the event that conceivable, the model ought to be tested with new data. At last, the model empowers to construe objective(s) of the process being studied. The properties gathered empower to comprehend, anticipate and control the process cycle: the role of the model is to change over data hid in the crude information into usable structure. The parameters of the developed model can be moderated. These changes show an increasingly profound effect on the utility of the model. Moreover, as the mathematical structure of the proposed model changes similarly its capacity to translate information changes. In other words, models can be altered externally, by adopting a different philosophical view (and hence a different axiomatic structure), and altered internally by discovering new facts about an existing model. It is often stated that organizational systems and human expertise are complex, and the complexity of the real world needs to be reflected in the complexity of the models describing it. If that is true, then designing an integrated and detailed knowledge-based system for the evaluation of the performance of an organizational system, comprising several different and interacting approaches like SCM, JIT, Lean manufacturing etc., a multitude of stakeholders and large set of different drivers and enablers, would necessitate a knowledge-based system.

Knowledge-based systems (also termed "expert systems") are a particular class of decision support systems that can be subdivided into four major components: (i) a structured knowledge base storing the underlying information, (ii) an information system accessing and retrieving the information, (iii) a modelling component predicting the outcome of a problem posed ("inference engine"), and (iv) a framework that facilitates communication between the user, the knowledge base and the inference engine. The terms expert system and knowledge-based system have the same meaning; therefore, most researchers use them synonymously by Khan et al. (2011). Knowledge-Based contains rules, facts and the acquired knowledge from human experts (Nawawi et al., 2008). Knowledge bases that are formalised within "rule-based models" applying classical, Boolean ("crisp") logic (Noble, 1987;

Starfield et al., 1989) are well suited for the integration and interpretation of different knowledge sources. Sarfiand Solo(2005) observation is that the effectiveness of the knowledge-based application relies heavily on the successful conceptualization of rules. In context of measuring performance rule-based models can synthesize different attributes so that, as a group, the attributes are interpreted effectively and consistently. McIvor, R.T. et al. (1997) discussed a knowledge-based (KB) system designed to assist companies in the area of strategic purchasing in a multi-national telecommunications company. Specific focus of his research was on the issues involved in the application of case-based reasoning techniques and multi-attribute analysis to the automation of the make or buy decision. The development of KB system has shown that it is possible to use a knowledge-based methodology to build a support system in an area of strategic purchasing, especially if the domain is well defined, has a large number of factors to be considered and the relevant knowledge is available. Houben, G. et al. (1999) developed knowledge-based system to perform SWOT-analysis as to overcome the vague ideas received from employees about competitive strengths and weaknesses, opportunities and threats of a company. Although this study concentrated solely on the internal business environment, therefore considered strengths and weaknesses factors only for measurement purposes. Mohamed Udin, Z. et al. (2006), presented a hybrid of knowledge-based (KB) and gauging absence of pre-requisite (GAP) analysis for the measurement of performance of collaborative SCM system. For the robust foundation of collaborative SCM system, authors considered different perspectives as factors, like organization environment perspective, collaborative business perspective and external-internal chain perspective. The application of the knowledge-based collaborative SCM system provides an opportunity for users to interact actively and explore knowledge that resides in the system, concluded by author. In the similar fashion, Khurshid Khan M. et al. (2008) used a hybrid methodology i.e knowledge-based, gauging absence of pre-requisite called it GAP analysis and analytic hierarchy process (AHP) approach for measurement of company performance. Gauging absence of pre-requisite is a benchmarking tool that is used in the KB. It is advocated that the KBPMS model consist five performance levels viz, business perspective, customer perspective, manufacturing competitive priorities perspective, internal process perspective and resource and method availability perspective. For this study hypothesis was developed to show that the application of KB systems was a viable performance measurement system (PMS) methodology to improve company competitiveness. Al Khamisi et al. (2019), proposed knowledge-based system (KBS) to support the Lean Six Sigma in health care to enhance quality management (QM) performance and also incorporated gauging absence prerequisites (GAP) technique within a KBS system to measure the differences between existing practices and benchmark. The finding of his paper strongly recommend that knowledge-based system (KBS) provides an enhanced strategic and operational decision-making hierarchy for achieving a performance benchmark. Jasim Aldairi et al. (2017), research paper aims to develop a rule base approach of knowledge-based (KB) system for Lean Six Sigma maintenance in environmentally sustainable buildings.

Data, information and knowledge are not static things in models but stages in the process of using data and transforming it into knowledge. Knowledge-based systems are focused on a particular problem and cannot be used to solve other problems, Debenham, J. K. (1988). In terms of knowledge base some requirements or constraints must be satisfied in order for a particular application to benefit from knowledge-based system treatment (KBS) recommended Singh, N. et al. (1997). The requirements for KBS recommended by Singh, N. et al. (1997) is as: (i) The design problem under study should be well understood so that well-defined knowledge can be formulated and represented (ii) there should be general agreement among recognized experts in the field, and (iii) the knowledge with the design domain should be sufficiently large to warrant the development of a KBS.

The assessor facilitates the process according to the methodology. By the end of the process, experts will often gain considerable familiarity with the process, and make suggestions for improvements. Expert system/knowledge bases can contain information collected from multiple sources. Assessors can draw on the domain knowledge from one, two or several subject matter experts. Reliance on multiple experts can also help to provide more balanced content in a knowledge base where users might be in adversarial problems and circumstances. The rationale behind this choice and the methods used for the computation are presented in this chapter. In reality, the CSFs of TQM vary substantially across industries. The main divide is between communication system of the organization that connect employees through the strong network and culture that are not connected through any network.

7.2 Existing TQM performance measurement system

There is no as such any practice is carried out for measurement of the quality system in particular. De facto the XYZ FMCGs Ltd. never thought in that direction that the implemented strategy can be evaluated. Although, the performance of employees is accessed by human resource department of XYZ FMCGs Ltd. on annual basis for their increment of wages and for the promotion to higher level. Ten years back the XYZ FMCGs Ltd. hired consultant for the measurement of overall equipment effectiveness (OEE) to know how their manufacturing activities and processes are working. That was the time when the market share of XYZ FMCGs Ltd. was going down and top- level management were planning for automation of the existing manufacturing processes to increase productivity and reduce costs. It comes about in part also because of a domestic policy environment that stimulates and encourages competition, along with other policies to promote a pro-growth agenda marked by rising productivity, income, and demand. FMCG products are basic necessity for the consumers. So, FMCG companies will always be on-demand. It is well known that calculation of OEE with Availability, Performance, and Quality gives complete picture of losses. When it proposed to evaluate the TQM, the employees of the XYZ FMCGs Ltd. ready to support at all endeavor. The things which convinced the top-level management of XYZ FMCGs Ltd. is communicated by us in context of TQM is that higher quality management (QM) levels in term of effectiveness have better customer satisfaction and employee satisfaction, efficiency and better organization performance. Organizations with better performance levels develop QM to a greater extent. Accordingly, QM level is one factor among others that explain better performance levels in industries. Also, good performance can facilitate the implementation of QM practices. Further the support of the employees makes easy to carry-out the entire study, although it was not easy task to evaluate it. Kristianto et al. (2012) strongly stated that it is not straightforward task to design and implement an effective performance measurement system in context of TQM.

7.3 Model of TQM system

During the course of the study this procedure is used successfully for the FMCGs organization and strongly recommend that all the steps of the procedure are used very carefully. The initial focal point of research is always the definition of the problem. This is the only way in which the limited research resources can be correctly allocated instead of being involve into irrelevant activities.

It is realized during study that the TQM creates its virtual closed periphery to function within the organizational system. The goal of TQM is linked with the organizational goal with following the mission and vision of the organization. In other words, it can be said that organizational goal dependents upon TQM goal. Sauser, B. et al. (2010) states that the system (TQM system) can control itself or, at least, those things that compose it (factors). Like TQM, organization use to implement other strategies also viz. JIT, SCM, LM, Six-Sigma etc. TQM enhance manufacturability as well as reduce defects. Conceptual model of TQM system is an abstract representation of its semantic contents by identifying complex semantic entities and relationships among these entities. In most of the existing proposals of conceptual models for TQM system, its hierarchical structure is also represented in addition to the semantics of it. Figure 7.1 gives a broad picture of TQM system. The system is seen in interaction with TQM drivers and enablers via capabilities

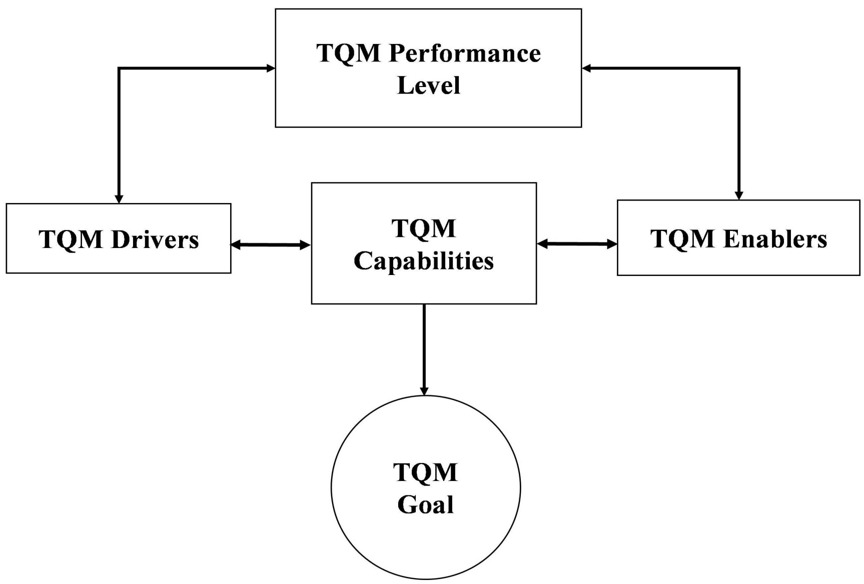

Figure 7.1: Conceptual TQM system model

for input and effective for achieving TQM goal. We use the term capabilities to refer to the exploitation of specific practices to attain performance gains. In addition, the TQM environment at times provides a scalar reinforcement, here termed TQM performance level. The basic idea of a TQM system drivers and enablers to act in an TQM environment to achieve goal. A total quality environment demands that employees participate in continuous improvement activities in an unhindered manner, that pushing decision making to the lowest practical level is the way. Thiagarajan and Zairi,(1997) labelled it "empowerment" in TQM terminology. TQM system descends from the organizational system but differs significantly in omitting several heuristics and critical success factors that aided that system. These included: Benchmarking, innovation and used in the performance measurement and elsewhere, and customer focus or centricity. Based on the business environment assessment, the desired performance level of TQM can be set by the organizational head.

The choice of attributes (variables) by the assessor affects the performance result. When a modular model of performance measurement is selected, the degrees of freedom in TQM system design are reduced and certain interactions are ignored, on purpose or without realizing it. Therefore, it was assumed that modularization leads to a loss in performance. The magnitude of this loss depends on the selection of variables and the characteristics of the organization. According to Ulrich and Ellison 1999, loss is higher for holistic performance attributes. (Demirbag et al. 2006; Welikala and Sohal 2008) strongly mentioned in their research that TQM is a holistic quality management approach that considers the entire value chain and emphasizes human factors.

Before measuring data, it is first vital to establish the hypothesis against which we measure it: in this case, the hypothesis of TQM performance. We will consider how something subjective like performance can be defined and start to explore how it might be measured. During the course of measurement of performance of TQM, many questions arise related to it. This simple statement hides a number of logical steps which can be expressed as a series of questions:

What is the goal of TQM?

How should resources be allocated to help the TQM achieve its goal?

How effectively is the TQM achieving its goal?

How can we measure how effectively TQM is achieving its goal?

What factors help TQM to achieve its goal?

How effectively is the TQM doing these factors?

How can the performance of TQM can be measured?

We suggest a number of criteria for judging indicators of performance:

Is it relevant to the problem we are trying to solve?

Is it helpful in indicating sources of difficulty and potential solutions to problems?

Is it valid - does it measure what it is supposed to measure?

Is it reliable or is the procedure for measurement subject to large and uncontrollable errors?

Can it be used for comparative purposes - to monitor changes over time within one organization, or to compare organizations?

Is it practical-in terms of cost, time of employees and users, possible interference with users' and employees' activities?

Vinkenburg (2006) stated about TQM that "To measure is to know" starts from variation in process (symptom), observe the uncontrollability of production processes as its problem (diagnosis) and seeks the solution in reduction of the variation (therapy) by determining the causes of the variation and take these away. This happens (treatment) by statistical analysis of process variables (SPC, seven tools, Six Sigma etc.). The TQM helps in streamlining processes, and ensures a proactive work system ready to counter deviations from the ideal state. TQM aids in process simplification and creates a proactive work system ready to fight deviations from the ideal condition. The major thrust of TQM is to achieve productivity and process efficiency by identifying and eliminating problems in work processes and systems. TQM addresses key problem areas such as mistakes in work processes, redundant processes, unnecessary tasks, and duplicate efforts. TQM interventions also help with predicting and preempting such mistakes and unproductive activities.

In this chapter, we are dealing with TQM performance measurement, a quantity that is subjective rather than objective. Subjective data is information from a person that relates to their feelings, their views or their understanding. As it is based upon a person's opinions, it is difficult to measure reliably and consistently. Zen and the Art of Motor Maintenance, the work of Pirsig (1974) is often quoted as proof that quality cannot be defined, but just discussed.

In practice, such inclusion helps to broaden the range of perspectives on a problem. If actors, as per SAP-LAP methodology (Chapter 5) can bring their perspective to bear on the issue, they are also more likely to recognize both the problem and its eventual solution to be theirs. Also as more knowledge from the context of operation as a some what artificial distinction from the context of research and development is included. It is likely that the implementation will be better adapted to that context. The above figure 7.1 illustrates our model of TQM system as a function of its driver and the enabler of its.

Zairi's (1994) developed analogy of comparing measurement to the umbilical cord that links a mother to its baby is apt in this context. Mothers, in a similar manner to organizations, have to look after themselves in such a way that whatever they do and whatever they eat, is not going to harm their baby (in this case, the business). The umbilical cord, or (performance measurement), is the mechanism by which the baby grows and the relationship with the mother remains a close one. Tangen, S. (2004) defines performance measurement is the process of quantifying the action and performance measure is a metric used to quantify action. TQM uses measures known as indicators (drivers and enablers), combinedly called critical success factors (CSFs) to track the effectiveness of TQM, and sets criteria for the selection of indicators and the process for their selection. CSFs provide a unifying effect, if only because most employees prefer to avoid the stigma of failing to contribute to an effort that is clearly good for the organization. To continuously improve the effectiveness of TQM system in organization, established scientific methods is used to analyze evidence and develop assessments of new and existing organizational system. R. R. Lakhe & R. P. Mohanty (1994) define TQM effectiveness as the extent to which the implementation of TQM can meet the desired objective. It can be perceived as a dependent variable (drivers and enablers) which may be affected by a set of independent variables.

Driver is a combination of actions initiated as a part of implementing a performance centric intervention stated Kandula, S. R. (2006). The drivers for TQM should be the same as the business drivers used by the organization to accomplish its mission. CSFs can be shared drivers for TQM and the organization. Enablers are defined as one that enables another to achieve an end, where "enables" implies to make able or give power, competency or ability. So, enabler is considered as a variable that gives the ability to maintain the sustainability in TQM. Enablers are assessed on the basis of the degree of excellence and degree of deployment of the approach, Oakland (2003). Enablers often referred as critical success factor in the literature with consideration to be one of the most significant components to attain effective quality management (Chiarini, 2013; Habidin and Mohd Yusof, 2013; Psomas, 2016). To be effective, a performance measurement system must therefore be based on the drivers of organizational success, which in the context of TQM depends on many factors: leadership, quality planning, specialized training, supplier management, process management and continuous improvement, customer satisfaction and social impact, as well as organizational learning (Claver et al., 2003). Competitiveness of Indian manufacturing is a function of the nature, especially FMCGs industries and extent of capabilities developed by these firms. Capability building is a complex process-it is supported by a variety of TQM drivers and the extent can be measured by a range of outcomes. Indian FMCGs have been building a wide range of capabilities. Restructuring of the industry is slowly leading to the emergence of a firms that is desirous of competing globally.

These reviews, called KBPM, also include recommendations to the FMCGs industries. The Strategic Committee, a group of evidence-based experts from across the same organization, reviews the methodology of assessments and then, after careful deliberation, makes their final recommendation.

7.3.1 The proposed framework

As Bimba et al. (2016, p.857) put it, "A system which represents knowledge is normally referred to as a knowledge-based system." Based on the characteristics of knowledge, Dignum and vab de Riet (1991) defined a knowledge base as "a set of statements that describe the knowledge about the truths of the actual world plus a set of constraints that describe statements that must be true in all possible worlds and statements that ought to be true in all possible worlds" (pp. 4). Knowledge base systems should in principle be able to store and manipulate any sort of knowledge, including vague (indefinite) knowledge, knowledge about events and obligations and knowledge about temporal aspects. The Knowledge-Based Performance Measurement Framework (the Framework) articulates the TQM performance measurement of XYZ FMCGs Ltd. The Framework promotes transparency and shared accountability for performance improvement across the system and helps inform future policy and planning strategies. The Framework describes the contextual, strategic and operational aspects of monitoring and improving organizations' performance. It also describes the various roles the department of organization, services and the performance information have in building, designing and monitoring best practice indicators to assist with the implementation of quality performance strategies. A structured measurement framework that can be used to quantify performance is required to understand the opportunities for improving performance of TQM. In other words, a detailed analysis of TQM metrics is needed. However, only a small step forward has been made in the measurement of TQM system efficiency in recent years. Therefore, the measurement of TQM performance, through a set of globally accepted metrics, is an ongoing challenge.

7.4 Selection of TQM critical success factors (TQM performance indicators)

Identifying Critical Success Factors enable to track and measure progress toward achieving strategic goals - and, ultimately, to fulfilling organization's mission. Converting responses and subjective data into numerical quantities is useful for analysis.

Using critical success factors of TQM identified on the basis of TQM goal, estimate a value for the performance of TQM.

Both primary and secondary types of data have been used throughout this study. The primary data were collected from in-depth key-informants interview with corporate head of quality assurance, high ranking officials to low level employees (key informants were selected based on their significance to the problem), mixed format survey questionnaire and direct personal site observation on the field (in order to triangulate the results from questionnaires and personal interviews and get the actual practice on the ground, the researcher went to the study area for an observation and fact-finding). The secondary data, on the other hand, were consulted from books, journals, the internet, and corporate reports.

For the research and study purpose, conducted an independent assessment of TQM system of an Indian FMCGs industry as a three-phase assessment based on TQM and performance measurement guidelines, performance of TQM system and feedback collected from all level of employee, vendors and suppliers. To finalize the framework and the questionnaire we conducted numerous times interactions with the quality experts and employees of the XYZ FMCGs LTD. All the effort contributed a lot to the improvement of the questionnaire. The assessment of performance of TQM system completed in time bound manner with self-deployment on-ground. The data dump and reports of performance along with a consolidated report of organizational performance would be shared with head of the organization.

7.4.1 Criteria for selection of TQM CSFs

The selection of the TQM CSFs (indicators) in this research used to measure performance is the culmination of stipulated time of work by the performance measurement steering committee, a group of experts and employees with extensive experience and expertise in TQM. Accomplishing critical success factors-and therefore achieving strategic business success-is an attainable goal. A critical success factor (often abbreviated "CSF") may sound complicated, but it's actually a pretty simple concept. A CSF is a high-level goal that is imperative for a business to meet. They are best stated as action phrases and may include the means and/or desired results, as well as the action. In order to be effective, a critical success factor must: (i) Be vital to the organization's success (ii) Benefit the company or department as a whole (iii) Be synonymous with a high-level goal and (iv) Link directly to the business strategy. Rockart defined CSFs as: "The limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization. They are the few key areas where things must go right for the business to flourish. If results in these areas are not adequate, the organization's efforts for the period will be less than desired." Rockart also concluded that CSFs are "areas of activity that should receive constant and careful attention from management." The success factors must be:

- Relevant/ Important: The indicator should reflect an issue related to quality that is important to the organizational goal and to relevant stakeholders and is consistent with the mandate of quality.
- Measurable: There should be data sources that can be used to measure the indicator.
- Actionable: The indicator is likely to inform and influence quality policy, alter behaviour of employees, and/or increase general understanding by the employees in order to improve quality of product or services.
- Evidence-Based: There must be good evidence to support the process, or evidence of the importance of the outcome of measuring and reporting on the indicator.
- Feasible: The indicator should be calculable and capable of being measured data is timely.

- Interpretable: The indicator should be clear and can be easily interpreted by a range of audiences; the results of the indicator are comparable and easy to understand, including what constitutes improved performance, such as clear directionality (i.e. a lower number is better).

- Data Quality: The indicator includes data quality such as technical definition, calculation methodology, validity and reliability of measurement, and timeliness of data.

7.4.2 Step-wise process of selection of CSFs/ TQM performance indicator

Step 1: Preliminary Analysis-is based on:

- Suggestions from the areas experts to consider for indicator development.
- Review of existing indicators.
- Consultation with subject matter experts, such as consultant and researchers.

Step 2: In-Depth, Expert Analysis: Exploration of the organizational system data, and wider consultation, accomplish ; through a technical expert panel. Consideration is given to whether each indicator can accurately identify high and low performance, using specific criteria.

Step 3: Presentation to External Stakeholders: Indicators that satisfy the expert panel are further developed, including technical specifications and methodology. The indicators are then must presented to organization's stakeholders for additional feedback.

Step 4: Approval for Reporting: Once an indicator is approved, further consideration is given to the best annual report, plus including it in organization's yearly report or specialized reports which provide more context. If an indicator is not

approved, it is kept on record and further development may be considered.
Step 5: Periodic Review: Indicators must regularly reviewed and may be excluded from reporting if no longer suitable.
Critical Success Factors (CSFs) entities of TQM may be defined between organizational performance and strategic goal to allow performance management to take place in an implemented organizational system. The CSFs (indicators) may be defined for access link, intra-organization, and inter-organization, and may be defined on a link or function basis.

The TQM CSFs as well as other's may be used to monitor performance within an organization or across organization, and may be used to monitor various performance parameters, such as Human resource management, top level management commitment, process management, customer focus, supplier's partnership and management, quality information, culture and communication, benchmarking, social and environmental responsibility, and innovation and many other independent parameters. Several management mechanisms may be used, and the measurements may be collected using a solicited collection method, in which a response is required and collected, or an unsolicited collection method in which a response is not required.

A novel conceptual framework which is presented in this chapter, its core is that of the performance measurement of TQM. It is started from identification of critical success factors keeping in view the goal of TQM. Dynamism of TQM depends on combination of its driver and enabler; Although these factors also play vital role for the well performance of organization, but it does not guarantee the company's success by itself. And with regard to what is mentioned in Fig. 7.2, in addition to dynamism and critical success factors, financial, non-financial and operational issues should be considered. Every organizational system has one or more objectives. A TQM system's function is to maintain the quality of the entire organization for the quality product at a set value (set point), this may lead to multiple objectives. The TQM enablers consist of performance level and an action generator and TQM drivers

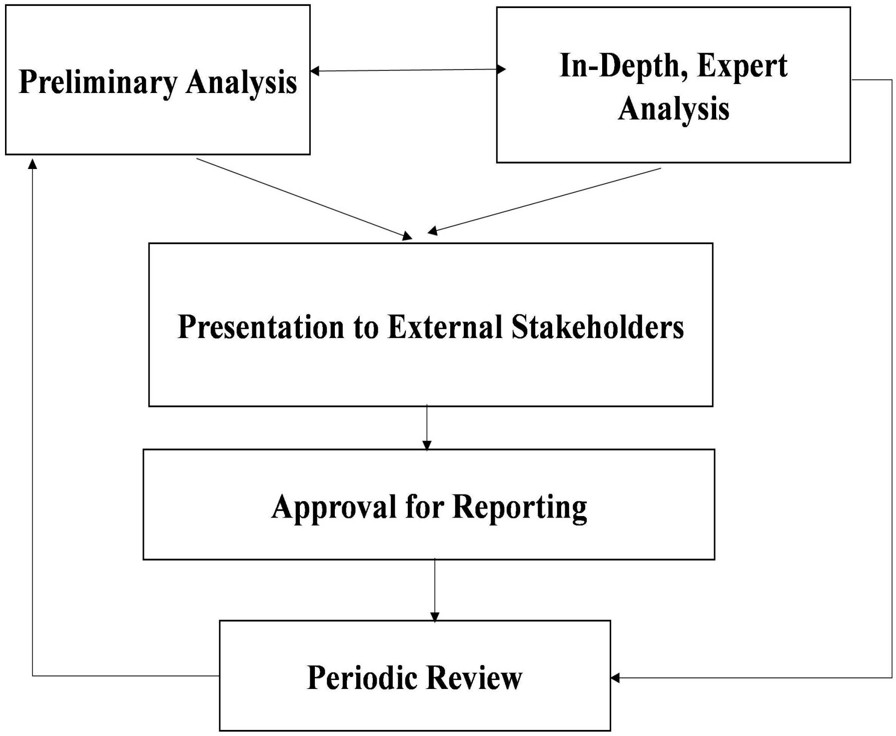

Figure 7.2: Process of TQM performance indicator selection

helps to generate the output, which is based on the guideline from the performance level. The performance level is to compare the objective or set point with the controlled variable (feedback). The result of the performance level is a positive or negative value, which represents the amount by which the actual output of the system varies from the target or the set point. If the performance level achieve excellent then becomes benchmark, though benchmarking is treated as enabler of any organizational system or subsystem.

7.5 Knowledge-based performance measurement (KBPM) of TQM

The name given to this framework on the basis that it models the human knowledge (employee responses) as a set of rules so, called the knowledge base. The knowledge base of the performance measurement of TQM system includes intelligent objects having fuzzy attributes and rules. A fuzzy inference method is used for deduction of fuzzy conclusions. The objects with deduction capability are called as intelligent objects in this study. The knowledge incorporated in form of fuzzy rules is clearly different from reasoning mechanism. The accessor could easily manipulate knowledge in the system by inserting or deleting some rules. In many cases, computing with words in place of numbers enhances tractability and lowers solution cost stated Zadeh (1965). In TQM, knowledge is represented by fuzzy rules in which the antecedent and the consequent involve linguistic variables. Fuzzy rules are used to derive new attributes or to specify some constraints using not only crisp but also fuzzy attributes of different objects. The variables of rules represent attributes of objects or objects themselves.

7.5.1 Fuzzy logic rule based performance measurement

Fuzzy Logic Rule Based Performance Measurement is an integrative evolutionary multi-level approach for TQM performance measurement termed as KBPM. In this section, we briefly outline the multi-level framework, which has been described more elaborately previously. The multi-level approach aims to integrate findings from live survey of the industry and different literatures. The different levels are not ontological descriptions of reality, but analytical and heuristic concepts to understand the complex dynamics of TQM system. The stability of established framework results from the linkages between heterogeneous TQM CSFs. The TQM CSFs and the linkages are the result of activities of employees which (re)produce them. Employee involvement, employee empowerment, recognition & reward and teamwork, for instance, are maintained by Human resource management for effective TQM. Training and learning factors are produced in the interaction between human resource management and quality data and reporting and internal quality information usage. Process management and Strategic quality planning emerge from Top management commitment. Innovation is the outcome of the Customer focus, benchmarking and Social and environmental responsibility. Identifying customer's requirements and fulfilling expectations is the very important first step in customer satisfaction, retention, and building a relationship with the customer. The product is manufactured by the workers under the guidance of the supervisor, while the raw materials are supplied by the suppliers on which the quality of product depends. The activities of these different factors are aligned to each other and co-ordinated for effective TQM. To understand this co-ordination, we build upon ISM model and MICMAC (refer chapter 6, subtitle 6.4). Harary conceptualise the mathematical basis for ISM methodology and the philosophical basis which led to the establishment of this approach has been given by Warfield in 1974. Organisations, and the employees involved, remember by doing. Such routine-based performance measurement also goes for strategies like TQM. In so far as strategies and firms share similar routines and goal, these form a technological regime. Technological regimes result in technological trajectories, because the strategies acts in the same direction. Technological regimes create stability because they guide the innovative activity towards incremental improvements along trajectories. Rip and Kemp (1998) widened the technological regime concept by defining it: "A technological regime is the rule-set or grammar embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artefacts and persons, ways of defining problems; all of them embedded in institutions and infrastructures".

Human do not usually think in probability values, but in such terms as often, generally, sometimes, occasionally and rarely. Fuzzy logic is concerned with capturing the meaning of words, human reasoning and decision making. Fuzzy Logic deals with vague, imprecise and uncertain knowledge and data and provides the way to breakthrough the computational bottlenecks of traditional one. At the heart of fuzzy logic lies the concept of linguistic variable. The values of the linguistic variable are words rather than numbers. Although fuzzy logic allow expression of expert knowledge in more natural way, they still depends on the rules extracted from the experts. The Fuzzy-Rule Based PM Model explains the components of performance operator of TQM, with a focus on dynamics of the TQM system and organization and its operational environment. The Fuzzy-Rule Based PM Model splits three phases of formation: Phase I states perception, Phase II for comprehension, and phase III for projection. Specifically, projection state extrapolates all information pieces gathered from previous stages forward in time to determine how they will influence future states of the operational environment, which makes this model unique. In addition to three phases, drivers and enablers of TQM are treated as critical success factors. They direct and limit operators in acquiring and interpreting information from the organizational environment to perform effectively and efficiently. TQM capabilities and principles are partially addressed in the model, but no other affective states are integrated into the model as shown in Fig.7.3. The phase wise steps to be followed in the framework development as below categorized phase wise to remove the complexity:

First phase involves: The Comprehensive study of the business operation and TQM environment for the identification and measuring TQM drivers and also to identify TQM capabilities. As we already mentioned that we use the term capabilities to refer to the exploitation of specific practices to attain performance gains. It is well known that TQM having wide capabilities like- defect reduction, waste elimination, throughput time reduction, responsiveness, flexibility etc. Through this evaluation the desired performance level of TQM can be assessed and TQM enablers can be identified for measuring its performance.

Second Phase Involves: Assess the TQM enable attributes and synthesize by using suggested tool and weights to obtain Performance Index.

Third Phase: Match performance Index with benchmark performance level to identify TQM performance level, and select major barrier to enable workforce which may proactively implement appropriate improvement measures.

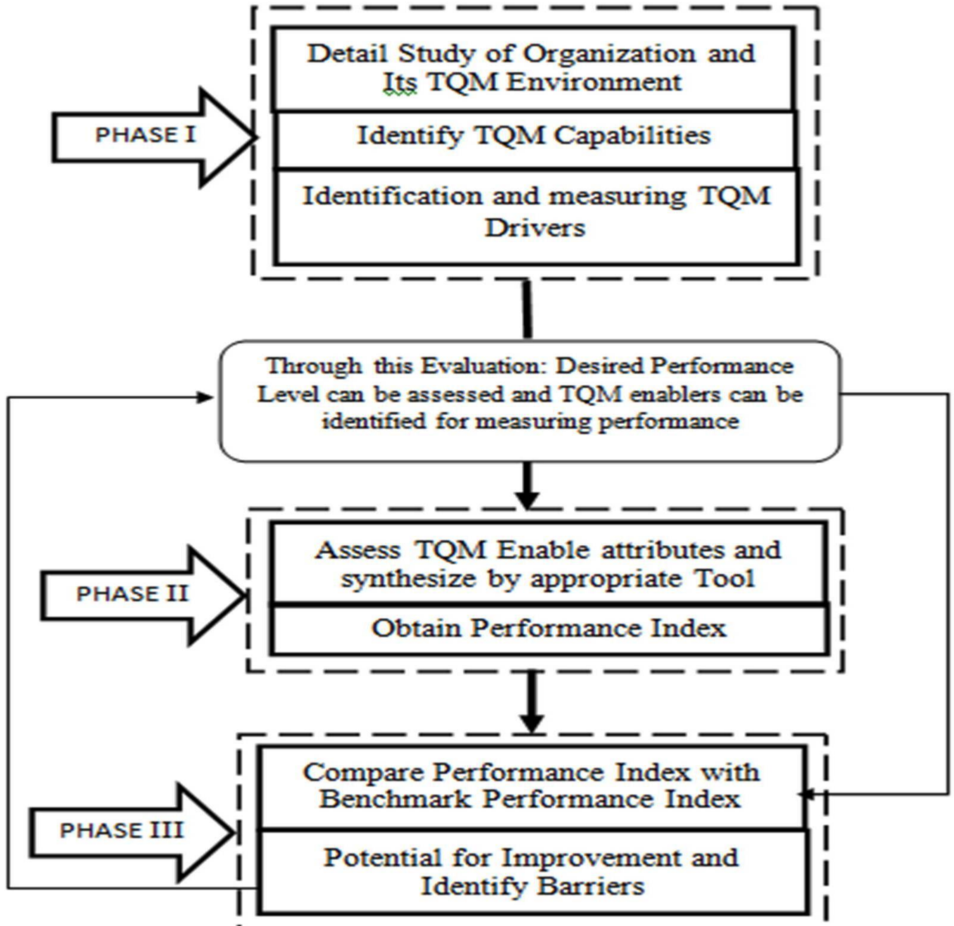

Figure 7.3: Conceptual framework for measurement of TQM performance

In order for a firm to successfully compete on its strategic objectives, relationships must exist between the firm's strategies, organizational actions, and performance measures (Dixon et al., 1990). Effectively, operating a quality system allows a reduction in costs, increasing the company's economic stability, competitiveness and prestige, as well as extending the number of customers, meeting better the environmental requirements, etc. The analysis performed on data collected can be summarized into the following algorithmic steps.

STEP I: Form steering and assessment committee, determine the required Performance level and select TQM-CSFs (attributes) for assessment.

STEP II: Collecting data and other information.

STEP III: Determine the appropriate preference scale for assessing the Ratings and Weights of the TQM CSFs.

STEP IV: Measure the TQM CSFs ratings and weight using linguistic data.

STEP V: Approximate the linguistic ratings and weights with fuzzy numbers.

STEP VI: Aggregate fuzzy ratings and fuzzy weights into the Fuzzy Performance Index (FPI) of TQM.

STEP VII: Translate the FPI into an appropriate linguistic level.

STEP VIII: Analyze gaps and identify barriers to be effective TQM.

Formation of assessment committee for determination of desired performance level and to select TQM enablers for assessment, upon completion of upper management's commitment and training, a steering committee must be created to guide the company through the process of measuring performance of implemented TQM. The role of the steering committee and the processes the committee must examine the operation environment in detail. The reasons to begin establishing performance measurement processes now are several. Study the various areas to determine the level of performance required by an effective TQM system and determine the TQM capabilities in response to the existing resources. TQM enable attributes/enablers were identified on the basis of operational environment survey and internal capability assessment which provide for its performance measurement which would affect company in a positive way.

Collecting data and information aims to understand the information that will be considered for the assessment of TQM enable attributes. Too much information and indicators can overload individuals and the provision of too many, or conflicting, performance measures may create an opposite reaction. This means that financial performance measures dominates over the non-financial performance measures. This appears to give an unbalanced view of the total organization's performance. To create appropriate action it is necessary to use a limited number of performance measures (Jackson, 2000). Tangen (2004) suggested that performance measure should have a clear purpose and be defined in an unambiguous way along with details of who will use the measure (e.g. collect the data, with what frequency, and how to act on the measure). Furthermore, it is also necessary to specify a target for each performance measure and a timeframe within which that target should be reached.

Preference scale for assessing TQM CSFs, precise evaluation of performance is not possible, if imprecise and obscure criteria is considered for evaluation. Vague human assessments in computing problems, Fuzzy logic provides an effective means for conflict resolution of multiple criteria and better assessment of options. Inspired by the processes of human perception and cognition, theory of fuzzy logic is based on the notion of relative graded membership.

FPI of TQM by aggregate fuzzy ratings and weights, Fuzzy performance index (FPI) is combination of information, which fuses the fuzzy ratings and weights of all of the factors that influence TQM performance. FPI represents overall effectiveness of TQM. As FPI increases the effectiveness of TQM increases. Arithmetic mean can be used to collect the opinions of experts, like as:
Assume that: a committee of m members for performance evaluation i.e., M_i , i=1,2,. . . . . . .m; conducts the performance evaluation. And Let F_j; j=1; 2; . . . ;n; be factors for measuring performance.

let $R_{ij} = a_{ij}, b_{ij}, c_{ij}$ be the fuzzy numbers approximating the linguistic ratings given to F_j by assessor M_i, and W_{ij}=x_{ij}, y_{ij}, z_{ij} be the fuzzy numbers approximating the linguistic importance weights assigned to F_j by assessor M_i.

Then, the aggregation of the opinions of experts are calculated by using the formula
Average fuzzy rating

$$R_{ij} = (a_{ij}, b_{ij}, c_{ij}) = R1_j(+)R2_j(+)R3_j...(+)Rm_j/m \tag{7.5.1}$$

andaAverage fuzzy weight

$$W_{ij} = (x_{ij}, y_{ij}, z_{ij}) = W1_j(+)W2_j(+)W3_j...(+)Wm_j/m \tag{7.5.2}$$

Then Fuzzy Performance Index:

$$FPI = \sum_{j=1}^{n} .(W_j X R_j) / \sum_{j=1}^{n} .(W_j) \tag{7.5.3}$$

Suggested by Sjoerd M. Baas et al. (1977) and W.M. Dong et al. (1987), is referred in this research to identify the TQM performance level. The membership functions of FPI can be calculated using fuzzy weighted average operation.

Matching of Fuzzy Attractiveness rating with appropriate linguistic level: on the basis of the closeness (the distance) from FPI to natural-language performance 'i' can be calculated, the FPI can be matched with linguistic level, which may be measured by Euclidean distance method or successive approximation method or any suggested method, the smallest one is identified. As in present case may consider the Euclidean method:

For this, say Performance Level (PL), the natural-language performance level expression set, and U_{FPI} represents the membership function of the FPI, and UPL represents natural-language performance set (i), then by using the formula

$$d(FPI, PL_i) = \sqrt{\sum_{x \epsilon t} (U_{FPI}) - (U_{PL_i})} \tag{7.5.4}$$

where , t = x_0, x_1, x_2,........x_mC[0,1]; so that 0 = x_0 ¡x_1 ¡ x_2........¡x_m=1.0
to simplify, let t = 0,0.05,0.1,0.15,0.2,0.25,0.3,0.35,0.4,0.45,0.5,0.55,0.6,0.65,0.7
,0.75,0.8,0.85,0.9,0.95,1.0

Rank fuzzy merit-importance indexes of performance provider: The suggested framework as well as to measure the performance of the TQM, also to identify the key barriers. This is also the part of my action plan to identify the main barriers to improve performance level. So, for this Fuzzy Performance Importance Index (FPII) is defined-which combines the performance rating and weight of each critical factor attributes of TQM. FPII represents an effect which influences TQM performance level. The degree of contribution of TQM performance for a factor decreases with decreasing FPII. Thus, the score of the FPII of a factor is used for the identification of the key barriers of TQM effectiveness.

The Fuzzy Performance Importance Index (FPII), which indicate the effect of each TQM's critical success factors (attributes) that contributes to effectiveness of TQM is defined as

$$FPII_i = R_j(.)[(1,1,1)(-)W_i] \tag{7.5.5}$$

Now to rank the FPII's, among the numerous methods of rankings, the left and right scores by Chen and Hwang's method (1992) is used. The beauty of this calculation method is that, their fuzzy max. and fuzzy min. are defined in a manner such that absolute locations of fuzzy numbers can be automatically incorporated in the comparison process. The fuzzy maximizing and minimizing sets are defined as

$$U_{max}(X) = \begin{cases} x, & 0 \leq x \leq 1 \\ 0 & otherwise \end{cases} \tag{7.5.6}$$

$$U_{min}(X) = \begin{cases} 1 - x, & 0 \leq x \leq 1 \\ 0 & otherwise \end{cases} \tag{7.5.7}$$

The left utility score of each fuzzy number FPII is defined as

$$U_{left}(FPII) = sup[U_{FPII}(x) \wedge U_{min}(x)] \tag{7.5.8}$$

$$U_{right}(FPII) = sup[U_{FPII}(x) \wedge U_{max}(x)] \tag{7.5.9}$$

Then the total of FPII is calculated by formula

$$U_{total} = \frac{U_{right}(FPII) + 1 - U_{left}(FPII)}{2} \tag{7.5.10}$$

The methods in this category utilize either the right score or both scores to derive the total score for each fuzzy number. The fuzzy number with a higher total score is considered better. ULEFT (FPII) and URIGHT (FPII) together assure the full utilization of information contained in U' Since the higher URIGHT (FPII) values indicate better fuzzy numbers and higher ULEFT (FPII) values indicate worse fuzzy numbers, the total score of U can be defined as in equation (10).

Linguistic levels for matching the FPI = Worst Performance (WP), Very Low Performance (VLP), Low Performance (LP), Fairly Low Performance (FLP), Good Performance (GP), Fairly High Performance (FHP), High Performance (HP), Very High Performance (VHP), Excellent Performance (EP).

One possible set of membership functions for the fuzzy numbers can be found in Fig. 7.4 Note that the choice of simple membership functions used in the figure is for present purposes only. They may not represent the exact functions used in other situations. The triangular fuzzy number is used for this synthesis and all membership functions for linguistic input data are standardized in the interval [0; 1]. Fuzzy logic takes truth degrees as a mathematical basis on the model of the vagueness phenomenon. Fuzzy logic algorithm helps to solve a problem after considering all available data. Then it takes the best possible decision for the given the input. Zadeh (1965) observed that conventional computer logic was not capable of manipulating data representing subjective or unclear human ideas. Linguistic levels

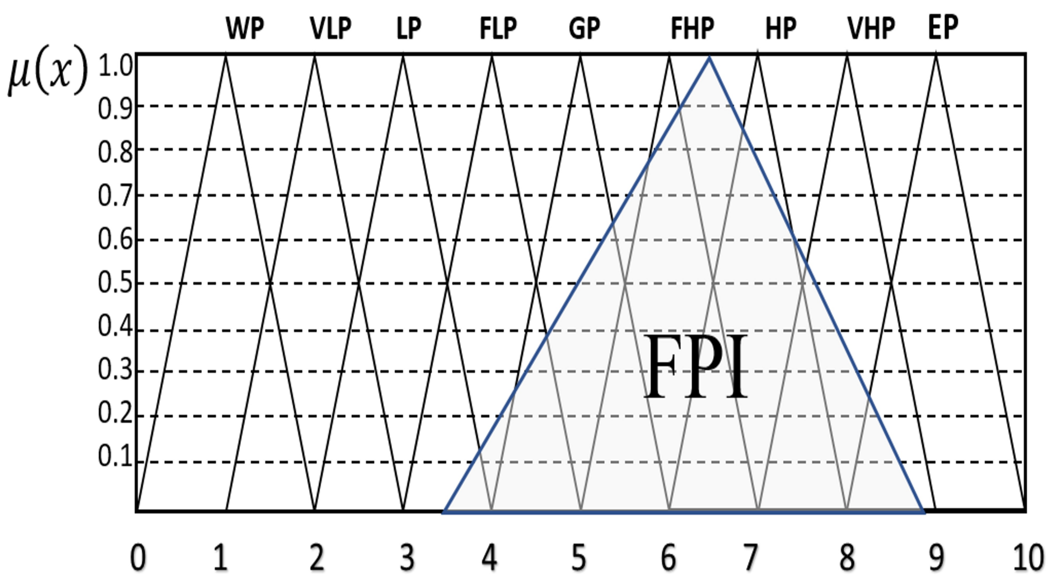

Figure 7.4: Linguistic levels for matching the FPI

for matching the FPI = Worst Performance (WP), Very Low Performance (VLP), Low Performance (LP), Fairly Low Performance (FLP), Good Performance (GP), Fairly High Performance (FHP), High Performance (HP), Very High Performance (VHP), Excellent Performance (EP).

The scale of fuzzy numbers is constructed on the basis of a particular situation and Its construction could also be quite intuitive. It is possible to say that a detailed conversion scale is important when the decision maker is more familiar with the decision-making situation. Some methodical approaches contain more conversion scales. Chen and Hwang (1992) show that when the number of conversion scales is greater, the system is able to cover more practical applications because it includes variously detailed scales (with different numbers of terms). The number of scales is discussed by Miller (1955) and Chen and Hwang (1992) in more detail. The rank score deviates from classical fuzzy rule composition because it allows output membership values greater than unity. However, the de-fuzzification process is sensitive to this conceptual problem. Rules with small weighting factors tend to get neglected in the "max" operation but make a helpful contribution when the "sum" is utilized in this application.

7.6 Input data

This evaluation process involves inputs in the form of linguistic data as employee's responses and such data are usually ambiguous and uncertain. The main source questionnaire responses of the employees of XYZ FMCGs Ltd. are used in this synthesis. To evaluate the performance of TQM under a fuzzy environment corresponding procedure is developed to deal with the fuzzy data. It presented a process model using linguistic variables, fuzzy arithmetic, and defuzzification techniques. Population counts from the survey are used to rate the TQM CSFs and peer reviewed literatures are used to list out the measures. Measuring TQM performance in XYZ FMCGs Ltd. and outcomes allows top management and quality engineers to target improvement efforts where performance lags. However, it should be mentioned that employee information was used for twelve (12) TQM CSFs and thirty (30) sub-factors which were completely enumerated during course of study. For the computation of the performance measures, the CSFs of TQM is measured with data from the survey collection. For the purpose of this synthesis, the fuzzy-rule based method was used. Present TQM goal of XYZ FMCGs Ltd is analyzed and expert opinion is used to identify the TQM CSFs of interest in the analysis. The spatial relation of the CSFs establishments is based on the standard classification maintained by Statistics in chapter 5.

The contextual relation between TQM CSFs establishment and its interdependency is made using ISM and MICMAC. The responses of employees of XYZ FMCGs Ltd. from each level of the management (Top-T, Middle-M and Low-L) to assess, and their opinion is called and summarized as single opinion of that level in linguistic form summarized in Table 7.1. The way of answering a question is reduced subject to a set of propositional fuzzy rules and fuzzy average rating of all three i.e top, middle and low level management is calculated shown in Table 7.2.

7.7 Data synthesis and computation

This synthesis is built upon the results of a preceding analysis of the TQM CSFs (Chapter-5), and every analysis requires a subsequent synthesis in order to verify and correct its results. The synthetic approach i.e. to infer effects on the basis of given causes. It is therefore appropriate when the laws and principles governing a system's internal processes are known, but when we lack a detailed picture of how the system behaves as a whole. In this study we infer effects from given causes, whereas by the second route we seek causes of given effects. we can call the first route synthetic, and the second analytic.

Through questionnaire and interview the responses of employee are collected for the study purpose. The employees were grouped as top level, middle level and low

Table 7.1: Rating of sub-factors of TQM assigned by employees using linguistic terms

		Employees Responses		
		T	M	L
D1	D11	VG	VG	G
	D12	G	F	VG
	D13	G	G	G
	D14	G	G	VG
D2	D21	E	G	F
	D 22	VG	G	VG
	D23	F	G	F
D3	D31	VG	VG	G
	D 32	F	F	G
	D 33	F	G	F
D4	D 41	G	VG	VG
	D42	G	G	F
	D43	F	G	F
D5	D51	VG	E	E
	D52	G	F	G
	D53	G	G	VG
D6	D61	VG	E	E
	D62	G	VG	VG
	D63	G	G	F
D7	D71	G	F	G
	D72	VG	G	VG
E1	E11	G	F	F
	E12	G	F	G
	E13	F	G	F
E2	E21	VG	G	VG
	E22	G	G	VG
E3	E31	F	F	G
E4	E41	P	F	F
	E42	F	F	G
E5	E51	VG		

Table 7.2: Fuzzy average rating of sub-factors of TQM CSFs

Rating of sub-factors of TQM CSFs assigned by employees using linguistic terms					
		Employees Responses			Fuzzy Average Rating
		T	M	L	
D1	D11	VG	VG	G	(6.3,7.5,8.6)
	D12	G	F	VG	(5,6.5,8)
	D13	G	G	G	(5,6.5,8)
	D14	G	G	VG	(5.6,7,8.3)
D2	D21	E	G	F	(5.5,7,8.3)
	D22	VG	G	VG	(6.3,7.5,8.6)
	D23	F	G	F	(3.6,5.5,7.3)
D3	D31	VG	VG	G	(6.3,7.5,8.6)
	D32	F	F	G	(3.6,5.5,7.3)
	D33	F	G	F	(3.6,5.5,7.3)
D4	D41	G	VG	VG	(6.3,7.5,8.6)
	D42	G	G	F	(4.3,6,7.6)
	D43	F	G	F	(3.6,5.5,7.3)
D5	D51	VG	E	E	(8,9,9.6)
	D52	G	F	G	(4.3,6,7.6)
	D53	G	G	VG	(5.6,7,8.3)
D6	D61	VG	E	E	(8,9,9.6)
	D62	G	VG	VG	(6.3,7.5,8.6)
	D63	G	G	F	(4.3,6,7.6)
D7	D71	G	F	G	(4.3,6,7.6)
	D72	VG	G	VG	(6.3,7.5,8.6)
E1	E11	G	F	F	(3.6,5.5,7.3)
	E12	G	F	G	(4.3,6,7.6)
	E13	F	G	F	(3.6,5.5,7.3)
E2	E21	VG	G	VG	(6.3,7.5,8.6)
	E22	G	G	VG	(5.6,7,8.3)
E3	E31	F	F	G	(3.6,5.5,7.3)
E4	E41	P	F	F	(2.6,4.5,6.3)
	E42	F	F	G	(3.6,5.5,7.3)
E5	E51	VG	E	VG	(7.5,8.5,9.3)

Table 7.3: Fuzzy numbers for approximation linguistic variables

Performance rating		Weight importance	
Linguistic variable	Fuzzy Numbers	Linguistic variable	Fuzzy Numbers
Excellent (E)	(8.5,9.5,10)	Very High (VH)	(0.85, 0.95, 1.0)
Very Good (VG)	(7,8,9)	High (H)	(0.7, 0.8, 0.9)
Good (G)	(5,6.5,8)	Fairly High (FH)	(0.5, 0.65, 0.8)
Fair (F)	(3,5,7)	Medium (M)	(0.3, 0.5, 0.7)
Poor (P)	(2,3.5,5)	Fairly Low (FL)	(0.2, 0.35, 0.5)
Very Poor (VP)	(1,2,3)	Low (L)	(0.1, 0.2, 0.3)
Worst (W)	(0,0.5,1.5)	Very Low (VL)	(0, 0.05, 0.15)

level and their individual view in respect of TQM and its performance is collected using 7 point Likert's scale. To minimize the calculation complexity the responses of the all employees were grouped as top level, middle level and low level. As not all the employees were participated in the survey, out of 2356 employees 365 employees those who were aware about TQM were further included for the performance measurement plan. The responses were collected as grouped top level, middle level and low level and their average is calculated. The mentioned industry was visited physically to collect the real data.

The proposed methodology combines objective and subjective approaches and utilizes fuzzy set theory to deal with imprecise information provided by employees of XYZ FMCGs Ltd. It analyzes the TQM performance based on CSFs, in an attempt to identify the relationship between the drivers and enablers of TQM system, at the time the level is assigned. Based on the established relationship, the model produces suggested current ranking by integrating employee's subjective opinions with the current situation of the sub-factors. The Table 7.3 summarises the response of the employees of XYZ FMCGs Ltd. in linguistic form of TQM CSFs, which further fuzzified by following the fuzzy scale. Responses of employees of XYZ FMCGs Ltd. on the TQM CSFs is the witness of the present situation of TQM. TQM has numerous capabilities important among them are waste minimization, zero defect, customer satisfaction, on time delivery of product etc. In pursuance of these to achieve goal, the quality manager continuously monitors the internal quality related actions, issues appropriate advisories, shares intelligence inputs, extends manpower and technical support, guidance and expertise to the responsible employees for enhancement of quality, continuous improvement without encroaching upon the other strategies of the organizational system.

General, any linguistic value is characterized by means of a label with semantic value. The label is an expression belonging to given linguistic term set. Finally, a mechanism for generating the linguistic descriptors is provided.

When both objective and subjective information are considered, the evaluators may want to assign some level of importance to each. To do so, the methodology offers an assignment of weights in the following manner. 1) The weights can be assigned by the organization conducting the evaluation, the group leader, and/or the panel's experts. 2) A total weight of one is divided between the weight factor (objective information) and the judgmental information. 3) The weight of the judgmental information can be assigned to each expert individually or to the panel as a whole. 4) Different weights may be assigned for each factor. The mathematics of weight assignment is provided in Equation 2. At this time, we have all the input information necessary for the analysis.

Information in a quantitative setting is usually expressed by means of numerical values. However, there are situations dealing with uncertainty or vague information in which the use of linguistic assessments instead of numerical values may be more useful. Linguistic decision analysis is based on the use of a linguistic approach and it is applied for solving decision-making problems under linguistic information, Herrera and Herrera (2000). Calculated fuzzy average weights are shown in Table 7.4.

Table 7.4: Calculated fuzzy average weight

Rating of sub-criteria assigned by assessors using lingustic terms					
Ci	**Cij**	**Assessors**			**Fuzzy Average weight**
		T	**M**	**L**	
D1		H	VH	FH	(0.6833 0.8000 0.9000)
	D11	M	FH	VH	(0.5500 0.7000 0.8333)
	D12	FH	M	FL	(0.3333 0.5000 0.6667)
	D13	L	FH	M	(0.3000 0.4500 0.6000)
	D14	FH	H	H	(0.6333 0.7500 0.8667)
D2		H	H	FL	(0.5333 0.6500 0.7667)
	D21	VH	H	VH	(0.8000 0.9000 0.9667)
	D22	FL	VH	FL	(0.4167 0.5500 0.6667)
	D23	H	H	L	(0.5000 0.6000 0.7000)
D3		VH	VH	H	(0.8000 0.9000 0.9667)
	D31	FL	L	H	(0.3333 0.4500 0.5667)
	D32	FL	H	FL	(0.3667 0.5000 0.6333)
	D33	H	FH	H	(0.6333 0.7500 0.8667)
D4		H	VH	VH	(0.8000 0.9000 0.9667)
	D41	H	M	FL	(0.4000 0.5500 0.7000)
	D42	FL	H	FL	(0.3667 0.5000 0.6333)
	D43	FL	H	M	(0.4000 0.5500 0.7000)
D5		VH	VH	H	(0.8000 0.9000 0.9667)
	D51	M	FL	H	(0.4000 0.5500 0.7000)
	D52	FH	H	VL	(0.4000 0.5000 0.6167)
	D53	M	FH	FH	(0.4333 0.6000 0.7667)
D6		VH	H	H	(0.7500 0.8500 0.9333)
	D61	H	VH	VH	(0.8000 0.9000 0.9667)
	D62	H	M	FL	(0.4000 0.5500 0.7000)
	D63	FL	M	M	(0.2667 0.4500 0.6333)
D7		FH	FH	H	(0.5667 0.7000 0.8333)
	D71	L	FL	FL	(0.1667 0.3000 0.4333)
	D72	H	M	H	(0.5667 0.7000 0.8333)

Table 7.5: Calculated fuzzy average weight

Rating of sub-criteria assigned by assessors using lingustic terms					
Ci	**Cij**	**Assessors**			**Fuzzy Average weight**
		T	**M**	**L**	
E1		H	FH	FL	(0.4667 0.6000 0.7333)
	E11	H	M	M	(0.4333 0.6000 0.7667)
	E12	FL	FH	FH	(0.4000 0.5500 0.7000)
	E13	FL	M	FL	(0.3333 0.5000 0.6667)
E2		VH	H	VH	(0.8000 0.9000 0.9667)
	E21	H	VH	VH	(0.8000 0.9000 0.9667)
	E22	H	H	FH	(0.6333 0.7500 0.8667)
E3		FH	FL	H	(0.4667 0.6000 0.7333)
	E31	FH	M	M	(0.3667 0.5500 0.7333)
E4		VL	FH	FH	(0.3333 0.4500 0.5833)
	E41	FL	FH	H	(0.4667 0.6000 0.7333
	E42	H	M	M	(0.4333 0.6000 0.7667)
E5		VH	H	VH	(0.8000 0.9000 0.9667)
	E51	H	FH	FH	(0.5667 0.7000 0.8333)

By following the STEP V, Eqs. (1) and (2) can be used to aggregate the rating and weight fuzzy numbers under the same criterion.

Total of RATING∗WEIGHT = [73.3500, 121.2500 123.7033]

and SUM OF WEIGHTS = [13.9000 18.0500 22.0835]

FPI_{Total} = [73.3500, 121.2500, 123.7033] / [13.9000, 18.0500 22.0835]

= [3.3215, 6.7175, 8.8995]

Then the next step VI, The FPI is translated into an appropriate linguistic term.

After obtaining the FPI, to identify the Performance level, further approximated a linguistic label with a meaning identical or close to the meaning of the FPI from the natural-language expression set of the Performance level (PL). The natural-language expression of Fuzzy Performance Index set, FPI = Worst Performance (WP), Very Low Performance (VLP), Low Performance (LP), Fairly Low Performance (FLP), Good Performance (GP), Fairly High Performance (FHP), High Performance (HP), Very High Performance (VHP), Excellent Performance (EP), is chosen for labeling. Furthermore, to simplify, suppose the membership functions shown in figure 7.4 are chosen for matching devised from Equation 4. (One can choose other membership functions if necessary). Then the Euclidean method which consists of calculating the Euclidean distance from the given fuzzy number to each of the fuzzy numbers representing the natural-language expressions set is obtained. It is recommended that the Euclidean distance method be utilized because the other methods (successive approximation or piecewise decomposition) are difficult to implement (Kangari & Riggs, 1989).

Euclidean Distances calculated

d(FPI AND WP) =16.9463

d(FPI AND VLP) =25.8403

d(FPI AND LP) =22.1249

d(FPI AND FLP) =18.6053

d(FPI AND GP) =15.7597

d(FPI AND FHP) =13.9938

d(FPI AND HP) =13.4882

d(FPI AND VHP) =14.3875

d(FPI AND EP) =16.6495

Following the recommended steps, next comes identification of the barriers to effective TQM performance level i.e Step VIII, for this fuzzy performance-importance index (FPII) is defined, which combines the performance rating and weighting of each TQM CSFs-attribute. FPII represents an effect which influences TQM performance level. The degree of contribution of TQM performance for a factor decreases with decreasing FPII as shown in Table 7.6. Thus, the score of the FPII of a factor is used for identifying the potential barriers of TQM. Although the Performance Index of the XYZ FMCGs Ltd. TQM approaches “High Performance” according to the evaluation i.e minimum “d”) while being far from “Excellent Performance” (the

Performance Level desired by TQM of XYZ FMCGs Ltd., because in the coming future XYZ FMCGs Ltd. aims to be benchmark company in the field of biscuits and dairy products). Pareto Principle for identification of barriers: Barriers inherently present in the system or can say that those success factors which unable to achieve the intended level were termed as barriers. Now our focus on the most potential barriers, which need improvement on priority basis and required fixing the barriers that have the biggest negative impact on TQM performance. Appropriately applying the Pareto principle to real-world problems can produce meaningful results without the need to resort to elaborate statistics and simple decision-making technique for assessing competing problems. Furthermore, Eqs. (6)-(10) were applied to defuzzify the FPIIs, as listed in Table 6. The scores represent the effect of each CSFs, which contributes to TQM to achieve goal. Based on the Pareto principle, we suggested to focus resources on the critical few factors (10%) and set a scale of 0.10 as the management threshold, i.e. 10 only for identifying the factors requiring most urgent improvement. Subsequently, Table 7.6 indicates that four sub-factors performed below the threshold, namely: (1) Top management support, (2) Process design (3) Learning and (4) Trust. Whereas Table 7.7 shows the Fuzzy performance-importance indexes of TQM sub-factors.

7.7.1 Result

The synthesis is based on secondary data of twelve (12) CSFs and thirty (30) sub-factors that were identified of TQM system of XYZ FMCGs Ltd. Each CSFs and sub-factors data consists of an employee's response and records views for all factors. The employee's response were collected on five-point Likert scale and aggregated form is summarized in tabular form. The analysis sample for TQM CSFs is restricted to the employees who aware about the quality practice in the company (Chapter-4), which we use to classify CSFs into TQM drivers and enablers strata. Fuzzy sets and membership values is used which provides a possible model for inexact

Table 7.6: Fuzzy merit-importance indexes of TQM sub-factors

Sub Factors	R	(1,1,1) (-) W	FMII	Ranking score
D11	(6.3,7.5,8.6)	(0.45000.30000.16670	(1.0502 2.2500 3.8700)	1.2500
D12	(5,6.5,8)	(0.66670.5000, 0.3333)	(1.6665 3.2500 5.3336)	1.4938
D13	(5,6.5,8)	(0.7000 0.5500 0.4000)	(2.0000 3.5750 5.6000)	1.6198
D14	(5.6,7,8.3)	(0.3667 0.2500 0.1333)	(0.7465 1.7500 3.0436)	1.1002
D21	(5.5,7,8.3)	(0.2000 0.1000 0.0333)	(0.1831 0.7000 1.6600)	0.6542
D22	(6.3,7.5,8.6)	(0.5833 0.4500 0.3333)	(2.0998 3.3750 5.0164)	1.6913
D23	(3.6,5.5,7.3)	(0.5000 0.4000 0.3000)	(1.0800 2.2000 3.6500)	1.2638
D31	(6.3,7.5,8.6)	(0.6667 0.5500 0.4333)	(2.7298 4.1250 5.7336)	1.9601
D32	(3.6,5.5,7.3)	(0.6333 0.5000 0.3667)	(1.3201 2.7500 4.6231)	1.3704
D33	(3.6,5.5,7.3)	(0.3667 0.2500 0.1333)	(0.4799 1.3750 2.6769)	0.9442
D41	(6.3,7.5,8.6)	(0.6000 0.4500 0.3000)	(1.8900 3.3750 5.1600)	1.6055
D42	(4.3,6,7.6)	(0.6333 0.5000 0.3667)	(1.5768 3.0000 4.8131)	1.4745
D43	(3.6,5.5,7.3)	(0.6000 0.4500 0.3000)	(1.0800 2.4750 4.3800)	1.2706
D51	(8,9,9.6)	(0.6000 0.4500 0.30000	(2.4000 4.0500 5.7600)	1.8269
D52	(4.3,6,7.6)	(0.6000 0.5000 0.3833)	(1.6482 3.0000 4.5600)	1.5284
D53	(5.6,7,8.3)	(0.5667 0.4000 0.2333)	(1.3065 2.8000 4.7036)	1.3714
D61	(8,9,9.6)	(0.2000 0.1000 0.0333)	(0.2664 0.9000 1.9200)	0.7507
D62	(6.3,7.5,8.6)	(0.6000 0.4500 0.3000)	(1.8900 3.3750 5.1600)	1.6055
D63	(4.3,6,7.6)	(0.7333 0.5500 0.3667)	(1.5768 3.3000 5.5731)	1.4573
D71	(4.3,6,7.6)	(0.8333 0.7000 0.5667)	(2.4368 4.2000 6.3331)	1.7707
D72	(6.3,7.5,8.6)	(0.4333 0.3000 0.1667)	(1.0502 2.2500 3.7264)	1.2638
E11	(3.6,5.5,7.3)	(0.5667 0.4000 0.2333)	(0.8399 2.2000 4.1369)	1.1704
E12	(4.3,6,7.6)	(0.6000 0.4500 0.3000)	(1.2900 2.7000 4.5600)	1.3574
E13	(3.6,5.5,7.3)	(0.6667 0.5000 0.3333)	(1.1999 2.7500 4.8669)	1.3199
E21	(6.3,7.5,8.6)	(0.2000 0.1000 0.0333)	(0.2098 0.7500 1.7200)	0.6800
E22	(5.6,7,8.3)	(0.3667 0.2500 0.1333)	(0.7465 1.7500 3.0436)	1.1002
E31	(3.6,5.5,7.3)	(0.6333 0.4500 0.2667)	(0.9601 2.4750 4.6231)	1.2263
E41	(2.6,4.5,6.3)	(0.5333 0.4000 0.2667)	(0.6934 1.8000 3.3598)	1.0835
E42	(3.6,5.5,7.3)	(0.5667 0.4000 0.2333)	(0.8399 2.2000 4.5336)	1.1461
E51	(7.5,8.5,9.3)	(0.4333 0.3000 0.1667)	(1.2502 2.5500 4.0297)	1.3669

Table 7.7: Fuzzy performance-importance indexes of TQM sub-factors

Sub factors	R	(1,1,1) (-) W	FPII	Ranking score
D11	(6.3,7.5,8.6)	(0.4500 0.3000 0.16670	(1.0502 2.2500 3.8700)	1.25
D12	(5,6.5,8)	(0.6667 0.5000, 0.3333)	(1.6665 3.2500 5.3336)	1.4938
D13	(5,6.5,8)	(0.7000 0.5500 0.4000)	(2.0000 3.5750 5.6000)	1.6198
D14	(5.6,7,8.3)	(0.3667 0.2500 0.1333)	(0.7465 1.7500 3.0436)	1.1002
D21	(5.5,7,8.3)	(0.2000 0.1000 0.0333)	(0.1831 0.7000 1.6600)	0.6542
D22	(6.3,7.5,8.6)	(0.5833 0.4500 0.3333)	(2.0998 3.3750 5.0164)	1.6913
D23	(3.6,5.5,7.3)	(0.5000 0.4000 0.3000)	(1.0800 2.2000 3.6500)	1.2638
D31	(6.3,7.5,8.6)	(0.6667 0.5500 0.4333)	(2.7298 4.1250 5.7336)	1.9601
D32	(3.6,5.5,7.3)	(0.6333 0.5000 0.3667)	(1.3201 2.7500 4.6231)	1.3704
D33	(3.6,5.5,7.3)	(0.3667 0.2500 0.1333)	(0.4799 1.3750 2.6769)	0.9442
D41	(6.3,7.5,8.6)	(0.6000 0.4500 0.3000)	(1.8900 3.3750 5.1600)	1.6055
D42	(4.3,6,7.6)	(0.6333 0.5000 0.3667)	(1.5768 3.0000 4.8131)	1.4745
D43	(3.6,5.5,7.3)	(0.6000 0.4500 0.3000)	(1.0800 2.4750 4.3800)	1.2706
D51	(8,9,9.6)	(0.6000 0.4500 0.30000	(2.4000 4.0500 5.7600)	1.8269
D52	(4.3,6,7.6)	(0.6000 0.5000 0.3833)	(1.6482 3.0000 4.5600)	1.5284
D53	(5.6,7,8.3)	(0.5667 0.4000 0.2333)	(1.3065 2.8000 4.7036)	1.3714

concepts, subjective judgements and for all types of evaluations. In this study fuzzy paradigm would be appropriate to represent the knowledge-based decision and to select proper evaluation of TQM performance. TQM dynamism possesses some complexity; and so exact evaluation is epistemologically impossible unless handled with fuzzy tools. Empirical results show that rank of CSFs is the predictor of TQM performance and that test score advantages do not insulate lower ranked CSFs from TQM underperformance. While there are good reasons for concern about the current system of TQM evaluation, there are also good reasons to be concerned about claims that measuring each CSFs effectiveness largely by test scores will lead to improved performance of TQM.

TQM is supposed to interact with its critical success factors (drivers and enablers) in a peer-to-peer fashion by following the organizational goal. The CSFs, i.e TQM drivers and enablers has number of attributes, such as top-level management, supplier quality, employee enforcement, training and education, benchmarking, which work in a unified fashion to achieve performance level. That means, the objectives/goal of TQM are directly linked to organizational goal of performance dimensions in which an organization wants to improve or excel and thereby, clear links between TQM objectives and the organization's strategy are secured. Subsequently, TQM objectives are operationalized in measurable critical success factors (CSFs) indicators that represent measurable properties and are relevant to the organizational performance and need to be improved. These CSFs are then operationalized by measurement plans, which specify the measurements that should be done. These consecutive steps collectively make up the TQM definition; a policy documentation with the strategic goal, the TQM objectives and the CSFs which are then operationalized in a measurement plan (Figure 7.1). As shown in figure 7.3, fuzzy based performance measurement models commonly include attention and decision-making as their primary factors in dynamic driving situations. First, the fuzzy average rating and fuzzy average weight is calculated. Then Fuzzy Performance index is calculated to identify the present performance level of TQM. Further the Euclidean distance from the given fuzzy number to each of the fuzzy numbers representing the natural-language expressions set is obtained, which shows that the TQM is at "High Performance" as per the minimum of "d" i.e FPI. But the desired level of XYZ is Excellent Performance, so question arises that what is the reason (cause), means which factor is acting as a barrier to achieving the targeted goal of the TQM system need to identify. Combining the performance rating and weighting of each TQM CSFs-attribute, fuzzy performance-importance index (FPII) is defined (Table-6) which represents an effect which influences TQM performance level. Through the score of the FPII of a factor the potential barriers of TQM are easily identified. The CSFs, tools and techniques of Process management is found most effective factor of TQM as this study was in FMCGs industry whereas the poor process design hindering in achievement of quality. Before that the top management support is also lacking, without that the TQM will fail. Besides these learning and trust sub-factors which were directly linked to the employee and these both sub-factors must be uplifted by the intervention of human resource management of the XYZ FMCGs Ltd.

7.8 Conclusion

In this chapter, we investigated TQM models for evaluating most prominent success factors. Based on the extracted indicators, we built a performance measurement structure for applying Fuzzy-rule. A three-phase framework of performance measurement of TQM was proposed. It includes estimating the weight of all of the factors that influence TQM performance in the assessment stage and extracting implications to be applied to the site in the diagnostic stage. A case study (Chapter-6) was conducted to verify the proposed framework. This research will be very helpful to managers who want to evaluate the performance of implemented strategies.

As the TQM system has complex factors, the evaluation of performance is widely accepted as an MCDM problem. Especially in the manufacturing industry, which has complete distinctive quality standard levels, lessening the gap and discrepancy among TQM levels is very important to get the organizational competitiveness. Our proposed framework affords a steppingstone for identifying those issues. Our proposed model can be used by FMCGs industries to measure the TQM performance completely, because building structure of indicators and doing study to each management level requires time and is cost consuming. Measuring performance by company of its any strategy is just bootstrapping itself out of a marred past performance in particular. Moreover, defining the relations among indicators is ambiguous as company size is bigger. Our proposed model fits the manufacturing industry, models (Baldridge, EFQM, Deming, etc.) from which we extracted the criterion are specialized in manufacturing. Moreover, a characteristic of our research, dividing the management level into three, is easily applied into manufacturing industry.

Researchers have long recognized that CSFs test scores are heavily influenced by organizational factors such as size and culture, manufacturing processes, competitiveness, organizational goal, and the maturity of the implemented strategy which may be relatively more advantaged or disadvantaged. Thus, strategies implemented in affluent organizations would almost always look more effective than others if the CSFs scores of their attributes were interpreted directly as a measure of effectiveness.

Chapter 8

Conclusions and scope of future work

8.1 Conclusions

The present thesis is an attempt to fill the gaps in the contemporary research on performance measurement of TQM. The main work undertaken in this thesis include the followings.

- Extensive literature is reviewed to explore the research gaps and relevant research issues in the TQM and its performance.
- A set of research hypothesis were formed on the basis of available literature and interaction with the academia and industrial personnel. These hypotheses are related to TQM practices in FMCGs industry.
- A Questionnaire based survey was performed to elicit responses from the quality management professionals. Responses from 365 Employees were taken in the survey. The responses to the questionnaire is used to understand the status of TQM performance in FMCGs industries. The various aspects covered in the questionnaire included TQM measures, benefits and barriers in achieving TQM implementation, level of information sharing and its goal.
- The questionnaire was analysed for its reliability, descriptive statistics and hypothesis testing.

- Two categories of hypothesis were developed and tested. In the first category, hypothesis belongs to general TQM issues and in the other category impact of the TQM CSFs on its performance has been presented and tested using Anderson-Darling Normality test and t-test.

- The statistical analysis of the questionnaire is followed by case study of Indian FMCGs industry, which is anIndia based food and bakery manufacturing industry.

- Twelve important critical success factors with their thirty subfactors on which the performance of TQM depends were identified from the consultation with experts and review of literature, both from academia and industry.

- Through SAP-LAP technique the case-study of the company XYZ FMCGs Ltd. is critically examined. This analysis is used to interpretive framework of investigation into the present research problem.

- Further an ISM based model is developed to understand the contextual relationship among the identified critical success factors of TQM performance and later using MICMAC the dependencies are analysed.

- An Knowledge-Based Performance Measurement (KBPM) model using Fuzzy Logic has been developed for measurement of performance of TQM. KBPM approach provides a structure that can use to develop a framework of performance measures throughout the organisation. The framework also covers how to analyse and present performance data in order to reveal valuable information about the behaviour of the organisation's processes and activities. And the approach covers ways of engaging employees with the measures and working towards business improvement.

8.2 Key findings of the thesis

It is essential to measure the right thing at the right time and in the right quantity in industry so that timely corrective action can be taken for improvement. It has been observed that performance measures are not just evaluate the performance of system but also embedded with social and economical issues. Therefore, TQM performance measurement is receiving considerable attention from both academicians and practitioners. Failure to achieve TQM performance level directly affects the organization's performance to accomplish its mission. Some key findings from this research are as follows:

- Identifying the right critical factors, determining the corrective actions to be taken for improvement as per the intended TQM goal.
- As the TQM CSFs are lastly ranked that shows that which factor have to be taken care for improvement.
- Setting objectives, evaluating performance and setting future course of action is the most important benefit perceived by TQM performance.
- Insufficient information system; reluctance of support of distributors, dealers and retailers, inadequate production planning and unawareness about performance of the implemented strategies are the prominent barrier while conducting performance measurement.
- Most of the companies evaluate their TQM based on the ROI and customer service criteria.
- Although most of the companies are using some another form of performance measures for their quality management like defect rates and cycle time etc. but majority of them don't have any specific TQM performance measurement system, neither there performance metrices are TQM oriented.

- ISM analysis suggests that the the human resource (D1) related factors and mechanistic covers process management (D3) and customer focus (D4). Top management commitment (D2) is necessary at all levels to reinforce the goals and purpose of an organization, product, or service. Engagement of employee which is ensured by Human Resource Management (D1) at all ranks is essential to reach the objective of an organization, product, or service.

- Supply chains (supplier partnership-D5) are managed by people, and these include leaders and managers who have diverse orientations in their practice.

- HRM department should develop the employee as a fast learner who has the ability to achieve comfort level in changed environments; develops practical solutions.

- Customers, suppliers and employees are the key players of TQM. To achieve success with TQM program, managers must understand and then communicate the TQM goal(s) for their product or organization with employees.

- To establish the contextual relationship among the TQM CSFs, the control/ dependent variables are considered (Table- 6.2; Chapter-6) whereas for the performance measurement of TQM, dependent as-well-as independent variables were considered (Table- 7.1; Chapter-7). Control variables/ Dependent variables not only help to measure the impact of any given variable above and beyond the effects of other variables, they also account for spurious relationships. An independent variable is the cause, and a dependent variable is the effect.

8.3 Implications of the research

For FMCG manufacturing industry to achieve quality level and strategy that will enable effective customer service and competitive advantage, staff and relevant stakeholders need to have a clear understanding of relevant theories that will assist them to solve critical problems encountered by them in quality related process. Novel concept of performance measurement of TQM for FMCG industries to be proposed and implemented. The new concept and theories of performance measurement should be emphasising the important components of TQM practices in the FMCG manufacturing industries. This means that FMCG industry stakeholders (staff and partners) need to understand and implement TQM performance measurement model. The key question is: Which factors will be the critical to success in achieving the TQM goal ? The selection of the factors will be considered for the success of TQM on the basis of the TQM goal but they seem to be for the organizational goal also. Drivers and enablers identified by intelligentsia are unlikely to bring up significant performance and when they measured the barriers were identified for hindering of the TQM system because they are focused on TQM goal rather than organizational goal and do not possess the necessary power to resist organizational system.

- The TQM system outlines how certain activities are directed to achieve the goalsof TQM and organization as-well.
- Effective TQM define each employee's job and how it fits within the overall system.
- A centralized TQM system has a defined chain of command, while decentralized system give almost every employee receiving a high level of personal agency.
- Top level management should consider key performance area before deciding success factors, including the TQM goalsand quality culture.
- The method is simple and intuitive in terms of evaluation and computation. It allows the analyst to evaluate the success and fuzzy merit importance index directly using linguistic terms, and fuzzy numbers can easily approximate the linguistic terms.

- The analyst can obtain a more reliable assessment, particularly in a situation with ill-defined, inaccurate as well as qualitative data in a management consultant evaluation. Moreover, the algorithm of the proposed method can be computerized. Thus, by the decision-makers' providing linguistic assessments through a menu-driven interface design, the decision-makers can make performance measurement decision.

In our opinion and according our experience, a crucial point is the development and validation of Performance Measures for TQM. In fact, for an effectiveness of TQM practices, it is very important to measure the performance over time. The methodological procedures proposed in this research aim to get a 'reference analysis' about TQM practices. This is important because the TQM performance measurement still needs to be explored and consolidated to define how it could become a managerial practice. To define a PM, an exploratory study was carried out. Studies performed by various researchers addressing performance measures/critical success factors/ essentials/foundation blocks for TQM were analysed. Determining critical success factors in business isn't just a one-off project—it's a complete culture shift and change. It doesn't have a lifespan—you have to integrate it into your organization and consistently work on it to ensure it all runs smoothly.And remember: Simply having CSFs in place doesn't mean your organization will magically change and become more successful. You have to be able to communicate, measure, and manage them to properly execute your strategy.Like Process management factors Include measures that evaluate whether key processes are functioning effectively or as planned. Process measures should be carefully selected to directly gauge the impact of the change ideas on the process(es) needing improvement (e.g., is the new process better? How do you know?). This information will help you determine if the change idea(s) should be adopted, amended, or abandoned. Process measures must be quantifiable and reportable as rates, percentages, or numbers over specific timeframes. Similarly, the information of financial performance shared to the operating personnel then data can be used to improve the operations in ways that can reduce energy needs, minimize raw material wastage and improve quality, thus minimizing the cost of production. If there is no performance measure of TQM or targets are set, then progress cannot be measured and later this becomes one of the reasons of failure of TQM. Many authors advocate and blame to the factors which were initially labelled as CSFs and later if not achieve the desired level, then termed as barriers.

8.4 Scope of future work

It is difficult, at least in the first instance, to determine the optimum number of critical success factors of TQM to be included in the model for an acceptable level of accuracy defined by the scope of the model. Due to lack of data, it will often become necessary at a later stage to accept a lower number than intended at the start or to provide additional data for improvement of the model. It has often been argued that a more complex model should account more accurately for the reactions of a real system, but this is not necessarily true. Additional factors are involved. A more complex model contains more parameters and increases the level of uncertainty, because parameters have to be estimated either by more observations in the organization, by experiments, or by past data, which again are based on actual measurements. Parameter estimations are never completely without errors, and the errors are carried through into the model, thereby contributing to its uncertainty. Although the case study demonstrated the usefulness of the model for TQM performance evaluation, we believe that room still remains for future validation and improvement. Further research is necessary to fine tune the proposed model and to compare the efficiency of different models for measuring performance. The performance of the TQM system varies considerably. It may be exemplary, but often is not, and most of the Indian FMCGs industry fail to receive effective benefits from TQM. If the TQM system cannot consistently perform to achieve the intended goal, we may conclude that it is even less prepared to respond to the global market that will surely affect the organizational goal. This study has various aspects to be improved in future research. Few of them are recommended as:

- If more performance indicators of TQM are selected, the assessment process will be rather time consuming. Thus, there is a challenge to neglectunimportant indicators before assessment. Developing the knowledge management system is helpful inthis issue.
- TQM focuses more on non-financial performance rather than financial. Financial metrics can't capture all value-creating activities. It's also need to assess nonfinancial measures such as customer loyalty, workplace safety,customer satisfaction, and product quality, and determine because they can be directly linked to the TQM performance that ultimately deliver value.
- More case studies could verify and strengthen the proposed framework. Further casestudies are recommended to analyze the framework's usefulness and difference between companies orindustries.
- As many states of the art technologies, such as the Internet of Things (IoT), are beingapplied into the real sites, Food Softwares like Food Safety Plan Builder (FSPB), Food Defense Plan Builder (FDPB) will help in enhancing the quality of the products, new indicators should be developed to reflect their performance. Feedbackfrom professionals would definitely enrich the list of indicators.
- As safety and environmental factorsbecome important in manufacturing, it is necessary to establish them.
- The development of e-commerce, based upon the Internet and the information technology, makes companies exchange information and do business more

quickly than ever before. In such an environment, companies have to reduce lead time and inventory to obtain quick response to markets with low cost.

- Organizations must regularly re-evaluate the TQM measures that are using to link performance with the governing objective. The CSFs change over time, and so must statistics. As the demand of the FMCGs customer base are changing, so the manufacturer needs to review the drivers of customer satisfaction. In that case companies have to launch innovative products that could improve their performance.

Chapter 9

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APPENDIX -A

Questionnaire to gauge TQM awareness

Name of Organization: ____
Year of Establishment:__________________________ Designation: ________________
Employee Name (Optional):__________________ Sex: _______________________
Department Deployed: ____

Section I

Mark (√) in the appropriate box.

1. Employees educational qualification (Please Tick)

SSLC	ITI	DIPLOMA	GRADUATE	PG	Others

2. Nature of Job

Technical	Non-Technical

3. Nature of Activities

Planning	Operations	Productions	Packaging	Maintenance	Safety

4. Experience of Employees

1-5 Years	6-15 Years	> 15 Years

Section II

Mark your response in specified box

	Low 1	2	3	4	High 5
(i) Rate your level of TQM concepts and practices familiarity?					
(ii) Rate the importance of quality for organization					
(iii) Rate your interest about learning new tools and techniques					
(iv) Rate the satisfactory level of working culture of your company					
(v) Rate your interest about learning quality concepts					

Sr. No.	Question	Yes	No
1	Do company invest on Training of employees on quality concepts and practices?		
2	Do you feel that quality management acts as guiding philosophy in the company		
3	Does your company guarantee high quality of products through quality management		
4	Do Company practices TQM program across all the departments		
5	Do you see that the TQM in your company is successful		
6	Is Company is well versed with continuous quality improvement and innovation program?		
7	Do you ever get reward for your work?		
8	Do you feel that quality is the only way through which your company can achieve utmost level		

APPENDIX -B

Measurement Scales for TQM factors and sub-factors

B_1 Questionnaires to gauge the involvement of HRM for TQM

Low High Importance	1	2	3	4	5
(i) Your positive involvement in organisational activities					
(ii) Training offered by employer time to time to learn new tools and techniques?					
(iii) Facility provided by company if you wish to learn new tools at your own interest?					
(iv) Employees reward for better performance					
(v) Scale the respect do your co-workers show with each other					
(vi) Connectivity with your co-workers					

B_2 Questionnaires to gauge the *commitmentTop management* for TQM

Low High Importance	1	2	3	4	5
(i) Senior managers support to co-workers and low level employee					
(ii) Employee motivation is encouraged by Top level management					
(iii) senior managers encourage employee to participate indecision-making					
(iv) senior managers are committed to their work					
(v)institutional pressures to top management for quality management					

B_3 Questionnaires to gauge the effect of *Process management* on TQM

In context of work (Low High Importance)	1	2	3	4	5
(i)maintenance and alignment of manufacturing process					
(ii) review of process frequently					
(iii) having detailed design and development process					
(iv)customer's easiness and assistance					
(v)Employees' contributions in the overall planning process					

B_4 Questionnaires to gauge the effect of *Customer focus/Customer Centricity* on TQM

DisagreeAgree Importance	1	2	3	4	5
(i) Organization's ability to meet customer's due dates					
(ii) Successfully resolving customer's complains					
(iii) Determining customers future expectations					
(iv) Locating close to organization's customers					

B_5 Questionnaires to gauge the effect of *Supplier partnership/ Supplier's management* on TQM

	Low High Importance 1	2	3	4	5
(i)The firm collaborates with suppliers in order to improve the product offered in the establishment					
(ii)The firm collaborates with intermediaries in order to improve the product offered in the establishment					
(iii) readily accessible of Suppliers					
(iv) traceability of (raw material/finished products)					

B_6 Questionnaires to gauge the effect of *Training and education* on TQM

	Yes	No
(i) Quality training helps in working style		
(ii) Do you feel confident for work when learnt about it		
(iii) Do you feel that knowledge acquisition is important		
(iv) Do you feel that knowledge affect the performance of organization		
(v) Do you feel need of training for latest technologies		

B_7 Questionnaires to gauge the effect of *Quality Information/Information Quality* on TQM

	Low High Importance 1	2	3	4	5
(i) appropriate amount of information to make correct decisions aboutwork					
(ii)importance of factual data for working culture					
(iii)Data retrieval					
(iv)adequate communication with all the employees					

B_8 Questionnaires to gauge the effect of *Strategic quality planning* on TQM

	Yes	No
(i) Is your consent is invited for quality planning		
(ii) Are you aware with the vision and mission of your company?		
(iii) Are you aware of your companies' quality policies?		
(iv) Do you feel that you contribute to the company's goals?		

B_9 Questionnaires to gauge the effect of *Culture and communication* on TQM

	Low High Importance 1	2	3	4	5
(i) Rate the company's communication with its customers					
(ii) Rate the responsiveness with company to customers					
(iii) Rate the prompt resolution of complaints by company					
(iv) information provided to customer promptly					
(v) customer's feeling for company					

B_10 Questionnaires to gauge the effect of *Benchmarking* on TQM performance

	Y	N
(i) Does your company ever compare with other company		
(ii) Does your company send team to other organization to learn from there		

B_11 Questionnaires to gauge the effect of *Social and environmental responsibility* on TQM

	Low Importance High 1	2	3	4	5
(i)Importance of corporate social responsibility					
(ii)company participation in social development work					
(iii) company approach for less pollution to environment					
(iv) Rate the authenticity and honesty behind our work recognition					

B_12 Questionnaires to gauge the effect of *Innovation* on TQM

	Low Importance High 1	2	3	4	5
(i) Having own R&D department/team of company					
(ii) launching new products first in market					
(iii) company care the customers wants					