TOTAL QUALITY MANAGEMENT: A FRAMEWORK FOR QUALITY IMPROVEMENT IN ARAB MANUFACTURING COMPANIES

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ABSTRACT

Total Quality Management (TQM), has been accepted globally as a management philosophy and practice to improve quality. However, only limited empirical studies have been carried out in manufacturing SMEs in the Gulf countries. The primary concern for the manufacturing SMEs in the Middle East who want to compete in the global market is that many competitors have been involved in quality improvement programs for decades which initially give them a competitive edge. These companies have already developed the top management commitment, infrastructure and other resources needed to sustain continuous improvement (CI) practices.

Manufacturing companies in the Middle East, on the other hand, have until recently often lacked the knowledge and skills essential to develop and implement a total quality program, hence struggle to improve the quality management system in comparison to the manufacturing companies in the west. There are many reasons for this wide gap. The causes include education, amount of time and capital spent on research on total quality management (TQM) and other quality management models, limited use of variety quality control lean tools and techniques, limited access to information and communication technology, low labour productivity and a variety of other social cultural issues that impede productivity and efficiency. This research investigates the actual causes of difficulties in implementing and adopting TQM and CI practices that challenge the manufacturing SMEs in the Gulf region in terms of quality management.

The research was designed to identify the current level of TQM implementation in manufacturing SMEs in the Gulf States and investigate the TQM and CI Parameters that affect the performance of the companies and to identify barriers that stop them from implementing TQM in their company. The main objectives were to determine the influencing factors and response to TQM implementation within manufacturing SMEs.

A first stage empirical analysis was carried out to establish the current state of quality initiatives and identify the current level of knowledge regarding TQM and critical success factors in manufacturing SMEs.in the Middle East.

The main findings of the research include the impact of TQM practice on manufacturing SMEs in the Middle East, identification of critical success factors to implement TQM effectively, establishing the impact of demographic characteristics on TQM and significant and positive effect on relationships such as education and training, employee participation, customer satisfaction and management commitment.

Based on the empirical findings a TQM framework was developed that is more suitable for Arab SMEs to improve the quality management and business performance. The contribution to knowledge in this research is the development of a framework to combine selected CI tools that suit the Arab manufacturing SMEs and that will improve the productivity, lead time, customer satisfaction, low cost, quality product and employee skills. The proposed TQM model was validated through a second stage empirical analysis.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

The implementation of Total Quality Management (TQM) has delivered extensive improvement in quality, costs, and capabilities across a range of industries around the world. However, the adaptation of TQM and continuous improvement (CI) approaches is quite minimal in the Arab businesses, especially in the manufacturing sector.

TQM is a philosophy that has been applied worldwide in various economic sectors. The aim of this research is to identify some management approaches to TQM within the manufacturing companies in the Arab nations. TQM has been a well-known quality management concept since the 1980's and significant research is still being carried out in this field to understand the critical factors for successful implementation and adoption, increasingly important in the context of different geographical location and cultures (Jha et.al, 2012).

This research seeks to understand the challenges involved in the ever-increasing demand for highest level quality management systems through an assessment of the different models of performance management and process or continuous improvement in the manufacturing sector, which have been adopted across the developed countries. As highlighted by Valmohammadi (2011), the manufacturing companies in the Arab countries must concentrate on improving the quality management implementation issues to survive the global competition.

1.2 The Research Problem and Its Significance

According to Argia and Ismail (2013), TQM has been viewed to be a critical facilitating factor in the development of customer satisfaction and has been identified as an important approach adopted by many business organisations worldwide. TQM, through its emphasis on the matching of product or service to customer requirements can improve the satisfaction of customers to a large extent. Customer satisfaction is linked with quality at the source. Studies in TQM emphasise the critical role of leadership in the implantation process of TQM. According to Manufacturer (2003), TQM demands increased continuous effort from everyone in the organisation to satisfy the customer. Without clear and consistent quality leadership, quality initiatives cannot be successfully achieved. Thus is it necessary for quality leadership to be made strategic objectives of the Arab organisations

Jonas (2003) stated that TQM drives the culture of an organisation towards commitment to total customer satisfaction through CI such a culture, materials, resources, equipment and quality management systems are implemented cost effectively and completely utilises, although in contrast, Temtime (2003) identified that culture has a strong influence upon organisational performance and individual satisfaction. Therefore, cultural awareness is very important for the organisation. The organisational development in developed nations, the considerations for local work culture is minimal in comparison to the business organisation in the Arab nations. Research shows that Arab work culture poses many difficulties for successful TQM benefits. As agreed by Rahman and Tannock (2005), this leads to conflict between organisational values and local values. Such a situation has affected many manufacturing organisations in the gulf countries when competing in global business.

Research carried out by Temtime and Solomon (2002) shows that introducing, implementing and adopting TQM in the Middle East manufacturing companies is still considered a major challenge due to many factors as listed below:

- Lack of commitment and leadership
- Lack of management culture
- Resistance from the employees
- Lack of proper and adequate training

The research study is significant to the manufacturing organisations in the Arab nations as it offers wide scope in exploring the issues and problems related to implementation and adoption of TQM. Practices of continuous improvement strategy are widely accepted in many organizations operating at national or international level. This study signifies the role and importance of those issues and problems affecting the functioning of TQM in manufacturing SMEs in the Middle East. Camison (1998) indicated that each manufacturing firm is different in terms of business and scope of operations, therefore, issues and problems faced by manufacturing organizations in the Arab nations also differ. The research aims at identifying some common issues and problems faced by manufacturing business organizations in the Arab manufacturing firms, specifically in the continuous improvement area. Exploring the issues and problems certainly help in handling these issues and implementing the concept successfully (Owen, 2002). A framework has been proposed to combine selected CI tools that suit the Arab manufacturing SMEs and that will improve the productivity, lead time, customer satisfaction, low cost, quality product and employee skills

1.3 Research Aim and Objectives

The aim of this research is intended to investigate the state of TQM practice in contemporary CI tools and techniques and identify barriers and critical success factors

that are prevalent in manufacturing companies in the Arab countries and seek potential niche opportunities for improving their manufacturing effectiveness through quality improvement and management.

The main objectives of this research are outlined below:

- Evaluate the underlying concepts of TQM.
- Carry out an empirical analysis to identify the current level of knowledge. regarding TQM and CI in manufacturing companies in the Arab countries.
- Develop a CI integrated TQM model to suit Arab manufacturing SMEs
- Validate the proposed TQM model through second empirical analysis

1.4 Research Questions

The key research questions in this research are below:

- What are the barriers and opportunities for TQM and CI implementation in the Arab manufacturing SMEs?
- What are the critical success factors for successful implementation for TQM model in Arab manufacturing SMEs?
- Does the Arabic work culture have an effect on the success of TQM?

1.5 Overview of Research Methodology

In general, a research must be conducted with an approach which states that the nature of the problem will lead to the means of the solutions. Thus, it is necessary to analyse the problem in some depth prior to the selection of the most appropriate research methodology and subsequent method.

The following steps were followed in this research:

Step 1 Identify research gaps

Step 2 Carry out an empirical analysis

Step 3 Develop a framework

Step 4 Validate the framework

Step 5 Write the thesis

CHAPTER 2
BACKGROUND TO RESEARCH

2.1 Manufacturing in a Global Environment

One of the key challenges in the new manufacturing industry is global competition. Manufacturing industry has developed substantial new technology and advanced techniques to produce low-cost products. These new technologies and state of art developments have now stretched to their limit and are exploited globally. This rapid technological growth has made the competition very fierce among manufacturing companies worldwide.

International business means to operate globally in terms of markets, operations, supply chains and financing (Mitel and Pennathur, 2004).

Although competing globally is not new for multinational companies the competition today is much intense. Small companies are also tangled in global competition. Even local SMEs are no longer secluded, as big organisations are increasingly striving to source components and services, and succeed in distribution, through local companies. According to Livesey (2006), as competition increases, companies tend to involve measures and take actions to improve their entire business process with regard to quality, cost, process technology, lead time, and innovation in their products.

2.2 Modern Manufacturing Challenges in SMEs

Competitiveness is needed for survival as global manufacturing commerce increases. As companies that wish to participate will need to compete on a variety of factors, such as price and quality. Producing high quality goods and services at a competitive price in the world economy is a challenge to any organization, but more so to a developing country in one of the Arab states. To become a member of the international manufacturing

community that includes the United States, Japan, Korea, Sweden and Germany requires a combination of national assets and virtues that have traditionally been scarce in most Arab countries. For example, Japan, once known for poor manufacturing quality, emerged after World War II as a manufacturing quality leader, attributable to the development of a quality control system that became a standard for world class manufacturing processes (Hokoma and et.al, 2008).

Manufacturing environment the today's world, is categorised by aggressive international competition; rapid product innovation, income and obsolescence; effective use of automation technology; new materials adoption; new manufacturing techniques; and substantial organisational changes (Manufacturer, 2006). Together these create new additional challenges for manufacturing organisations, with manufacturers from the highly developed nations. Taking these into consideration manufacturing SMEs in the Gulf countries accept that these changes in the manufacturing environment and must be accompanied by fundamental changes in the way manufacturing operations are performed. To be able to cope with the changing manufacturing trend, new systems such as cloud manufacturing, responsive manufacturing and additive manufacturing and technology (examples include nano technology, use of IoT and predictive maintenance technology) are required to derive, evaluate, and sustain best performance (Moreno-Luzon, 1993).

2.3 Ever Increasing Demand for Quality

Nowadays consumers demanding low-cost product at higher quality and faster delivery in both services and manufactured products. Improvement in the standard of consumers' life pattern and education, has rendered them gradually knowledgeable about the products they purchase (Smith and et. al, 2003). They are now in a position to differentiate between product qualities, reliability. Specification and performance. With the advancement in

internet technology and regular use of web technology more than 75% of the customers in the developed nations consumers are able to shop around and bargain the best prices and for their products they intend to buy Modern day consumers are also becoming more conscious about their market power. They are also aware of abundant supply that drives them to buy the products at lower cost. This situation pressurise global manufacturers to satisfy the various customers' demands i to succeed in their business (Stephen et. al 2009). Dealing with increasing customer anticipations is another major challenge for manufacturers today.

2.4 Demand for Low-Cost Products

Manufacturing companies in the developed nations face price pressures from competitors from the developing countries due to differences in wage-rate between the developing and developed countries. This is likely to reduce the thrust of investments in manufacturing in the developing countries such as the Arab SMEs, which in turn will lower tax revenues and job losses (Molleman and Slomp, 1999). This indicates that the future of manufacturing in the developed countries is uncertain.. (Watson, 2003). An empirical study carried out by the U.S. Bureau of Labour Statistics in 2010 identified that manufacturing companies in China paid their employees a minimum of at least 4% the rate of the average US firms (Valmohammadi, 2011).

2.5 Advancement in Information Technology

Rapidly growing computing power and data storage capacity have made information technology to become a major business driver.. The capability of fibre optics technology interconnects information fast and error free (Black, 1991). Software ability improves product performance and marks significant difference in the functionality and performance between various products Use of expert systems with human knowledge base is integrated through sophisticated software is used manufacturing and business

applications to aid intelligent decision making. Such rapid advances in technological sector has led i manufacturing firms to compete even fiercer (Gilmore, 1999).

2.6 Introduction of Innovative Materials

Emergence of new materials has been driven mainly by the cost of materials but also improved functional and quality aspects. Computer numerically controlled manufacturing (CNC) and computer-aided engineering (CAE) has also played a progressive role in accelerating the introduction and adoption of new materials, mainly plastic. With the benefit of CNC manufacturing, it is now conceivable to design and machine complicated dies accurately and quickly (The Manufacturer, 2012).

Innovative materials used to assemble products together, such as new adhesives, has significantly improved fastening processes and eliminated the need for traditional fastening parts such as nails, screws, , nuts, rivets and s. Bolts. These materials have reduced the manufacturing lead time through speedy assembly process, reduction in the weight and manufacturing cost, and improved the aesthetic of manufactured parts (The Manufacturer, 2006).

Nowadays, consumers demand low-cost products that function better, durable and better quality, but the, manufacturers strive for materials that are easy to process, cheap, and easy to manufacture. Thus, the adoption of new materials increased the need for new manufacturing processes (The Manufacturer, 2013).

2.7 New Production Technologies

The adoption of smart materials in manufacturing has been a major driver for transforming traditional manufacturing techniques leading to invention of non-traditional manufacturing processes such as nanotechnology. Manufacturing firms using such new process technologies have eliminated the need for large workforce. g. Aerospace industry

is a good example for this scenario: CNC tape-laying, epoxy coating equipment and autoclaves for curing large components of composite materials are now being replaced with metal cutters, presses and machine tools, sheet metal benders, operated by a large number of workers s (Broeze, 2006).

Application of industrial lasers in sheet metal working is another prime example of how new manufacturing processes and techniques are replacing traditional methods. . Lasers techniques have replaced metal cutting, drilling holes and heat treatment. New processes also offer reduced production cycle time, waste, and low cost manufacturing. . This is quite apparent in casting and forging of metal parts, where a large amount of flashing and metal chips resulting from the use of traditional machining process is reduced and the component produced result in tight tolerance and dimensional accuracy (Knouse et al, 2009).

2.8 Future of Manufacturing Industry

The changes in manufacturing discussed so far in this previous sections have created the following challenges that manufacturers need to address to sustain competitive advantage:

- Accurate prediction of market needs
- Reduce product costs by reducing manufacturing cost
- Reduce delivery times by reducing manufacturing lead time
- Improve quality and reliability
- Increase value added features
- Offer product varieties and options
- Provide products with accessory functions additional features
- Provide customisation in products
- Offer customer support

As commented by Voon-Hsien Lee et al, (2010), these challenges can be interpreted into manufacturing system requirements as outlined below:

- Effective market survey
- Elimination of waste and non-value added activities
- Improving material flow
- Product enhancement through innovative materials and advanced technologies
- Improve flexibility and efficiency in the manufacturing process and systems
- Support production systems with software in the design, manufacturing, materials planning, supplier selection and purchase of materials (e.g. CAD, CAM, MRP and ERP).
- Improving communication with customers and after-sales services

Research (The Manufacturer, 2012) shows that manufacturers have followed different strategies to achieve these requirements. Examples of popular strategies of these are:

- Searching worldwide for cheap labour
- Outsourcing to external suppliers
- Market diversification such as mergers and acquisitions
- Reducing product life cycles and introducing product to market faster
- Follow vertical integration techniques i.e. in-source the critical processes to control quality, cost, and lead time (Jha et al, 2012)
- Training employees to be multi-skilled
- Investing in updating and introducing new technology
- Adopt continuous improvement programmes and strategy

2.9 Manufacturing Trends of the Future

Manufacturing technology and processes need to change to cope with the future challenges. Ferris (2005) projected some trends for future manufacturing. The key predictions the research made are:

- Productivity must be viewed as a priority for supply-chain savings; this can add up to 10–15% of revenue. Internal productivity improvements surpass market growth, at some instance, generating surplus capability.
- Manufacturers will eradicated plan strategy and push products into demand information management, which will intensify the customer based business operations and functions.
- The scope of CI programmes will expand and include range of processes and eliminate all forms waste in areas other than in the production floor such as back office, the supply chain, , and sales and marketing. Manufacturing firms will also strive for ways and means to enhance the abilities of such programmes to aid in setting up project priorities (Voon-Hsien Lee et al, 2010).

- Investment on IT will shift to the business performance function. Spending will be concentrated less on reducing costs and integrating variety of systems and more on improving a firm's business processes activities (Rahman and Siddiqui, 2006).

CHAPTER 3
QUALITY MANAGEMENT

3.1 Historic Perspectives of Quality

The more common definition of quality is the ability of a product or service to satisfy the needs and expectations of the customers (Bergman, 1994). This can be interpreted as 'fitness for purpose'. It is expected that quality products or services must meet customer requirements and expectations. According to Schonberger and Knob (2001), quality is multiple performance characteristics focussing on what customers want as opposed to what producers wish to manufacture.

Quality has been defined in many ways. Normally it is identified with conformity to specifications, value fitness for use, avoidance of loss and meeting and/or exceeding customers' expectations (Reeves and Bedner, 1994). Deming (1986) defines quality as "a multifunctional approach to producing a product and/or delivering a service that meets customers' exact expectations to ensure customer satisfaction. Through this definition, Deming equates high quality and customers' satisfaction (Garvin, 1987).

The market place has become highly unstable which means the demand for innovation has intensified (Garvin 2010). With such an onslaught, manufacturers find it difficult to keep going and their mere survival becomes a big question. So, it is becoming imperative to look into the future to ensure the longevity of the organization. The two management concepts that shaped the 20th century still hold the key. One being the Scientific Management developed by F W Taylor and the other is Total Quality Management concept (Garvin, 1987). The first focused on the increasing efficiency and the second one with the major thrust on quality improvements. In 1950s, Japan rebuilt its economy by concentrating on producing quality products. Then the quality management became a

wildfire and the words such as quality and quality improvement have permeated into the organizational boardrooms (Vathsala, 2012).

Quality is one important weapon that made many organizations win their competitive advantage and survive in the business. Today, quality has become very fundamental requirement in any business sector. Improving and maintaining the quality through continuous improvement in quality has become an essential day to day activity.

3.1 Total Quality of Management

In quality management, the three widely used terms are: quality control, quality assurance and total quality management (TQM). According to Feigenbaum (1956 p94), quality control referred to activity of traditional factory inspection. This is one of the earliest approaches to quality, concentrated on improving product quality through inspection methods. Quality assurance achieved by the setting up and use of a quality management system which is continually monitored to ensure its relevance and effectiveness.

TQM on the other hand, is an extension of the principle of quality into the broader spectrum of business life. According to Eyre, TQM can therefore be applied to any business field. The general concept being that by involving everyone in the process of coordinating the company's activities, errors can be eliminated and activities streamlined, producing consistency in the products manufactured or service rendered. The implementation of TQM has delivered great improvements in quality, cost and capabilities across a range of industries worldwide (Fred, 2012).

As stated by Anderson et. al (2006), TQM as a management system and philosophy has gained wider acceptance and been practiced in both manufacturing and service environments. It is the latest step in the evolution of quality control. One of the major

concepts of TQM is that customer needs are typically cross-functional and effort must be made organisation-wide to satisfy them. As stated by Ishikawa (citation?)total quality is achieved when there is both quality of design and quality of conformance. That is quality is built into each design and each process, and then conformance to that design is monitored through control activities (Black, 1991). TQM is considered as a process and not a one-off programme. TQM is not a fixed method of management. TQM insists that the need to get to the "root cause approach" to any problem)

Total Quality Management has changed the way the business is being done. It has been in existence for the last sixty years. Even then a full understanding of TQM has not yet reached the minds of the organization. For many years researchers have written off TQM as a failure because it did not provide the results it is supposed to deliver. But TQM practices have become pervasive in the management parlance (Thomas Powell, 1995). TQM still has the cutting edge to keep the organizations strong and sustain for a long time (M.Zairi, 2002). In the interest of the long term survival of the organization it is important to understand the concepts in a right attitude and ensure that the obstacles in the implementation process are removed.

3.3 Difficult issues in the implementing of TQM in SMEs

3.3.1 Financial barriers

Many manufacturing SMEs do not have sufficient financial resources and limited or nil access to lending bodies or find it difficult to secure loans. The consequence is that the SMEs do not have reasonable budget allocation for staff training, which can affect efforts in improving technological advancement.

3.3.2 Human resources

Research (Ghobadian and Gallear, 1997) shows that SMEs always struggle with the skill shortage of labour and they frequently forced to compete with larger firms for skilled workers (i.e. big companies are capable of offering better financial incentive to skilled workers in terms of salary and working conditions).

3.3.3 Raw material

SMEs are also hampered with shortages in materials supply very frequently and are likely to have to pay more in times of fluctuation in raw material price. This in turn forces small firms to suffer with inadequate credit and inventory management. This leads to lack of control of stock in raw materials and limited bargaining power in comparison to larger manufacturing organisations.

3.3.4 Education barrier

Large number of entrepreneurs in manufacturing companies have low level of formal education and inadequate training in latest management principles and manufacturing practices, which leads to lack of managerial and technical capability.

3.3.5 Awareness of management barriers

Usually, manufacturing SMEs depended on one-person management, thus lacking time and attention to concentrate on managerial functions (Hashim and Wafa, 2002). Furthermore, Deros et al (2006) stated that, many manufacturing SMEs lack proper time and cash flow management system, which leads to high variation in productivity and difficulty in maintaining quality standards.

Along with other difficulties such as lacking knowledge in marketing techniques, opportunities at national and international levels, limited accessibility to the distribution channels and market information, constraints in marketing such as pricing, late payment from customers, failure in on-time delivery and ensuring efficiency of work. SMEs are

also facing problems in delivering quality products and lack of competitive promotional strategies.

3.3.5 Culture barriers

As stated by Ghobadian and Gallear (1997), the culture that persists in many manufacturing SMEs may not be advantageous to TQM. The relative intimacy of the workforce may be regarded as SMEs are more vulnerable to hostile attitudes towards TQM (Patel and Randell, 1994). Management and staff may become over-ambitious in achieving high quality through their quality improvement plans and strategy leading to disappointment when outcomes do not meet the expected results.

3.4 Continuous improvement

Continuous improvement (CI), which is also referred to as process improvement is a philosophy that Deming described simply as "Improvement initiatives that increase successes and reduce failures" (Deming, 1982). CI is an organisation-wide process of intensive and incremental continuous innovation maintained over a long period of time (Bessant et al., 1994). CI is also defined as "the act of consistently improving process efficiency by targeting waste, variation and poor quality to improve output and make the most out of available resources"

Berger (1997) stated that "CI as a by-product of existing quality initiatives, such as TQM, or as a totally new methodology to improving creativity and accomplishing competitive distinction in the current market". Total quality can be achieved by constantly pursuing process improvement through the involvement of every employee at all levels of the organisation.

Schroeder and Robinson, (1991) identified that the origin of CI and the fundamentals of modern improvement programmes goes back to 1800s where attempts were made by

several companies, where business managers motivated their workers to make improvements, and incentive schemes were established to reward employees for their contribution to positive changes

According to Juergensen (2000), the first three decades of quality and CI which included inspection, statistical quality control and quality assurance focused on the internal operations of the organisation. In the1980s, quality was recognised as a tool to gain advantage over the competition. This led to the birth of strategic quality management whose philosophy concentrated on the customer and the organisation in order to ensure effective response to customer and market needs To meet today's challenges of a rapidly changing business environment, uncertainty and unpredictability, many quality gurus believe that a fifth quality era of competitive continuous improvement may be required in order to ensure flexibility and the ability to respond and adapt quickly to market changes. Although CI initiatives in the past echoed the use of different principles and strategies associated to improving work practices, modern-day process improvement is related to well organised and comprehensive procedures associated with the use of TQM advocated by Deming.

CI evolved from the work of Edward Deming and a number of CI methodologies have been developed based on a basic concept of quality or process improvement, or both, to reduce all forms of waste, simplify the production line and improve quality. The Toyota Motor Company implemented the first Quality Circles within the production process itself and developed the Toyota production system which is known as lean manufacturing and is currently adopted in manufacturing worldwide (Womack et al., 1990). As identified by Boon et al (2009), from this era several variations on quality improvement methods and strategies have been developed and expanded to include macro-level issues which included organizational culture, business strategy, top management commitment,

and employee involvement, all of which built around a management philosophy that is concentrated on practices designed to maximize profitability, competitive advantages and business excellence

To achieve excellence in manufacturing activities, researchers and practitioners suggest many important factors such as including quality-orientation, employee involvement, lead time reduction while meeting daily demand, increasing flexibility in production methods to allow small batch production, utilisation of cellular processes, and closely working with customers and supplier. Minimising waste, reducing lead time and cost, improving quality, encouraging employee participation and CI as the new approaches to manufacturing business. Hayes et al. (1988) suggested to concentrate on just-in-time, total quality control, and zero defects production and inventory management, low-cost, manufacturing and innovativeness as the three major requirements for achieving competitive position in manufacturing business.

3.5 Need for Continuous Improvement

CI is crucial for meeting customers' different changing needs. As pointed out by (Deming, 1986), continuous improvement must be an integral part of TQM. However, Garvin (1987, 1993) and Misterek et al. (1990) believe that companies have become more interested in process improvement due to the intensity of global competition. Bhuiyan and Baghel (2005) argue that CI is needed for the following reasons:

- To survive competition: in a competitive market, manufacturers must be aware of their competitors who are striving to provide similar products to their customers at a low-cost and superior quality with shorter lead time.
- To improve quality: quality improvement goes beyond physical aspects; it requires a collective and total approach including several cross-functional

activities including product design and development, supply chain, manufacturing, delivery, service, and customer support.

- To satisfy customers: customers nowadays demand beyond basic quality attributes; they expect innovative, customised, accessory-supported products which will surprise and delight them.
- To be agile: Ensure flexibility of the manufacturing to cope with changes in the market and uncertainty.

3.6 Continuous Improvement Tools

In the early days, CI tools were mainly focussed on improving employees' performance, with the objective of producing zero defects. According to research and case studies, these improvement initiatives had some drawbacks because they were not able to satisfy the requirements of the business needs. According to Caffyn (1999), the drawbacks included:

- They were designed to work best in manufacturing environments; they could not prove their effectiveness in other environments.
- They only addressed technical problems, which form 20% of a typical business operation; the remaining 80% were managerial problems.
- Because they addressed processes (individual tasks) rather than the whole business operation, they caused sub-optimisation throughout the organisation.

To survive fierce competition, manufacturing organisations are being compelled to make quality improvement of their products more thoroughly and much quicker than the competitors. Besides the improvement needed must be significant and sustainable. A quick fix approach will not be a good solution; hence any continuous improvement process should be expected to result in 10–15% yearly ongoing improvements in the process if the organisation wishes to maintain their competitive gains (James et al., 1999).

Figure 3.1 shows the CI process steps and Figure 3.2 shows examples of the tools and techniques used in CI.

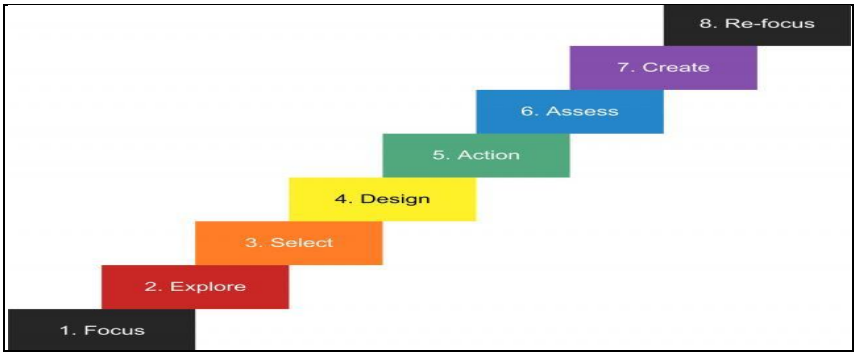


Fig 3.1: CI Process Steps (James et al, 1999)

3.6 Success of Continuous Improvement

CI capability model suggested by Bessant and Caffyn (1997) for evaluating the effectiveness of CI implementation in organisations comprises ten generic behaviours that are considered essential for the successful implementation of CI. They are listed below:

- Employees must be aware of and understand the organisation's aims and objectives.
- The organisation's strategic goals and objectives should be considered when improvement activities are prioritised
- Enabling mechanisms such as training and teamwork are monitored and developed to encourage engagement in process improvement.
- Constant review and assessment of the organisation's structure, systems, procedures, and the approach and mechanisms used to develop process improvement.
- Active management commitment to and leadership of process improvement.
- Active employee engagement in step-by-step improvement.

- Effective work throughout the organisation at all levels both internally and externally.
- Employees learn positive and negative lessons from their own and from others' experience.
- Achievement from learning of individual employee and groups is recognised and deployed in manufacturing activities.
- Workers are motivated by a shared set of cultural values that form the basis for process improvement.

According to Comincini, (1994) tools and techniques used for a successful CI process are listed in Fig 3.2:

- 5Y
- 5S
- 8D problem solving
- 7 Wastes
- Affinity Diagram
- Brainstorming
- Benchmarking
- Activity Network Diagram
- CCC
- Auditing
- Attribute Control Charts
- BCS
- Capability study
- Consensus Agreement
- Check Sheets
- Customer Focus Surveys
- Cost of Quality
- CTQ tree
- Cycle time studies
- Data Analysis in Microsoft Excel
- Data Analysis Techniques
- Database Deployment
- Data Analysis Explained
- Design of Experiments
- Linear Regression
- Nominal Group Technique
- Normal Distribution
- Organized Teams
- Pareto Charts
- Paynter Chart
- Payoff Matrix
- Prioritization Matrix
- Pie Charts
- Planning For Influence Chart
- Process Summary Worksheet
- Process Mapping
- Process Streamlining
- Project Selection Checklist
- Process Standardization
- Responsibility Chart
- Quality Costs
- QMS Review
- Reduce Variation
- Scatter Diagram
- Sampling
- Run Charts
- Set Specifications
- Solution Vision Matrix

• Effective Team Meetings	• Stakeholder Chart
• Team Dynamics	• SWOT Analysis
• DMAIC	• Statistical Sampling
• Flow Charts	• Spaghetti Diagram
• Error Proofing	• Target Shifting
• Flowcharting Software	• Statistical Process Control
• Fishbone	• Surveys
• Histograms in Excel	• Value Stream Mapping
• Gantt Charts	• Theory of Constraints
• Interrelationship Diagram	• Team Progress Model
• Force Field Analysis	• Training
• Histogram	• Kaizen

Fig 3.2: Tools and Techniques used in CI Process (Comincini, 1994)

The increasing competition in the manufacturing industry over the years has forced manufacturers to recognise that the winners are organisations who are consistently able to provide products of better quality, at a lower price, and on time (Nicholas, 1998). Nicholas claims that the second wave of improvement tools, which started in the late 1970s and early 1980s, had a wider scope for improvement. They were meant to improve the whole manufacturing operations and systems rather than the individual process on the production floor; hence, the second wave of improvement tools took the form of improvement programmes and strategies that aimed to improve the entire business process, from receiving customer orders to delivering products. Example of tools and techniques are:

- Total Quality Management
- Lean manufacturing

- Just-in-time manufacturing
- Six sigma
- Agile manufacturing
- Business Process re-engineering

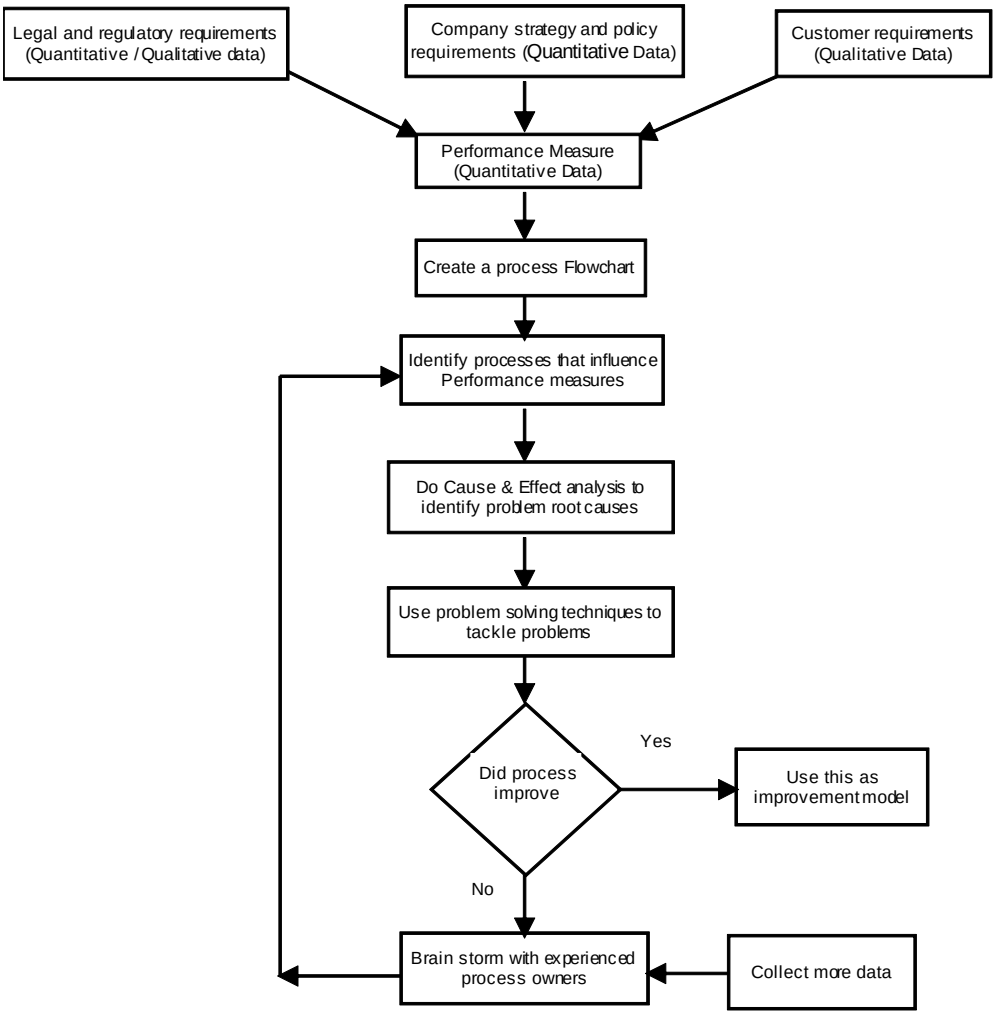


Fig 3.3: A Typical Continuous Improvement Approach (Besant 1994)

Besant et al, (1994) reported that there is a general trend to use CI programmes to improve overall business functions in order to gain competitive advantage. The researcher believes that CI programmes were very effective and helped many companies around the world. Fig 3.3 shows a typical CI approaching with various stages in the improvement process, aiming to improve the overall business performance.

3.7 Approaches to CI

Caffyn (1999), argues that while CI indicates the requirement for continuous improvement but the effectiveness of any process improvement tactic has its own limits. It is not always possible to use the same approach to improve the process forever because the process can become obsolete in the near future. This should be expected very soon to save resources and substituting with alternate and new process.

There are mainly three approaches to continuous improvements: incremental, innovative and re-engineering. As stated by Juergensen (2000), the best approach to follow relies on the position of the prevailing process in the improvement threshold curve. The business need in a specific market sector may also be a reason for changing from the incremental to the innovative approach. Changes in the market situation can impose a need for a leap in performance output that may only be possible by adopting a new technology. According to Robinson (1990), approaches to process improvement can be classified into three main streams: 1) Incremental improvement, 2) Innovative improvement and 3) Process re-engineering.

3.9 Incremental Improvement

Nicholas (1998) suggests that incremental CI is executed at an operational level, and is carried out in small increments by process owners. The incremental approach builds on small successes that motivate teams to continue. Incremental CI involves everyone in the organisation to together to promote improvements without the need for large investments. It can take place through radical improvements, in which improvements may be made incrementally, or through a evolutionary and major changes that take place as a result of a pioneering idea or latest technology. As analysed by Zhang and Cao (2002), lots of major improvements take place over a period of time as a result of many gradual improvements. Generally, any scale of improvement is achieved through the use of many

tools, strategies and techniques committed to identifying the root causes of problems, waste, variation, and looking for ways and means to eliminate them or reduce their adverse effect

3.10 Innovative Improvement

When incremental process improvement reaches its threshold, further improvements will not be cost effective. At this stage, a radical change becomes necessary (Foster, 1986). This is achieved by introducing innovative technologies in several areas including processes, materials and design concepts. Innovative improvements generally create a big leap in process performance in comparison to the old technologies; however, once adopted, they too require incremental improvements when they reach their improvement threshold and have to be replaced by latest technologies (Juergensen, 2000).

3.11 Process Re-engineering

Goestsch and Davis (2006) reported that many manufacturing companies did not succeed in improving their manufacturing operations due to failure in examining and improving the structure of their production system. They did not attempt to fix and redesign the basic business operations that affect their competitive position. This opinion is also supported by Mjchrzak (1998) who argues that only 25% of the total lead time of a typical product ordering process can be attributed to the shop floor, with the remaining 75% attributed to other departments. As indicated by Tao et al (2011), this is an indication that bigger opportunities for improvement are available outside the manufacturing plant requiring a review of the entire business process. On the other hand, the ability to compete requires a company-wide effort to eliminate or minimise all forms of waste (Andersson et. al, 2006).

System-wide problems cannot be resolved by just innovating process. In such situations, the entire manufacturing system needs to be analysed at and improved. This is known as process re-engineering. The fundamental difference between process re-engineering and other process improvement approaches is that re-engineering never uses the existing process as the basis for improvement (Hammer and Champy, 1993); most of the features relating to the existing process are discarded, and a new process is invented from scratch. Another key feature of process re-engineering is process approach, which removes functional boundaries and gets everyone working together in team to achieve external business objectives of satisfying customers and becoming the market leader (Achanga, 2006). Process re-engineering emphasises process simplification; elimination of waste and non-value-adding activities; cost reduction; and improvement of health and safety and job ergonomics.

According to Smith et al (2003), some distinctive outcomes from a re-engineering process are:

- Work can be reallocated to a different cell or department
- Different processes or jobs can be combined into one
- Some process steps can be eliminated
- Process sequence can be changed
- Non-core business processes can be externally outsourced
- Introduction of business support software such as CAM, CAD and ERP
- Usage of inspection and controls is minimised or eliminated
- More than one process is done simultaneously (Oakland, 1994)

It is evident that a concern for quality and continuous improvement is an evolutionary process. Countries that are now at the forefront of continuous improvement (CI)

leadership and innovation, like Japan and the United States, were able to do so over a period of years. (Valmohammadi 2011).

From the literature one can ascertain that there is no simple, uniform solution to the problem of measuring and managing organizational performance, productivity or effectiveness. As global business environments have become more complex so have the needs to address business performance on a multi-lateral basis. Today's global competition occurs on many fronts. Organizations need to continuously look for ways to optimize their work processes or lose their position in the marketplace (Yusof and Aspinwall, 2000).

As mentioned by Juergensen (2000), these are the conditions that led to the introduction to contemporary CI tools and techniques. Although CI has been historically associated with quality movement of the 1980's, it also has roots in socio technical systems design, the human relations movement and the lean and agile manufacturing movement. CI programs were developed over a period of time to address manufacturing issues that were not able to be solved by the older management systems (Berger, 1997). Toyota's work on CI and continuous-flow manufacturing processes which were designed to absolutely to achieve short production cycle time and on-time delivery by reducing bottleneck problems in production methods, and low costs manufacturing were remarkable, which later was known as "Lean Manufacturing" (Ohno, 1988). Lean manufacturing aims to eliminate all forms of wastes that do not add value to the product.

3.12 TQM and CI Approaches in the Arab Manufacturing SMEs

3.13 Lack of Understanding the Need to Change

Over the last two decades, TQM has played a vital role in global business strategy environment. As the global competition arises, the majority of manufacturing companies

seek to adopt and acknowledge TQM techniques in their organization. In achieving manufacturing excellence companies work into applying strategic management, quality assurance, quality system, and quality control techniques. The successful adoption of TQM concept has been proved to enhance the firms' commitment as well as their position in the competing market. That is due to the vital role TQM principles play in the cost reduction, productivity enhancement, product quality improvement and output.

In recent years, particularly in developed countries, the adoption of the TQM concept has been considered widely unlike the developing countries. If comparison is made with large business, this field has received a little attention especially in small and medium business.

The purpose of this research is to improve manufacturing SME's performance in Arab nations as developing countries through the adoption of TQM principles which includes understanding the major factors and challenges that face these enterprises. Manufacturing firms in Arab nations have great opportunities to compete in the world market with established market players. Lately, the manufacturing industry is subjugated by the production of metal for construction, food products, furniture production and a variety of other types of merchandises. Many SMEs also participate in manufacturing, ceramics, clothing, bricks and publication materials. Small size manufacturing companies have the capability to link into opportunities to develop economic growth. There is also capable companies which can expand their activities in other sectors such as leather goods industries, glass and fisheries and tourism.

Nowadays, the value added contribution and high level of growth performance in the manufacturing sector and non-oil sector have been significantly lower than that gained by companies in the oil sector. Exports from fisheries are very low. The Arab nations' local private sector in manufacturing suffer through shortage of business expertise and struggle to achieve of economies of scale and suffer from poor managerial, financial and

marketing capabilities. In addition to this, although the macroeconomic environment is promising and business taxes are reasonably low, the whole regulatory framework still requires to be streamlined and enhanced. Transaction and business start-up costs for developing and supporting manufacturing businesses are comparatively high, and often pose lots of uncertainties.

In Arab manufacturing organizations there is often a lack of understanding for the need to change in radical ways. This often results in companies only making token efforts of small incremental change which do not really advance the company in the market. The need to change can only be created if, a greater understanding about the present situation is provided. This is only a small requirement to simulate the company into initializing the change, although, without it a change programme may not be successful (Goestsch and Davis, 2006).

According to Rahman et.al (2011), many manufacturing companies in the Arab countries do not realize that it is imperative to understand the reason for wanting to change in a radical way. They also fail to appreciate that the amount of effort required achieving such a change. Generally the companies lack reasonable amount of assessment made to distinguish whether the change requires the radical steps that process improvement methodologies offer or whether simpler incremental changes should be employed which is achieved through more traditional change techniques (Vokurka, 2007).

Many manufacturing companies in the Gulf nations do not relate process improvement to anything other than creating great developments by focusing on processes and involving information technology Livesey (2006). Too many companies think that process improvement will magically bring them out of their present situation without any real effort or dedication to the programme of change (Hokoma et. al, 2008). Also many companies outsource their activities rather than making effort to improve their in-house

expertise. So far, there are few empirical studies conducted towards gaining an understating of the holistic nature of quality. In particular, there are no known researches that attempt to relate the importance of values to the continuous improvement process of the Arab companies. This limits the understanding of how and why organizations end up with certain quality emphasis or priorities.

The importance of quality in Arab nations is being stressed by the government and private organizations. The benefit derived from quality improvement efforts are regarded by the government as crucial towards achieving the nation's vision i.e., to become fully developed nation, not only economically but also in all other aspects. The quality initiatives employed by Arab organizations envisage overall organizational effectiveness and long-term survival; however empirical works in these areas are limited (Khalid et.al, 2011).

The primary concern for Arab manufacturing companies who want to compete on the world stage is that many competitors have been involved in continuous improvement programs for decades which initially give them a competitive edge. These companies have already developed the top management commitment, infrastructure and other resources needed to sustain CI practices. Arab manufacturing companies, on the other hand, have until recently often lacked the knowledge and skills necessary to develop and implement a total quality program. There are several reasons for this gap. As reported in the Arab Human Development Report 2002 (Abdel-Khalek, 2003), the causes include: education, amount spent on research, brain drain to other countries, limited access to information and communication technology (ICT), low labour productivity, and a variety of other social cultural issues that impede productivity and efficiency.

Other challenges the manufacturing SMEs facing the Gulf countries is the constrained culture of entrepreneurship within the community. However, the authority of the

incentive structure and the development of a policy for manufacturing SMEs development suffer from major knowledge gap. This research assesses the manufacturing SMEs in Arab countries and organizational framework to recognize existing opportunities and challenges to support TQM along with local, national and international competitive advantages.

The main research gaps include that the research study highlights the concept of use of CI in TQM framework and its importance, but it lacks in exploring the information related to Arab manufacturing organisations. There is less specific knowledge and content related to Arab manufacturing business organisations. It is seen that the research study (Rahman and Tannock, 2008) highlights the concept of TQM, but it does not explain the areas of TQM where it can be applied, and how it can be applied. The research study does not explain the ways in which CI are being used in TQM in Arab manufacturing organisations. Boon et.al (2008) identifies that the main concepts of TQM are customer satisfaction, leadership, continuous process improvement, employee involvement, performance measures and supplier partnership. One of the main concepts is of leadership which explains that the importance of quality must be realised by the top management. Business strategy should make quality excellence its part. Thus, it is necessary to implement the strategic approach to CI framework for TQM to perform to its full potential in the Arab manufacturing organisations. As agreed by Bhuiyan, and Baghel (2005) to date, the research studies in the Arab manufacturing organisations does not clearly highlight the importance of CI tools and techniques to fit the Arabic manufacturing culture and strategic approach to CI implantation which is the most important research gap identified in this research (Stephen, 2009).

CHAPTER 4
EMPIRICAL STUDY

4.1 The Need for Empirical Study

Surveys are carried out to describe the opinions, attitudes, performance or characteristics of a particular group. They are usually directed in one of two ways, either at a specific time over a cross-section or over a period of time with the sample population. In cross-sectional study, the purpose is to explain current practice or to appraise a program or activity in which the survey participants have been involved (Oppenheim, 1992). There are basically two instruments for researches performing survey namely interview and the questionnaire. Interviews can be conducted in one-to-one settings (Hague, 1993), whereas, in a questionnaire, it is the participants that record the data.

Collecting and analysing data from Arab manufacturing companies is important for this research in order to understand their quality system and methodologies in use and evaluate their level of success and achievement and uncover any problems in the quality management related issues (Floyd, 2009).

4.2 Qualitative Research

Qualitative research is used to discover, explore, understand or describe phenomena that have been previously identified but not understood fully. Additionally, it involves collecting, studying and interpreting data that is difficult to quantify. It is based on connotations communicated through words (Demirbag et.al. 2006). Qualitative research uses tools that include interviews, observations and the methodological tool employed is interpretations. In research of this type, principles and theories often underpin in data. Narrative techniques and ethnographic are used to support in the interpretation and studying social interactions and phenomena. This research technique has not been able to

fully complete the chosen qualitative approach for several reasons such as lack of understanding of TQM (Hennessy, 1989).

4.3 Quantitative Research

The general process in quantitative research is to test a theory by relating independent variables in a controlled setting. As stated by Hague (1998), the quantitative methodology is termed the traditions, the positivist, the experimental or the empiricist paradigm. As stated by Hennessy (1989), the quantitative researcher views reality as 'objective' or something that can be measured objectively by using a questionnaire or an instrument. Questionnaire based surveys and experiments are commonly used for quantitative studies (Floyd, 2009).

In this research, quantitative survey method was preferred due to its ability to collect data from a relatively large number of respondents within a limited time frame. Furthermore, this type of survey is more often not concerned with generalized results when data is abstracted from a particular sample or population. This type of data collection deals with perceptions and attitudes of people and should be considered in depth. In this type of survey, subjectivity of researcher in methodology is recognised less and often reduces and restructures a complex problem to a limited number of variables

4.4 Methodology

There are various data collection methods and each have their advantages and disadvantages. The differences in the methods lie in the way the questions are delivered to the target. The methods include personnel interview, telephone interview, postal survey, fax, internet, and e-mail.

4.5 Personnel Interview

This data collection method is used to gather information from one person or a group of people face to face. The questions are delivered and filled in by the interviewer.

Advantages

- Interviewer is able to give more detail about the questions
- The interviewee has a chance to ask any questions for clarification before answering the questions, if necessary
- The answers are more accurate compared to other methods as feedback of the meanings of the questions can take place through human interaction
- More information can be collected orally from respondents than by hand writing or e-mail
- High response rate
- It might give the interviewer more 'valid' information in some sense (Oppenheim, 1992)

Disadvantages

- Time consuming and costly
- It requires interviewing skills
- The interviewer might influence the responses
- Possible interviewer bias

4.6 Telephone Interview

This is similar to the personnel interview but is more limited than the personnel interview regarding the benefits of face-to-face personal interaction.

Advantages

- Easier to organise and carry out than the personnel interview
- Cheaper than the personnel interview
- Less time consuming than the personnel interview
- It enables collection of information from a wider geographical area
- It allows opportunities to discuss and clarify the questions, if necessary and obtain more detailed answers but with more limitations than in the personnel interview

Disadvantages

- Lack of face-to-face contact
- It limits the number questions due to the patience and courtesy of interviewees
- It is sometimes difficult to get trust from interviewees without prior contact with them and their companies
- It requires interviewing skills

4.7 Postal Survey

This involves the use of questionnaires sent out to companies/individuals via the post. This is the most common form of data collection from consumers in use today.

Advantages

- Relatively cheap compare to either personal or telephone interviews
- It enables collection of information from a wider geographical area
- There is little or no interviewer bias

Disadvantages

- Response rates are low; sometimes as low as 10%
- Generally, the questions must be short
- Unable to detect and correct misunderstanding of questions due to lack of face-to-face discussion

- No control on who fills the questionnaire

4.8 E-Mail Survey

This is similar to a postal survey except the questionnaire will be delivered via email. As e-mail communication is spread throughout the world, this survey method has become popular. It is obviously the most cost effective and fastest method in terms of delivering a questionnaire. It can be assumed that advantages and disadvantages are almost the same as for the postal survey questionnaire; however, as it is relatively new, experience with this method to assess its effectiveness is limited.

4.9 Internet Survey

This is also similar to a postal survey except it is conducted on the internet. In general, companies develop a questionnaire and link it to its own computer system so that the answer will be stored in their system and analysed almost immediately.

Advantages

- Very cheap
- Easy to organise the answers and analyse them
- Because of technology development, it enables audio-visual aid questions, such as sounds, video clips, and so on

Disadvantages

- Required technical knowledge
- Concerns on confidentiality
- Unable to discuss the questions for clarification, if necessary, due to lack of face-to-face discussion

4.10 Survey Method Used

For the empirical study, the author has chosen to use an email survey questionnaire, complemented where possible by interviews and/or company visits. This is due to the fact that a postal questionnaire is the expensive method given the time constraints. Visiting every company would be very time consuming and would entail large travel costs; however, it is very productive as meetings take place face-to-face with person being interviewed. Some postal surveys also have been used since postal survey allowed the author to target companies in a wider geographical area than would be practicable with visits. The author assumes that the advantages of the postal survey questionnaire would easily offset its disadvantages (Floyd, 2009).

Obviously, personnel interview would give the best possible data because of involving face-to-face discussions. Where appropriate and possible, however, the author visited SMEs to collect enhanced data. Moreover, this research aimed to propose a new TQM framework and validated it. Prior to and during the validation, the author visited some SMEs and investigated and collected more detailed information.

Telephone interview was also used in the empirical study and experienced difficulties in getting the interviewees over the phone. It was hugely time consuming to make phone calls to all the target companies. Obtaining direct phone numbers for all the people who are able to give the information was not be an easy task. The numbers which authors required were those for production manager or managing director, who were usually unwilling to give out their telephone numbers to researchers. However, it was possible to find the names of the managers in company profile or registration information for postal survey questionnaires. .

4.11 Design of Questionnaire

Various rules and techniques were used when designing the questionnaire. They were researched so that the author could produce the best possible questionnaire in order to get the information required and the maximum number of responses. The following considerations were taken in the survey:

1. A good balance of open and closed questions. Open questions allow the interviewee to answer the question freely while closed questions only allow the interviewee a limited range of responses.
2. Advantages of open questions are it encourages the interviewee to give his/her opinion freely and allows distinctions to be made which are not possible with closed questions. Disadvantages are answers may be short and superficial, insufficient space might affect the wording, interviewees might have difficulties in expressing what they want to say, and finally, it makes the analysis more challenging (Hague, 1993).
3. Advantages of closed questions are that they are simple, easily answered and easily analysed. Disadvantages are it might force interviewees to give an opinion despite not having any on a specific issue, omission of alternatives might cause bias, and skills are required to compose the questions.
4. Long questionnaires in general, get fewer responses than short ones. Therefore it is better to keep a questionnaire as short as possible.
5. The questions must be clear and unambiguous so that they do not confuse or mislead the interviewee. Long, technical words and jargon should be avoided. Words such as ‘frequently’, ‘often’, ‘regularly’ or ‘usually’ need to be qualified.
6. Questions should have a logical flow and progression. Questions on the same or similar subjects should be grouped together. It should start with the questions which are easy to answer as it will put interviewee at ease. Personal questions should ideally be put towards the end of the questionnaire. Questions should be arranged in a logical sequence.
7. The layout of the questionnaire is important. Questions, answers and answer spaces must not be split between pages. Adequate space should be allowed for the answers.

8. The covering letter has to explain the aims of the questionnaire. It must also clearly state that the information given to the author will be confidential. Moreover, supervisor information should be provided for interviewees as it presents a more professional image. It includes the author's contact address in case of queries.

9. Postal surveys have the lowest response rate, thus in order to encourage people to complete questionnaires it is a good idea to include a postage paid and self-addressed envelope (Oppenheim, 1992).

10. The return address of the questionnaire should be printed on the questionnaire itself not only on the covering letter. Moreover, if the questionnaire has more than one page, it is a good idea to staple the questionnaire together and include some respondent information on each page since pages and envelopes often become separated (Oppenheim, 1992).

11. Use a commemorative postage stamp to attract the receivers to open the envelope rather than put it straight into the rubbish bin. Try to address personally rather than just to the company and try to make the appearance professional rather than like junk mail.

12. The use of leading questions should be avoided. Leading questions are those, which encourage a particular answer. An example of such a question would be "Do you think product A is better than product B?" a better (non leading) question to get similar information would be "Which product do you prefer – A or B?" (Oppenheim, 1992).

13. Try out the questionnaire with someone before sending out to the targets to identify any misunderstandings and difficulties and rectify them.

4.12 Survey Aims

The survey was aimed at:

- Investigating how successful organisations were in implementing the methodologies and achieving objectives and highlighting any deviations.
- Identifying common implementation and success trends between organisations from different industries.
- Evaluating the integrity of the existing implementation approach and highlighting any weaknesses in the approach.
- Identifying critical success factors and making recommendations for a most robust implementation approach.

4.13 Survey Methodology

The following methodology was followed to carry out the survey. The methodology is based on Oppenheim's (1992) guidelines for survey design. It is made up of 10 steps. Steps 1 to 8 constitute the formulation of the survey (Part 1) and steps 9 to 10 constitute the data analysis and results (Part 2) as outlined below:

1. Specify research theory and hypothesis to be tested
2. Define survey objectives
3. Identify survey variables
4. Select data collection instrument
5. Questionnaire layout
6. Define sampling plan
7. Collect data
8. Validate data
9. Select statistical procedure for data analysis

10. Analyse data and obtain results

4.14 Formulation of Survey

Successful TQM implementation and continuous improvement strategies and techniques is based on various factors from strategic, structural and cultural perspectives (Ahrens, 2006). Therefore, accurate evaluation can only be obtained by collecting data from the users about the application of the elements of the methodology, the success in the achievement of objectives, and the identification of factors affecting the achievement of these objectives. This implies that a quantitative approach to the survey will be more suitable (Floyd, 2009).

4.15 Research Theory and Hypothesis

Theory: For manufacturing companies to run an efficient, profitable business and survive competition, they need to eliminate waste, reduce lead time, achieve high quality and be more flexible.

Hypotheses: Based on reports published in Industry Week magazine (George, 2002), manufacturing companies are not improving at a rate that is fast enough to enable them to stay competitive. After studying manufacturing trends in chapter 2 and the merits and misgivings of the most popular improvement methodologies in chapters 3 and 4, the author assumes that this lack of sufficient improvement is due to the hypotheses listed below, and intends to investigate them:

- Manufacturers have not been able to eliminate all sources of waste.
- Manufacturers have not been able to reduce their lead time significantly.
- Manufacturers are still struggling to meet their quality targets.

- Companies are facing TQM implementation issues that prevent them from taking full advantage of CI techniques
- Using TQM or CI separately does not create an efficient system or provide a complete fix for struggling companies.
- There is a need in the manufacturing industry for a new methodology that combines the advantages of both TQM and CI.

4.16 Objectives of Survey

- Based on the hypotheses listed above and the literature review, the main objectives of this study are:
- To evaluate the effectiveness of TQM and CI in improving manufacturing performance with respect to waste, lead time and quality.
- To investigate TQM and CI implementation issues.
- To determine manufacturers' satisfaction with TQM and CI.

These objectives have been developed into a number of specific questions, as follows:

- To what extent can TQM combined with CI help manufacturing businesses eliminate waste?
- To what extent can TQM with CI help manufacturing businesses reduce their lead time?
- How has quality performance improved by using CI?
- What are the implementation issues?
- How satisfied are the users with TQM and CI?

4.17 Questionnaire Explained

The main purpose of the questionnaire in this study was to investigate the CI strategies, methods, and TQM tools used in manufacturing organizations and also gain the information of their problems related to training and CI implementation. The questionnaires were sent to a total sample of 200 companies, preferably to be answered by production and manufacturing managers who were selected randomly from manufacturing companies in Arab Nations. Email questionnaires and interviews were given preference in this survey due to most practical method given the time constraints on research and the fact that it has minimal costs (Hague, 1993).

The final questionnaire was designed following the rules shown above, and can be found in appendix N. The overall purposes of this questionnaire were:

- To find out the nature of the companies' production systems
- To investigate the companies' attitude towards training issues such as how they take initiative in the training process, what are the main purposes of training, what are the main problems with training and so on.
- To analyse how the companies deal with the issues of TQM implementation and continuous improvement techniques
- To investigate the training practices and methods used
- To investigate the management culture towards TQM and CI strategy.

The analysed data were taken into account in the process of developing a framework in order to identify the gap between current quality management practices used by Arab manufacturing companies. The questionnaire covered the following sections:

Introduction – Explain the aims and the instructions of the questionnaire

Section 1: Management leadership

Section 2: Performance rating

Section 3: Rating on current TQM and CI practices

Section 4: Manufacturing

These four sections were composed of questions to select single and/or multiple choice answers, questions to write open answers, and questions to select the rank according to the levels of perception. The final question was to choose if the company was interested in participating in the next phase of the research, the validation stage.

The questionnaire was first completed by some engineers and lecturers known to the author, as a pilot trial. Modifications were made in the light of the feedback obtained. The final version of the questionnaire was sent out to a total of 200 companies with a covering letter as described above. This can be found in Appendix M. The manufacturing companies were randomly selected in the Arab Nations. The questionnaire was addressed to Operations Managers.

The main purpose of the questionnaire was to investigate the CI strategies, methods, and TQM tools used in manufacturing organizations and also gain the information of their problems related to TQM, CI implementation and company's state of quality management system. It has been designed already and on the last confirming process. Email and questionnaire and telephone interviews were chosen for this survey due to the time constraints on research and the fact that it has minimal costs.

Along with the postal questionnaire, some company visiting and interview were conducted. This empirical study gave the best possible and accurate data because of involving face-to-face discussions and observing the production system. Additional questionnaire was carried out to manufacturing workers to collect the data related to TQM

and CI. The questionnaire aimed at gaining the TQM, CI and training knowledge gap between workers and managers.

Inductive research approach was used for collecting information and will be moved from specific to general information base. The researcher collected information from selected manufacturing organization. The empirical study concentrated to evaluate the differences in the application of continuous improvement tools and techniques in Arab organization. The nature of exiting framework and associated issues were evaluated (Palland, 2007).

The population sample size covered twe200 companies which were selected from a directory of manufacturing companies known to this researcher and/or a directory of companies from member states in the Arab League or the Gulf Cooperation Council. Companies were selected using as broad a representation of product, size and geographic dispersion as possible. These respondents were asked a few questions. The important question of this investigation included what types of continuous improvement techniques Arab manufacturing companies have successfully implemented and what factors contributed to their success and how they rate TQM as important for their companies to survive the global competition (Silverman, 2000).

The questionnaire was presented to company representatives representing the program managers who implemented the programs well as operating managers who participated in the quality management and CI program. The specific CI programs to be analysed were: critical factors analysis lean manufacturing, statistical process control and other related factors defined by the company. The variables to be measured included type of intervention, locus of intervention such as company-wide, function, top management involvement, employee involvement, and current program status. The questions were measured using a combination of categorical data, ordinal scales and interval scales

The questionnaire was developed to test the following hypotheses:

H1 What are the barriers and opportunities for TQM and CI implementation?

H2 Does employee involvement have a measureable effect on TQM and CI program?

H3 Does company size have a significant effect on employee involvement in CI? programs?

H4 To what extent does the amount of training and education on TQM and CI techniques affect the overall growth of the company?

H5 Does the Arabic work culture have an effect on the success of TQM?

4.18 Validation of questionnaire

The most important concept of data collection technique is validity related with the facts and data collected. It is vital to ensure that the questions framed in the questionnaire help to estimate and identify the statics related to the research topic. It is very important in analysing the appropriateness, meaningfulness and usefulness of a research study. The validity of a questionnaire can be analysed with the help of content validity, construct validity, discrimination validity and convergent validity. These types of validity analyses help in identifying and presenting the validity of questionnaire and ensuring if it is according to the research question (Oliveira, 2013). Random sampling can be used in which respondents are surveyed on a random basis. Respondents can be selected on a random basis and surveyed. Random sampling helps to minimize bias from the research study conducted.

Statistical analyses included measures of validity and reliability, such as Cronbach's Alpha for reliability including regression analysis, factor analysis for additional measures of data validity and reliability (Field, 2005). A complete set of descriptive statistics were calculated, including means, standard deviations, and correlation matrixes for all variables. A pilot test of the questionnaire using a panel of experts helped in determining the suitability of the questionnaire to obtain the desired information from probable survey

respondents. Adjustments were made, based on the respondent's feedback and integrated into the final design of the questionnaire (Hague, 1993).

In this study, inductive research approach were also used for collecting information and moved from specific to general information base. The researcher collected information from selected manufacturing organization in Arab countries and performed the empirical study to evaluate the differences in the application of continuous improvement tools and techniques in the Arab organization. The nature of exiting framework and associated issues were evaluated. Companies were selected using as broad a representation of product, size and geographic dispersion as possible. The respondents were asked few questions. The overarching question of this investigation is: what types of continuous improvement techniques have Arab manufacturing companies successfully implemented and what factors contributed to their success. Analysis of these questions will help to identify the critical success factors to improve manufacturing performance.

CHAPTER 5
DATA ANALYSIS AND DISCUSSION

5.0 Introduction

As discussed in section 4.16, the empirical study aims to (i) identify the status of quality initiatives in manufacturing industries in the Arab nations (ii) understand the current state of knowledge regarding TQM and CI and (iii) establish which of the quality improvement dimensions have major influence on the performance of TQM and CI of different manufacturing industries under consideration.

5.1 Focus of Analysis

As highlighted in section 4.10, manufacturing industries are keen to establish and improve the product quality, so as to gain the possible benefits of increased customer satisfaction and thus by increased profit. Customer satisfaction is influenced by various factors involved in manufacturing and distribution of the products to customers. The analysis focuses on to identify the critical quality improvement (QI) attributes through the application of importance-performance analysis (IPA) and then to identify appropriate strategic action plans to improve the performance with respect to these critical attributes to enhance the TQM and CI. The study also investigates the influence of QI dimensions and attributes on overall performance of TQM & CI by using regression analysis. Furthermore, the study analysed and addressed the shortcomings on the manufacturing operations carried out by the manufacturing industries through the descriptive analysis.

5.2 Development of Research Models for the Survey

The research models shown in Fig.1 and Fig.2 are proposed to predict the relationship of the quality improvement (QI) based attributes (Independent variables) with overall

performance of TQM and CI (Dependent variable) in the manufacturing industries. From the previous studies, it is found that the common approach to identify and operate appropriate quality improvement strategies to enhance product quality is to divide the whole manufacturing processes into its constituent key attributes and to elicit the opinion of respondents on the performance with respect to each of these attributes.

The first step in this study is identifying which QI attributes are important to the company in improving TQM and CI. In the first part of this study, there are 19 various QI attributes associated with quality improvement are derived by a review of literature and conducting telephone and face-to-face interviews with the management staff and employees of the company and these attributes are categorized as the constituents of six QI dimensions, namely Management Leadership, Employee Involvement, Training and Education, Supplier Management, Work Environment and Culture and Customer Satisfaction as shown in table 5.1. Based on this, the research model 1 shown in Fig 1 is proposed with specific number of QI attributes, representing the six QI dimensions, to measure performance of the TQM and CI. Once the key attributes is derived, multiple regression analysis is then employed to determine the relative importance of these attributes in influencing TQM and CI.

Table 5. 1: Quality Improvement (QI) dimensions and attributes

Dimensions	Attributes
Management Leadership (ML)	Commitment and support of management
	Communication link between employee and management
	Empowering of employees by management
	Provision of sufficient resources to TQM
	Use of quality improvement tools & techniques
	Promotion of staff & improvement activities
Employee Involvement (EI)	Recognition of employee's views & suggestions to improve quality
	Commitment & Enthusiasm of employees
	Use of self-assessment tools to identify and remedy weaknesses
	Expertise & knowledge of employees on quality concepts
Training and Education (TE)	Conduct of employees training on TQM concepts
	Provision of continuous learning through training & education
Supplier Management (SM)	Selection of suppliers based on quality aspects
	Information sharing between supplier & Management
	Involvement of supplier in quality improvement
Work Environment and Culture (WEC)	Provision of pleasant working environment
	Adaptation of employee satisfaction initiatives
Customer Satisfaction (CS)	Measuring & Monitoring level of customer satisfaction
	Capturing customer requirement during product development & quality improvement

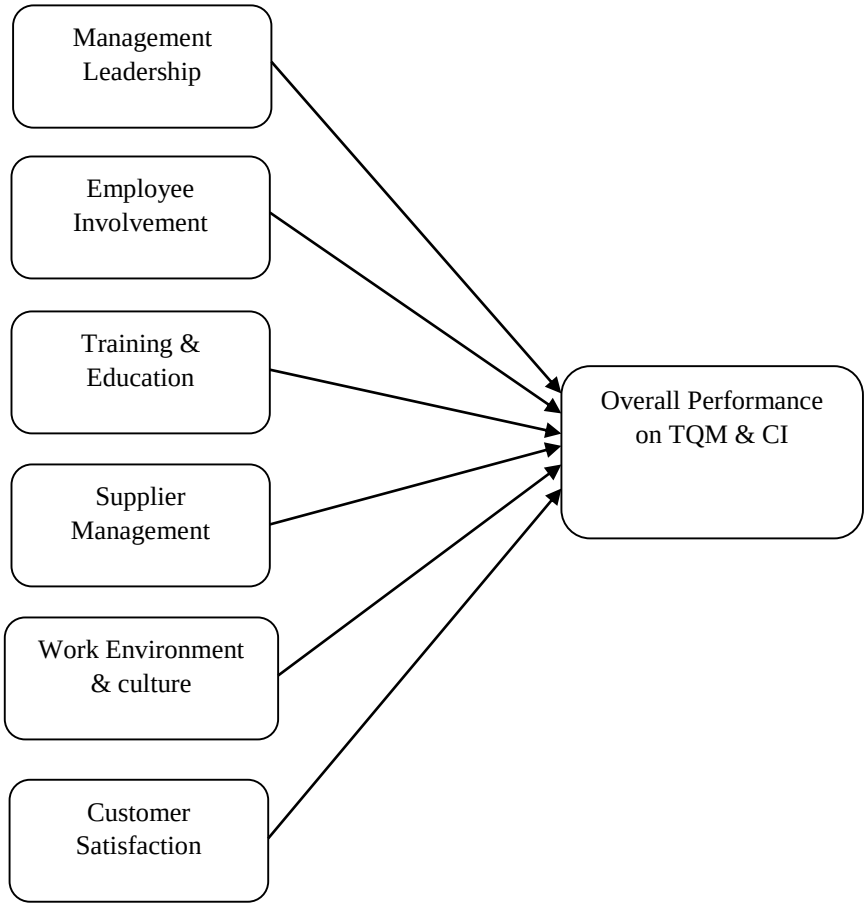


Fig 5.1: Proposed Research Model 1

In the second part of this study, there are 14 statements associated with quality improvement are derived by literature review and conducting interviews with the management staff and employees of the company and these attributes are categorized as the constituents of three dimensions, namely, Strategic Quality Management, Internal Measurement and Quality System Improvement as shown in table 5.2. Based on this, the research model 2 shown in Fig2 is proposed to investigate the current practices of TQM and CI in the case companies. Once the key attributes is derived, multiple regression analysis is then employed to determine the relative importance of these attributes in influencing TQM and CI.

Table 5.2: TQM and CI Practices

Dimensions	Attributes
Strategic Quality Management (SQM)	Philosophy is at the heart of our organisation
	Company has identified critical success factors
	Company has identified critical processes
	Company has identified the quality dimension of each key process
	Company has appropriate measures in place for each key process
Internal Measurement (IM)	Internal customers' needs and expectations are known
	Performance against standards for key Processes is regularly evaluated
	Statistical techniques are used to monitor Performance of key processes
Quality System Improvement (QSI)	Company has established and maintains a quality manual
	Quality policy and quality objectives are documented
	Internal audits are performed on the quality system
	Senior management acts on suggestions to improve quality
	Company uses customers feedback to improve product quality
	Resources and activities needed to achieve quality objectives are identified and allocated

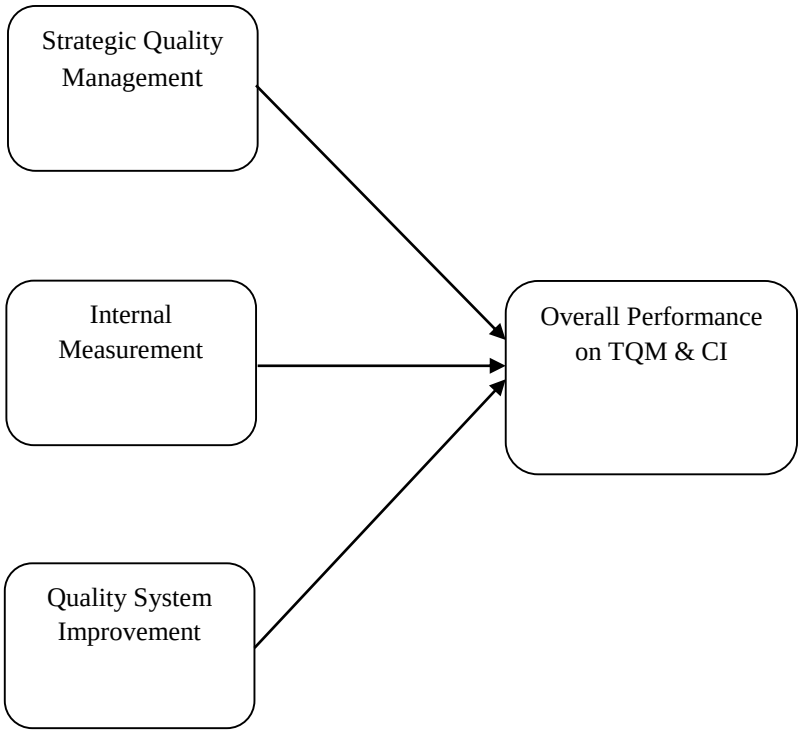


Fig 5.2: Proposed research model 2

5.3 Description of Case Company

The case companies under consideration were the Arab based manufacturing firms**.**

5.4 Design of Questionnaire

Based on the extensive literature review and consultation with company executives, the relevant quality improvement (QI) dimensions and attributes were identified and are presented in table 5.1. Questionnaire based survey method is used in this study. The list of QI attributes was developed based on literature and conduct of focus group interviews with the company executives belonging to various functional departments such as purchase, product and process design, production, quality control and product assembly. A questionnaire was developed using scale rating to assess the importance and performance of each attribute with the sections I and II. After determining those attributes that are worthy of subsequent examination, response from various manufacturing companies' middle level executives was solicited with regard to two questions: the first one relating to the expectations or importance of the attributes and the other to the company's performance in terms of delivery of these attributes. The questionnaire was structured so that each attribute was rated using a 5-point Likert scale, ranging from 1 (= Not at all important) to 5 (= extremely important) in the importance part (section I), and from 1 (= poor) to 5 (= excellent) in the performance part (section II). Section III comprises the statements for rating the current practices on TQM & CI in the manufacturing industries and it was also rated with 5-point Likert scale, ranging from 1 (= strongly disagree) to 5 (= strongly agree); and for the overall performance of TQM & CI ranging from 1 (= not at all satisfied) to 5 (= extremely satisfied) respectively. Finally, the questionnaire ended with section IV which deals with open ended questions regarding the practices on manufacturing operations performed by the manufacturing industries.

5.6 Sampling and Data Collection

The questionnaire was pilot tested and the Cronbach's alpha coefficient for all of the importance and performance attributes ranged from 0.81 to 0.89. After the pilot test, the tested questionnaire has been revised into the final version. In total 60 questionnaires were distributed to the middle level executives of case companies and another 15 electronic questionnaires were sent via email. Of the total 90 questionnaires distributed, 50 were obtained yielding 66.6 % response rate in which 42 (70%) were received in person and 8 (53%) were received in electronic form and statistically analysed. The reliability of the questionnaire was assessed using Cronbach's alpha analysis. The Cronbach's alpha value is improved and ranged from 0.95 to 0.98 and it shows that there is an internal consistency in the questionnaire, since, Cronbach's alpha values for each dimension is greater than 0.7 (Hair et al. 2009).-In this case, the sample size is found to be adequate following the Evan's rule (Evans, 1991) according to which the ratio of observations or sample size (n) to number of independent variables (k) should be ≥ 10 for the sample size to be sufficient.

5.7 Importance-Performance Analysis (IPA)

Importance-Performance Analysis (IPA) is a powerful strategic tool for identifying the critical attributes that are most in need of improvement or that are candidates for possible cost-saving conditions without significant loss to overall quality (Abalo et al. 2007). Martilla and James (1977) introduced IPA as a matrix-based approach to analyse the performance of automobile industry, which measures customer satisfaction with a product or service. The IPA approach recognizes satisfaction as the function of two components: the importance of a product or service to a customer and the performance of an organisation in providing that product or service (Martilla and James 1977). In this approach, IPA examines not only the performance of the attribute, but also the importance

of that attribute as a determining factor in satisfaction to the respondent (Silva and Fernandes 2010).

Generally, Importance-Performance (IP) matrix is constructed with a list of derived key attributes which are obtained from literature survey, brainstorming and interaction with the concerned. After making questionnaires using this list, they are administered to respondents. Finally, importance and performance of the attributes are plotted against each other. Fig1 shows IP framework (Martilla and James 1977). The four quadrants in importance-performance analysis are characterized as:

Quadrant A: Attributes lying in this quadrant are supposed to be very important but the performance levels of the organization about them are fairly low. It means that the organization should focus their concentration on these attributes.

Quadrant B: Both importance and performance level of attributes lying in this quadrant are high. It means that the organization should keep up the good work on these attributes.

Quadrant C: Both importance and performance level of attributes found in this quadrant are low. It means that limited source should be spent on this area.

Quadrant D: This area contains attributes of low importance and high performance. Although customers are satisfied with the performance; managers should consider overdoing their efforts on the attributes of this quadrant as being unnecessary (Zhang and Chow 2004).

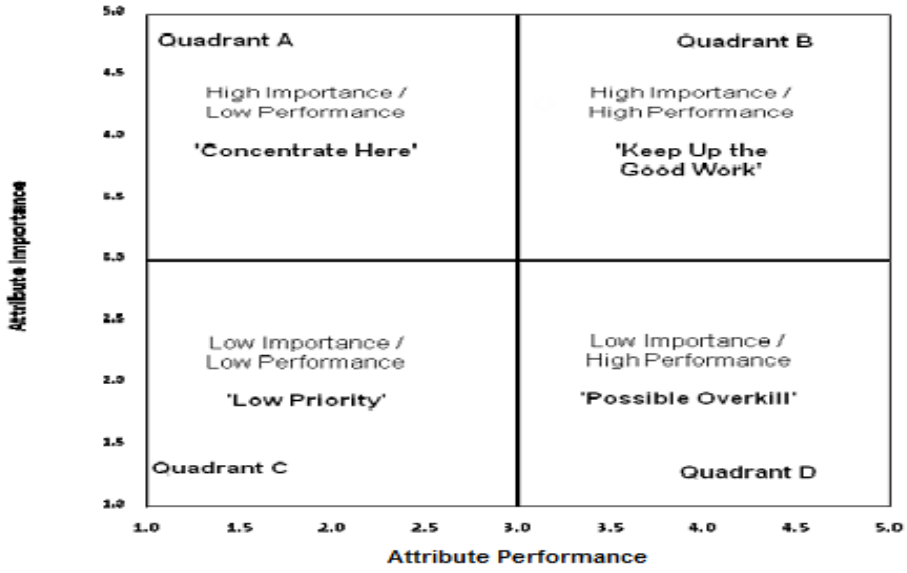


Fig 5.3: Importance-Performance Matrix (Martilla and James 1977)

Table 5.3: Importance and performance of QI attributes

Q I Dimensions	#	Q I Attributes	Importance mean	Performance mean	GAP score
Management Leadership	1	Commitment and support of management	4.16	3.12	-1.04
	2	Communication link between employee and management	4.02	2.90	-1.12
	3	Empowering of employees by management	3.46	3.02	-0.44
	4	Provision of sufficient resources to TQM	4.12	2.66	-1.46
	5	Use of quality improvement tools & techniques	4.20	2.60	-1.60
	6	Promotion of staff & improvement activities	3.96	3.40	-0.56
					-1.04
Employee Involvement	7	Recognition of employee's views & suggestions to improve quality	4.10	2.54	-1.56
	8	Commitment & Enthusiasm of employees	4.10	2.36	-1.74
	9	Use of self-assessment tools to identify and remedy weaknesses	4.00	2.96	-1.04
	10	Expertise & knowledge of employees on quality concepts	4.16	2.52	-1.64

					-1.50
Training and Education	11	Conduct of employees training on TQM concepts	4.10	2.68	-1.42
	12	Provision of continuous learning through training & education	4.12	2.80	-1.32
					-1.37
Supplier Management	13	Selection of suppliers based on quality aspects	4.12	3.12	-1.00
	14	Information sharing between supplier & Management	3.92	2.78	-1.14
	15	Involvement of supplier in quality improvement	4.14	3.10	-1.04
					-1.06
Work Environment and Culture	16	Provision of pleasant working environment	4.08	2.58	-1.50
	17	Adaptation of employee satisfaction initiatives (Suggestion Schemes, Profit sharing etc.,)	4.16	2.60	-1.56
					-1.53
Customer Satisfaction	18	Measuring & Monitoring level of customer satisfaction	4.08	2.80	-1.28
	19	Capturing customer requirement during product development & quality improvement	4.20	3.14	-1.06
					-1.17
		Grand mean	**4.06**	**2.83**	**-1.23**

The aggregate mean values of importance and performance of each QI attribute along with the difference that shows the performance gap between the two are listed in the Table 5.3. survey analysis showed that the respondents were the least satisfied with the attribute of 'Commitment & Enthusiasm of employees with the minimum mean score value (2.36). In contrast, the respondents expressed the greatest satisfaction with respect to the

following attributes: ‘Promotion of staff and improvement activities’ (3.40), ‘Capturing customer requirement during product development & quality improvement’ (3.14), ‘Selection of suppliers based on quality aspects’ (3.12), ‘Commitment and support of management’ (3.12), ‘Involvement of supplier in quality improvement’ (3.10), ‘Empowering of employees by management’ (3.02).

Table 5.3 also indicates the respondents’ perception that performance on all QI attributes were below their expectations (revealed by the negative gap between the expected importance and perceived performance) and this implies that there is room for improvement with respect to all performance attributes, so that attributes with greater differences will be given higher priority (Murali, et al. 2016).

From the gap between means, it is observed that the case companies needs to work harder to achieve better results on the attributes such as ‘Commitment and Enthusiasm of employees’, ‘Expertise and knowledge of employees on quality concepts’, ‘Use of quality improvement tools and techniques’, ‘Recognition of employee’s views and suggestions to improve quality’, ‘Adaptation of employee satisfaction initiatives’, ‘Provision of pleasant working environment’, ‘Provision of sufficient resources to TQM’ and ‘Conduct of employees training on TQM concepts’. These eight attributes have the highest gap scores indicating that the firm needs to focus more on these attributes.

On the other hand, the attributes with the lowest gap scores suggest that the current performance levels are manageable, even if they are still below the expectations. These include ‘Provision of continuous learning through training and education’, ‘Measuring and Monitoring level of customer satisfaction’, ‘Information sharing between supplier and Management’, ‘Communication link between employee and management’, ‘Capturing customer requirement during product development and quality improvement’

and ‘Commitment and support of management’, ‘Selection of suppliers based on quality aspects’, ‘Promotion of staff and improvement activities’ and ‘Empowering of employees by management’. The mean scores for both importance and performance data on all attributes were plotted as coordinates on the importance-performance map as depicted in figure 4. Figure 5.4 highlights the relative positions of attributes in matrix format, with the importance values on the vertical axis and performance values on the horizontal axis with the hairlines fixed at the mean level of importance at 4.06 and the mean level of performance at 2.83.

It is observed that many of the attributes clustered together at the top of the matrix. As pointed out by Abalo et al. (2007), the IPA procedure has a natural tendency to record high importance ratings on a metric or Likert scale for the salient attributes selected for evaluation, with the result that they all crowd together at the top of the IPA grid. Such a crowding phenomenon is quite common and this may be attributed to lack of involvement of respondents (Bacon, 2003) and the possible lack of expertise of respondents regarding the product or service assessed (Sanbonmatsu et al. 2003).

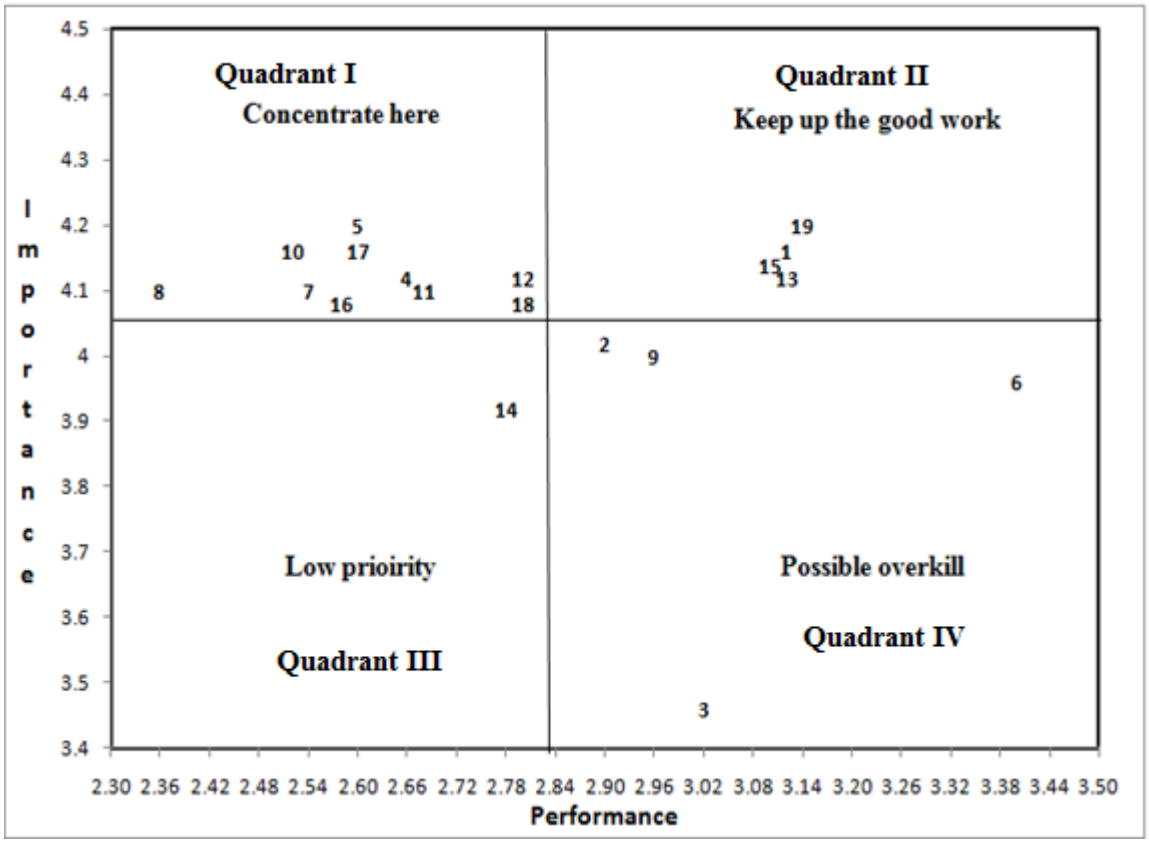


Fig.5.4 Importance–Performance Matrix

5.8 Results of Importance - Performance analysis

In the IP matrix shown in figure 5.4, the attributes that fall in quadrant I are needed to be concentrated upon and they include 'Commitment & Enthusiasm of employees', 'Expertise and knowledge of employees on quality concepts', 'Use of quality improvement tools and techniques', 'Recognition of employee's views and suggestions to improve quality', 'Adaptation of employee satisfaction initiatives', 'Provision of pleasant working environment', 'Provision of sufficient resources to TQM' and 'Conduct of employees training on TQM concepts', 'Provision of continuous learning through training & education', 'Adaptation of employee satisfaction initiatives' and 'Measuring and Monitoring level of customer satisfaction'. This shows that the attributes related to management leadership, Employee involvement, Training and Education, Work environment and culture and customer satisfaction are to be mainly focused upon by the company through appropriate resource planning, proper usage of quality improvement

tools, motivating the employees by recognizing their suggestions, improving their skills and knowledge on quality concepts, conduct comprehensive and periodic training on TQM and CI, providing the pleasant working conditions and monitoring the level of customer satisfaction by getting feedback continuously.

Attributes namely 'Commitment and support of management, 'Selection of suppliers based on quality aspects', 'Involvement of supplier in quality improvement' and 'Capturing customer requirement during product development and quality improvement' were identified to belong to quadrant II (Keep up the good work). Though performance on these attributes may be considered to be satisfactorily in meeting the needs, it is to be seen that the efforts are to be maintained in relation to these four aspects.

The 'low priority' quadrant (quadrant III) consist only one attribute named as 'Information sharing between supplier and Management'. Although the result showed that the respondents perceive these attributes not-so-important, this does not mean that the case company should reduce their efforts to improve such attributes. On the contrary, this is often considered as the basic thing to bring the quality.

Quadrant IV (possible overkill) quadrant, there are four attributes namely, 'Communication link between employee and management', 'Empowering of employees by management', 'Promotion of staff and improvement activities' and 'Use of self-assessment tools to identify and remedy weaknesses' which are rated by respondents as of low importance with high performance. It means that, the respondents are very satisfied with the organisation's performance and the companies are able to meet the expectations of the respondents.

According to Coghlan (2012), the traditional IPA technique identifies areas of perceived high or low attribute performance combined with high or low attribute importance, providing managers with guidelines to factors that (i) are performing well but need attention (Quadrant II), (ii) require additional care and attention as they are under performing (Quadrant I), (iii) are of low priority and may not require any attention (Quadrant III) and (iv) are at risk of over investment as they are of low importance to customers (Quadrant IV).

5.9 Regression analysis for research model 1

In statistics, regression analysis is a statistical process for estimating the relationships among variables. More specifically, regression analysis helps one understand how the typical value of the dependent variable changes when any one of the independent variables is varied, while the other independent variables are held fixed. Multiple regression is an extension of simple linear regression which is used to predict the value of a dependent variable based on the value of two or more independent variables. It is the simultaneous combination of multiple factors to assess how and to what extent they affect a certain outcome.

With the consideration of the research objective, multiple regression analysis was performed by using Statistical Software Package for Social Science (SPSS) and the Analysis of Moment Structure (AMOS 21) to investigate the relationship of the independent variables, namely Management Leadership, Employee Involvement, Training and Education, Supplier Management, Work Environment and Culture and Customer Satisfaction with Overall Performance on (OVP) TQM and CI as dependent variable.

A series of regression analyses were adopted to examine the impact of QI dimensions (independent variables) on OVP on TQM and CI (dependent variable) and the parameters estimated, the standard error (S.E.), the critical ratio (C.R.) and significance level (P) of each variable are presented in this Table 4. According to Janssens et al. (2008), with the significance level of 0.05 and a critical ratio greater than 1.96 for a two-tail test can be considered statistically significant. The impacts of every dimension were studied as well. From the figure 5.5, it is revealed that there is a significant relationship between QI dimensions and overall performance on TQM and CI.

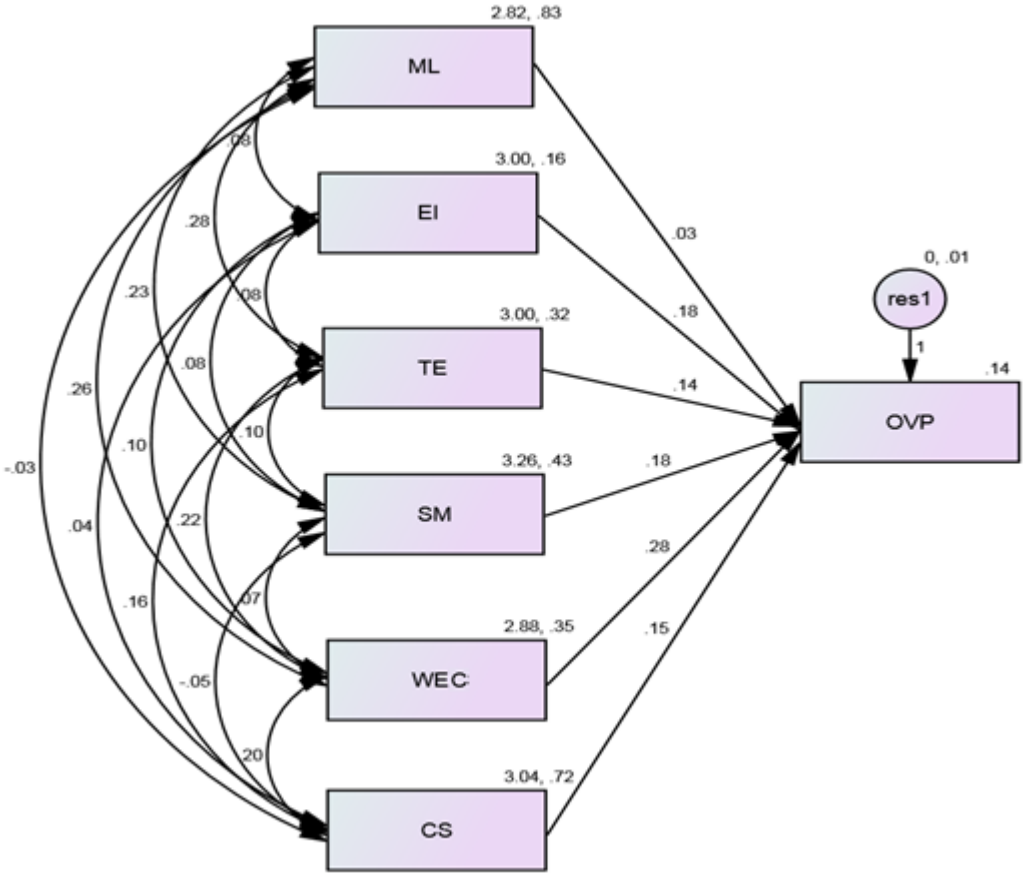


Fig 5.5. Regressed Model 2

Table 5.4. Results of Regression Analysis

			Estimate	S.E.	C.R.	P
OVP	<---	ML	.034	.012	2.833	.028
OVP	<---	EI	.182	.043	4.250	***
OVP	<---	TE	.141	.039	3.645	***
OVP	<---	SM	.182	.026	7.124	***
OVP	<---	WEC	.280	.038	7.272	***
OVP	<---	CS	.152	.021	7.258	***

The regressed model revealed that, among the six QI dimensions, the dimension work Environment and culture (WEC) (28%) positively influences overall performance followed by the dimension employee involvement (EI) (18.2%) and supplier management (SM) (18.2%).The results also indicated that a positive correlation exist between customer satisfaction (CS) (15.2%) and overall performance. It is also observed that the influence of the dimension Training and Education (TE) (14%) on OVP is statistically significant. It is further seen that, the regression coefficient is positive for the dimension management Leadership (ML) (3.4% at $p = 0.028$). The representations of covariance analysis shown in figure 5 suggest that there is a relationship among the attributes of six dimensions of quality improvement.

In general, it is revealed that five dimensions such as work Environment and culture, employee involvement, supplier management, customer satisfaction and Training and Education play an important role in improving the OVP and it can be concluded that the attributes identified under these dimensions could be prioritised as the most important ones for deriving OVP. On the other hand, the dimension management leadership is not influenced as in case of other dimensions. It may be recommended to the case companies to focus on:

- Providing better working conditions and culture by improving the shop layout, working condition of machineries and equipment and initiating the employee satisfaction measures.
- Recognising the employees' suggestions in improving quality, making them to expertise, knowledge and to commit in adopting the quality concepts.
- Implementing the comprehensive approach of evaluating and selecting the suppliers and make them to adopt the company quality policy.
- Implementing effective information sharing system with appropriate IT tools.
- Providing comprehensive and systematic training to the employees in quality management.
- Getting feedback from the customers continuously regarding the quality of product.

5.10 Regression Analysis for Research Model 2

In this study, multiple regression analysis was performed by using SPSS and AMOS, to investigate the relationship of the independent variables, namely Strategic Quality Management (SQM), Internal Measurement (IM) and Quality System Improvement (QSI) with Overall Performance on TQM and CI (OVP1) as dependent variable.

5.11 Results and Discussion

A series of regression analyses were adopted to examine the impact of QI dimensions (independent variables) on overall performance of TQM and CI (dependent variable) and the parameters estimated, the standard error (S.E.), the critical ratio (C.R.) and significance level (P) of each variable are presented in this table 5. From the Fig5. 6, it is revealed that there is a positive significant relationship between QI dimensions and overall performance of TQM and CI.

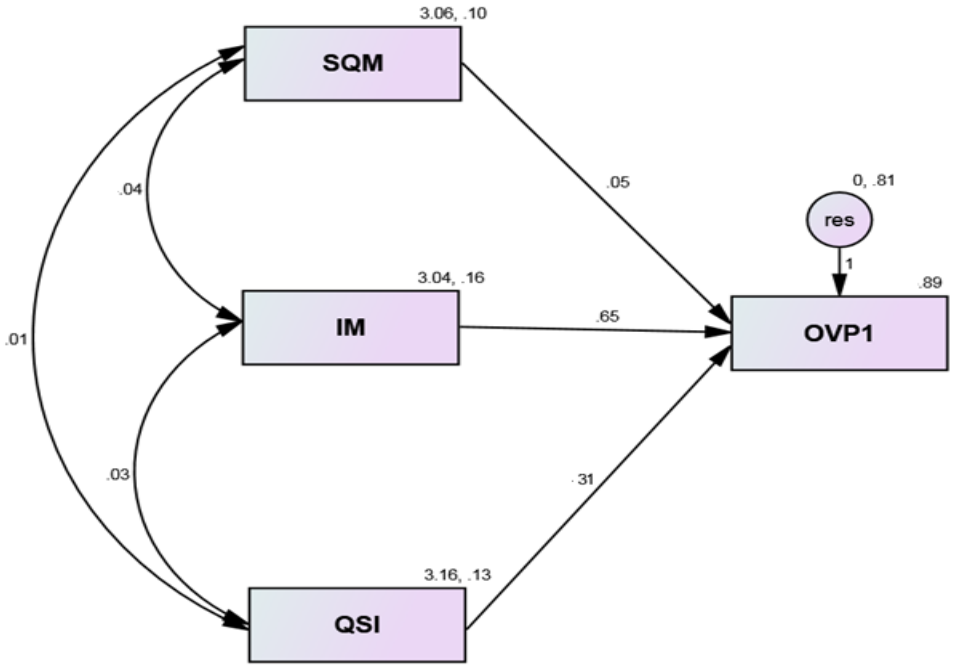


Fig 5.6: Regressed model 2

Table 5.5: Results of Regression analysis

			Estimate	S.E.	C.R.	P
OVP1	<---	SQM	.052	.012	2.833	.028
OVP1	<---	IM	.651	.048	7.563	***
OVP1	<---	QSI	.312	.072	4.577	***

The results of regression analysis revealed that, the dimension Internal Measurement (IM)) (65%) based attributes are strongly associated with overall performance of TQM & CI followed by the dimension Quality improvement system (QSI) (31.2%) based attributes. The results also indicated that there is a positive correlation exists between strategic quality management (SQM) (5.2%) and overall performance of TQM and CI. The representations of covariance analysis shown in Fig 5.4 suggest that there is a relationship among the attributes of three dimensions of quality improvement.

From the results, it is evident that the case companies delivering good performance on internal measurement based attributes such as internal customer's needs and expectations are known. Performance against standards for key processes is regularly evaluated and statistical techniques are used to monitor performance of key processes. To improve the performance on this dimension, the case companies have to apply TQM techniques such as total productive maintenance, value stream mapping, cellular manufacturing, kanban, kaizen and poka yoke for improving total quality. Furthermore, the case companies should identify the critical success factors and allocate the resources properly to improve such factors to achieve total quality. Also, the case companies may use appropriate tool for getting continuous feedback from the customers on the product quality.

5.12 Conclusion

Analysis of data shows that case companies are required to pay more attention on improving the performance of the attributes of the dimensions such as work environment and culture, employee involvement, training and education, internal measurement and quality system improvement. Hence, it is recommended that case companies must focus on improving the performance of the above mentioned dimensions based attributes. This will lead to improvement in total quality which will result in increasing the level of customer satisfaction.

5.13 Extended Analysis

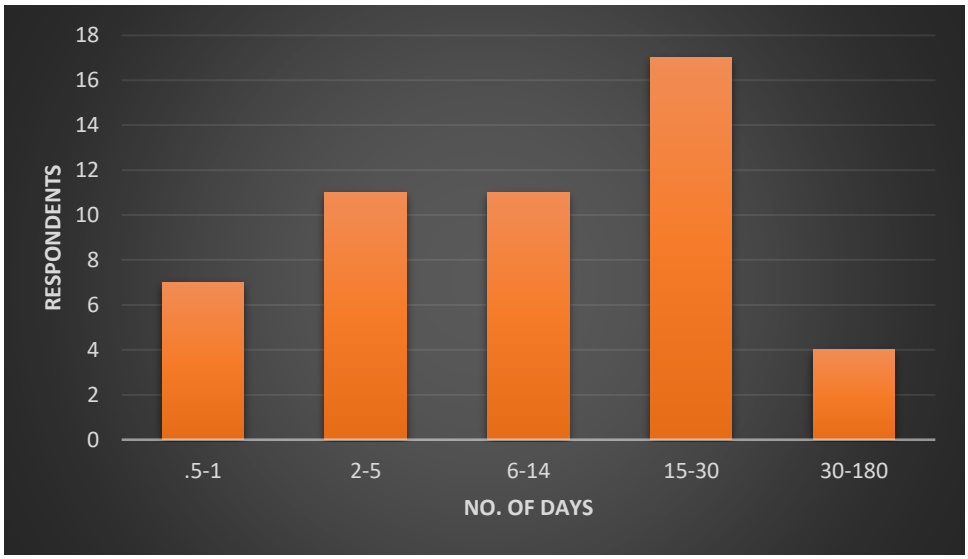
The study is further extended to cope with the aspects concerned with formulating appropriate strategic action plans to improve the total quality and thereby customer satisfaction. The idea behind the extended analysis to analyse the current practices of the manufacturing processes by the companies through questionnaire survey method. Frequency distributions summarize and compress data by grouping it into Return to Table of Contents classes and recording how many data points fall into each class. That is, they

show how many observations on a given variable have a particular attribute. Converting these raw numbers into percentages would then provide an even more useful description of the data. The frequency distribution is the foundation of descriptive statistics.

Frequency analysis has conducted on the data collected through questionnaire survey from the representatives of case companies and design of questionnaire is explained earlier in the section 5.0. The outcome of this study definitely would be the solution to the improvement of total quality through the concepts of TQM and CI.

Table 1: Average amount of raw material stocks held

No of days	Frequency	Percent	Valid Percent	Cumulative Percent
0.5-1	7	14.0	14.0	14.0
2-5	11	22.0	22.0	36.0
6-14	11	22.0	22.0	58.0
15-30	17	34.0	34.0	92.0
30-180	4	8.0	8.0	100.0
Total	50	100.0	100.0	

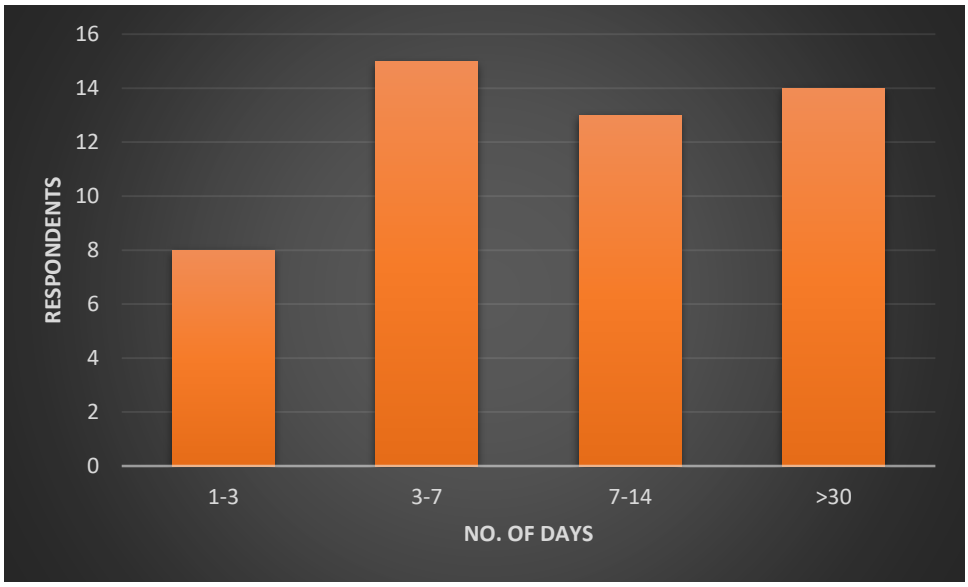


From the above results, it is inferred that in 34% of the companies, the average amount of raw material stocks held for 15-30 days. On the other hand, the stock is held for 6-

14 days and 2-5 days by 22% of companies each. It indicates that most of the companies not having effective inventory control system.

Table 2: Number of days finished products held in stock

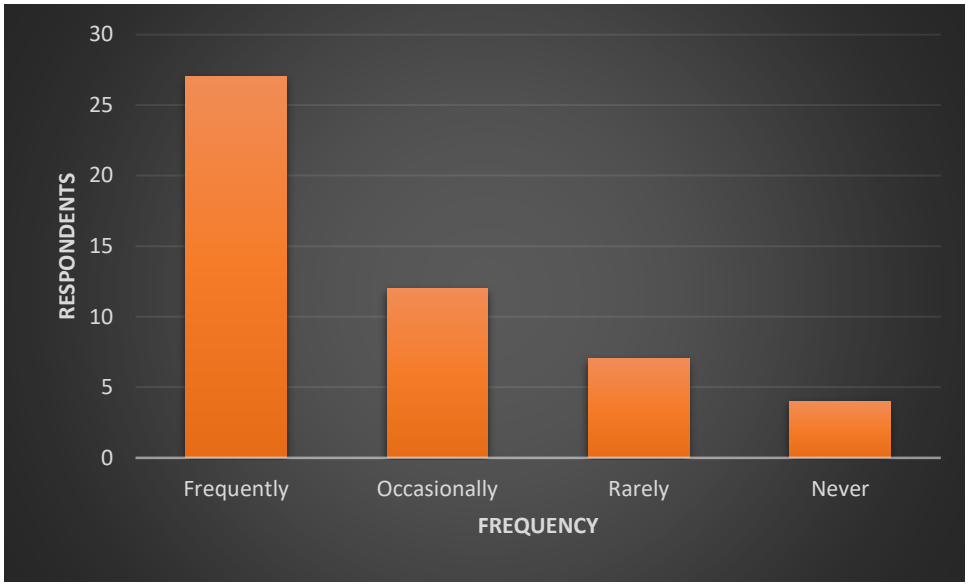
No of Days	Frequency	Percent	Valid Percent	Cumulative Percent
1-3	8	16.0	16.0	16.0
3-7	15	30.0	30.0	46.0
7-14	13	26.0	26.0	72.0
>30	14	28.0	28.0	100.0
Total	50	100.0	100.0	



From the results, it is clear that 30% of the companies stocking the finished products for 3-7 days. But at the same time, 28% of the companies have stocked finished products for more than 30 days. The companies stocking finished products for 1-3 days is only 16%. It indicates that most of the companies not having effective demand – supply management.

Table 3: Frequency of production stops due to waiting for instructions or materials

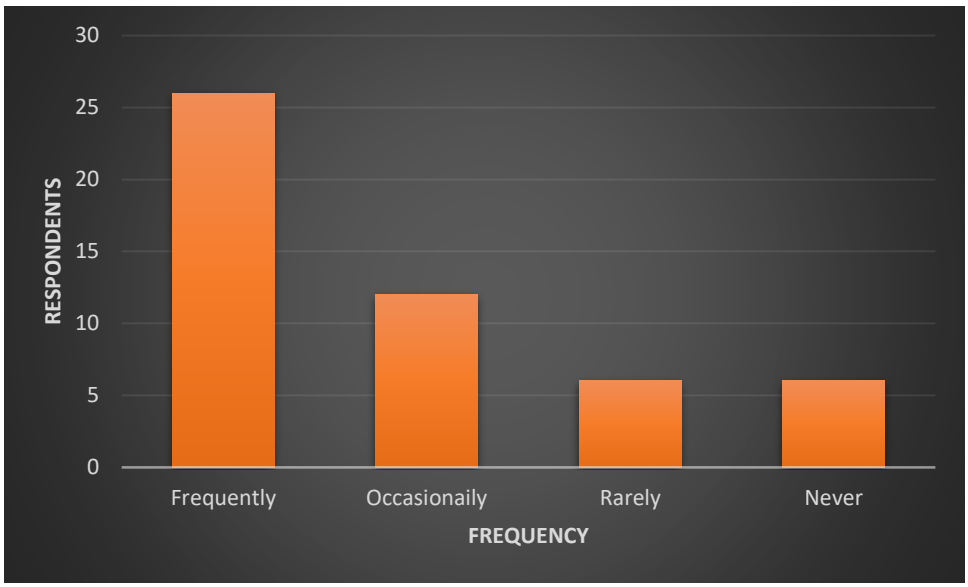
	Frequency	Percent	Valid Percent	Cumulative Percent
Frequently	27	54.0	54.0	54.0
Occasionally	12	24.0	24.0	78.0
Rarely	7	14.0	14.0	92.0
Never	4	8.0	8.0	100.0
Total	50	100.0	100.0	



It is manifested from the results that in majority of the companies (54%) the production stopped frequently due to waiting for instructions or materials. The production stopped occasionally in 24%, rarely in 14% and it never stopped in 8% of the companies. This indicates that the most of the companies manage the materials handling and work instructions very poorly.

Table 4: Frequency of production stops due to equipment failure / breakdown

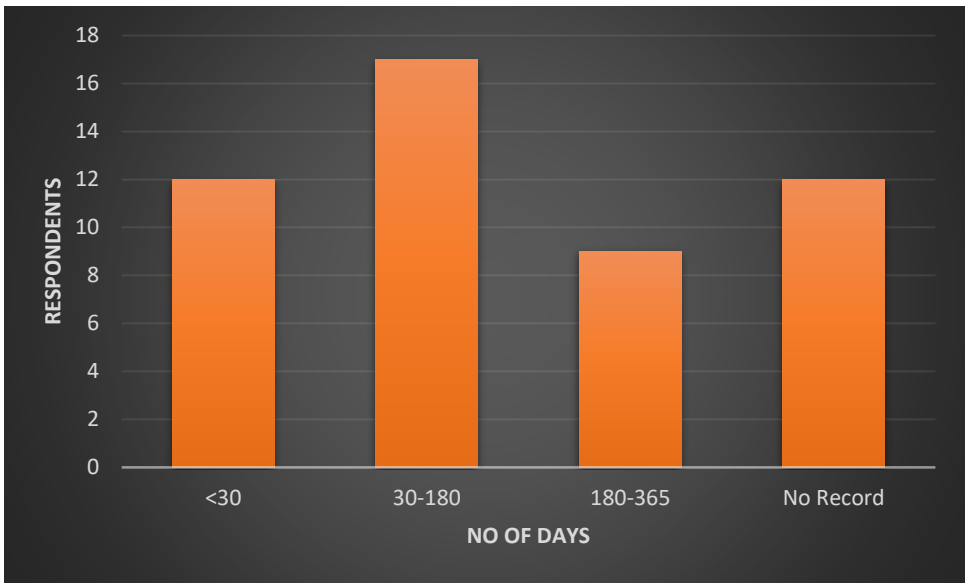
	Frequency	Percent	Valid Percent	Cumulative Percent
Frequently	26	52.0	52.0	52.0
Occasionally	12	24.0	24.0	76.0
Rarely	6	12.0	12.0	88.0
Never	6	12.0	12.0	100.0
Total	50	100.0	100.0	



It is known from the results, the production stopped frequently due to equipment failure or breakdown in 52% of the companies. The production stopped occasionally in 24%, rarely in 12% and it never stopped only in 12% of the companies for above reason. It shows that majority of the companies are very poor in equipment failure.

Table 5 Average equipment Mean Time between Failures (MTBF)

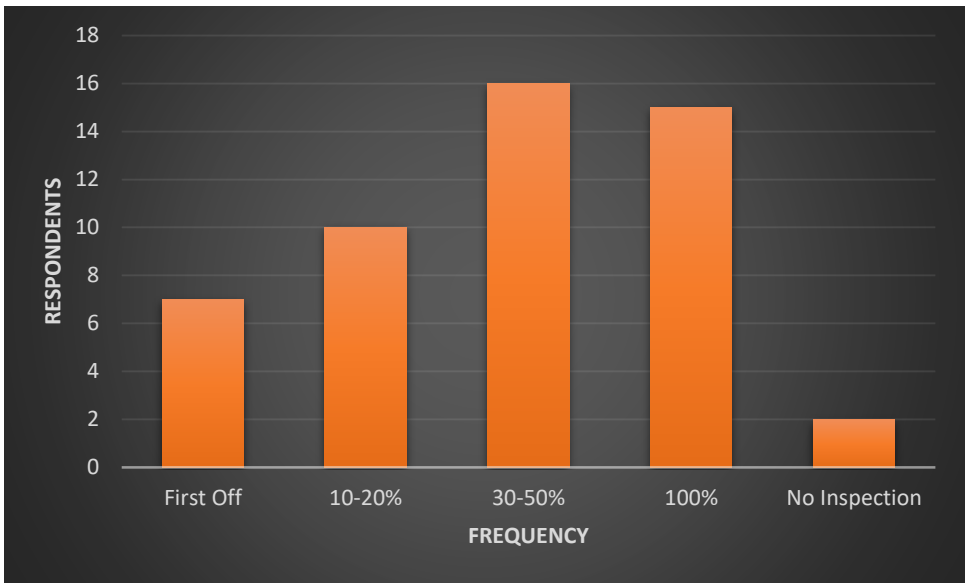
No of days	Frequency	Percent	Valid Percent	Cumulative Percent
< 30	12	24.0	24.0	24.0
30-180	17	34.0	34.0	58.0
180-365	9	18.0	18.0	76.0
No Record	12	24.0	24.0	100.0
Total	50	100.0	100.0	



The results showed that the average equipment Mean Time between Failures (MTBF) is 30-180 days in 34% of the companies. In 24% of companies, it could be less than 30 days. There was no record available in 24% of the companies. It indicates that, failure history is not being documented properly and even no record is available in some industries.

Table 6: Frequency of products inspection before shipping to customers

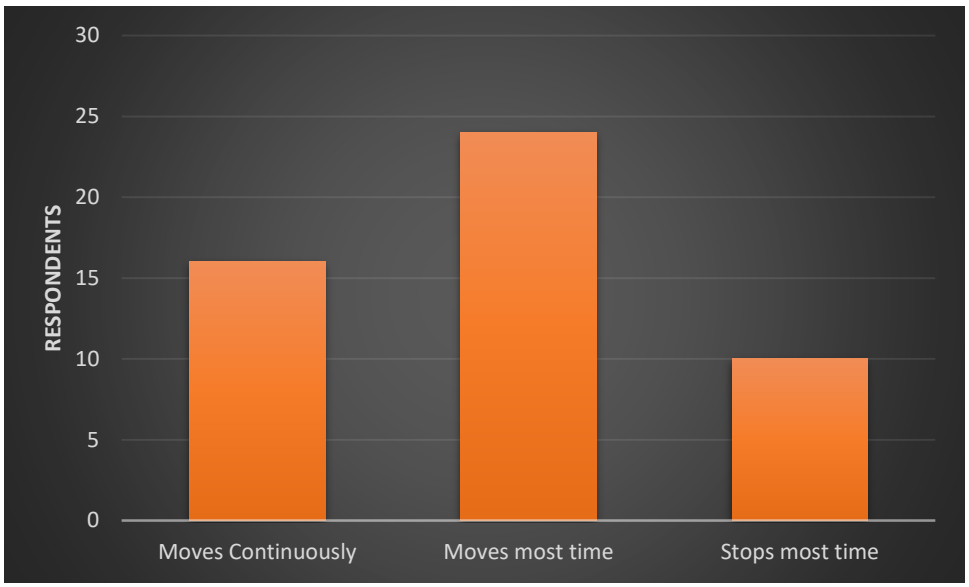
Frequency	Frequency	Percent	Valid Percent	Cumulative Percent
First Off	7	14.0	14.0	14.0
10-20%	10	20.0	20.0	34.0
30-50%	16	32.0	32.0	66.0
100%	15	30.0	30.0	96.0
No Inspection	2	4.0	4.0	100.0
Total	50	100.0	100.0	



The results clearly explicit 30-50 % of the products are inspected before they delivered to the customers in 32% of the companies. The results also inferred that 30% of the companies doing 100% inspection. Only in 4% of the companies the products are not inspected before the shipment to customers. It signifies that majority of companies not implementing quality control policy effectively.

Table 7: Movement of product between work stations

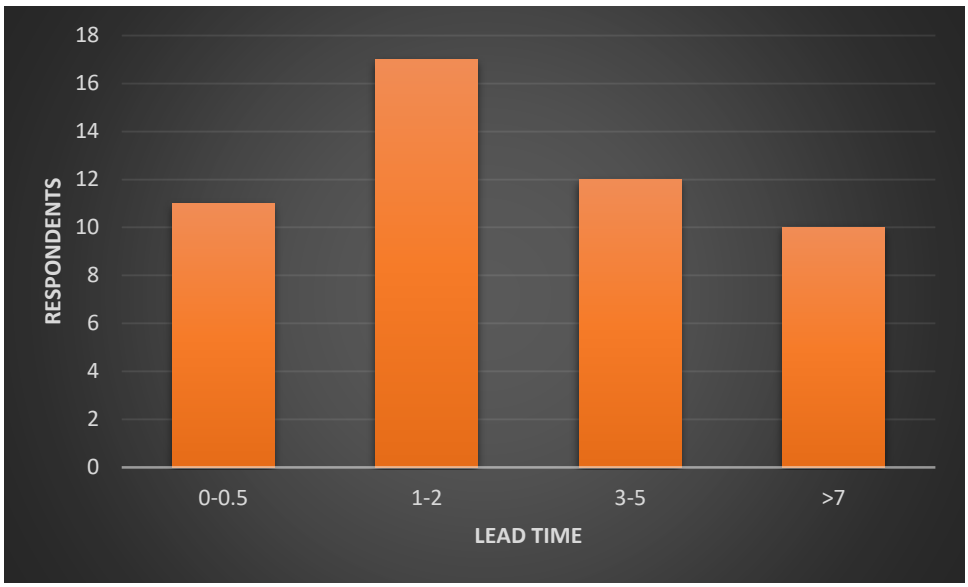
	Frequency	Percent	Valid Percent	Cumulative Percent
Moves continuously	16	32.0	32.0	32.0
Moves Most time	24	48.0	48.0	80.0
Stops Most time	10	20.0	20.0	100.0
Total	50	100.0	100.0	



From the results, it is inferred that in majority of companies (48%), the product moves most of the time continuously between workstations. The product moves continuously between workstations in 32% of companies. Most of the time, the product stopped in 20% of companies. It indicates that there is no line balancing incorporated particularly in assembly line in the majority of industries.

Table 8: Overall operation lead time

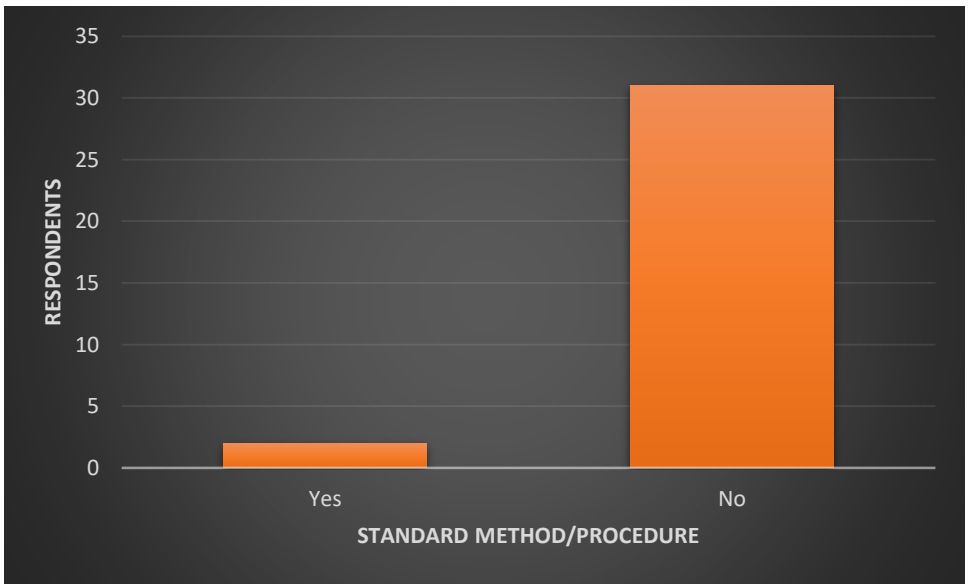
No of days	Frequency	Percent	Valid Percent	Cumulative Percent
0-0.5	11	22.0	22.0	22.0
1-2	17	34.0	34.0	56.0
3-5	12	24.0	24.0	80.0
>7	10	20.0	20.0	100.0
Total	50	100.0	100.0	



From the above, it is found that 34% of the companies having the overall operation lead time as 1-2 days. 24% of the companies having the lead time of 3-5 days. The lead time is 0 – 0.5 day for only 22% of companies.

Table 9: Use of standard methods/procedures used to make products

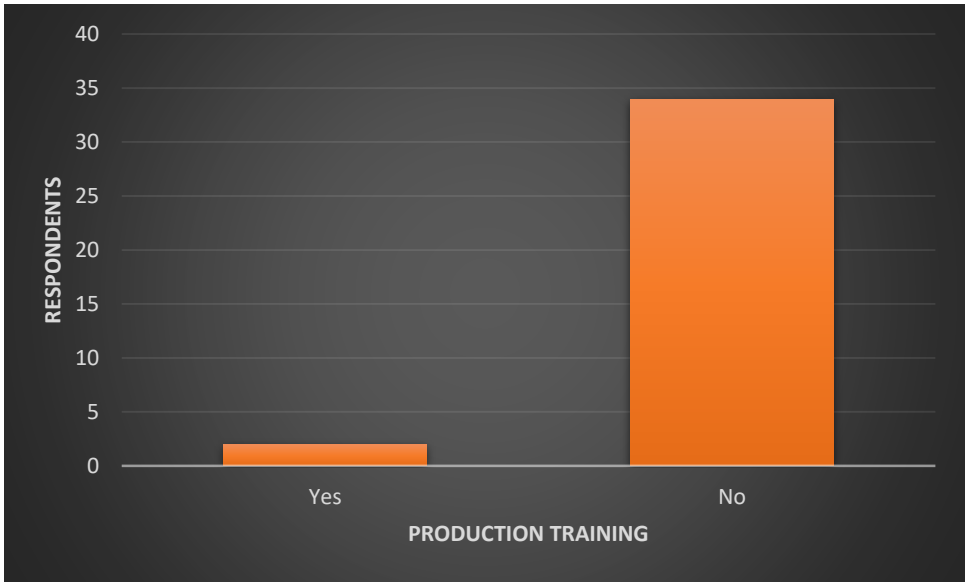
	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	19	38.0	38.0	38.0
No	31	62.0	62.0	100.0
Total	50	100.0	100.0	



From the above figure, it is inferred that there is no standard method or procedure is used to produce the product in 62% of the companies. Only in 38% of companies, the product is produced by using standard method or procedure.

Table 10: Production operators receive formal training before working on production line

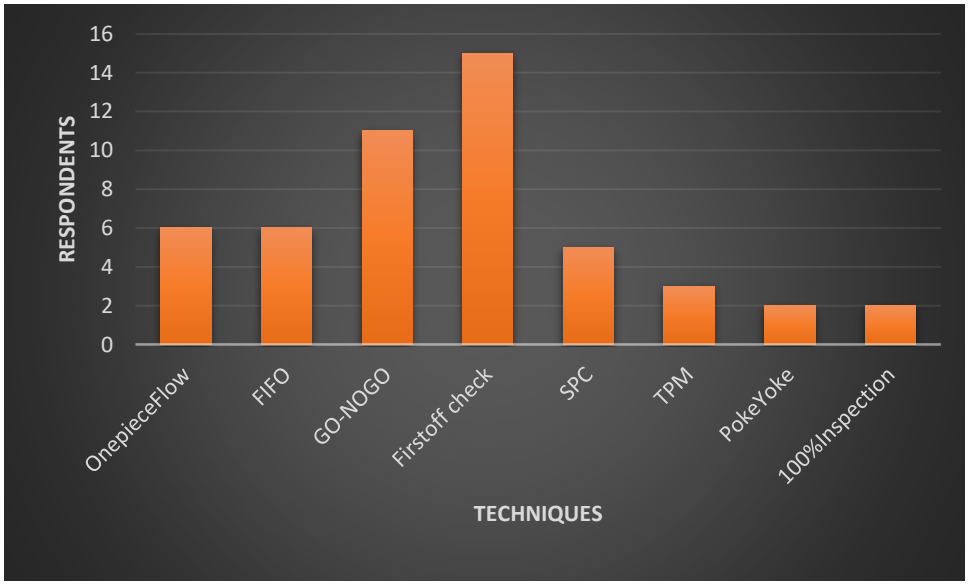
	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	16	32.0	32.0	32.0
No	34	68.0	68.0	100.0
Total	50	100.0	100.0	



From the opinion of respondents belonging to case companies, it is found that the production operators not receiving the formal training before working on production line in majority of companies (68%) and only in 32% of companies, the operators are given proper training before the production.

Table 11: Techniques used to minimize opportunities of producing defects

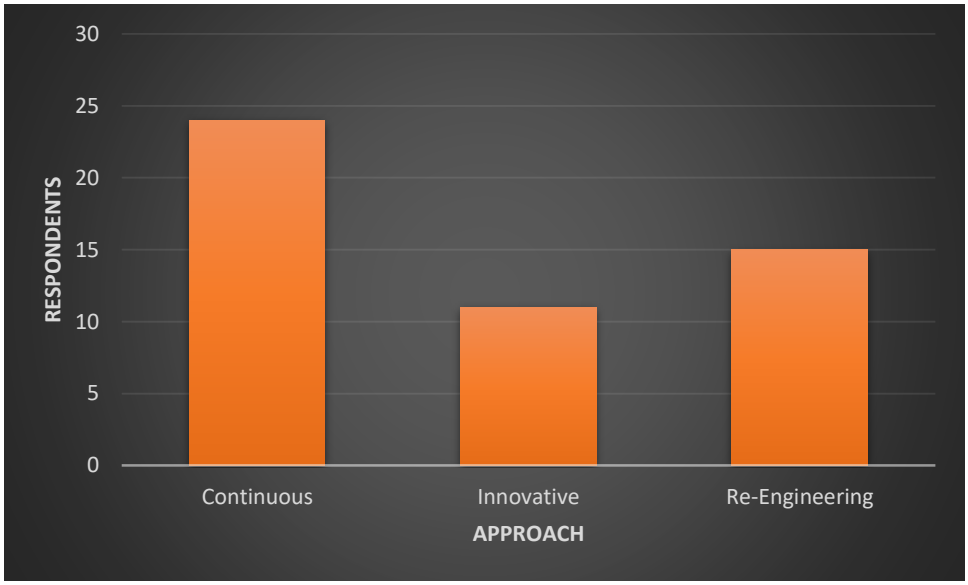
	Frequency	Percent	Valid Percent	Cumulative Percent
One piece flow	6	12.0	12.0	12.0
FIFO	6	12.0	12.0	24.0
GO-NOGO	11	22.0	22.0	46.0
First off check	15	30.0	30.0	76.0
Statistical process control	5	10.0	10.0	86.0
TPM	3	6.0	6.0	92.0
Poke Yoke	2	4.0	4.0	96.0
100% Inspection	2	4.0	4.0	100.0
Total	50	100.0	100.0	



From the analysis, it is inferred that, first off check technique is used to minimize the defects in 30% of the companies followed by Go-No Go gauge technique in 22% of companies. 12% of the companies using one piece flow and another 12% using FIFO method. Only 10% of the companies adopt statistical process control technique in their production.

Table 12: CI Approach company uses the most

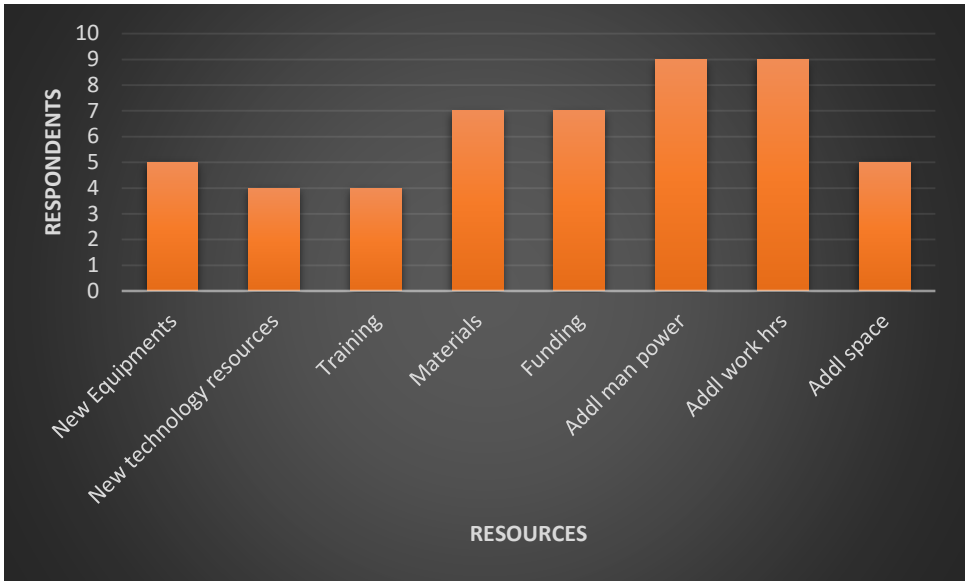
	Frequency	Percent	Valid Percent	Cumulative Percent
Continuous	24	48.0	48.0	48.0
Innovative	11	22.0	22.0	70.0
Re-Engineering	15	30.0	30.0	100.0
Total	50	100.0	100.0	



From the results, it is found that the continuous improvement approach is used by 48% of companies, Re-engineering approach is implemented in 30% and only 22% of companies are having innovative approach.

Table 13: Resources implications of implementing the improvement projects

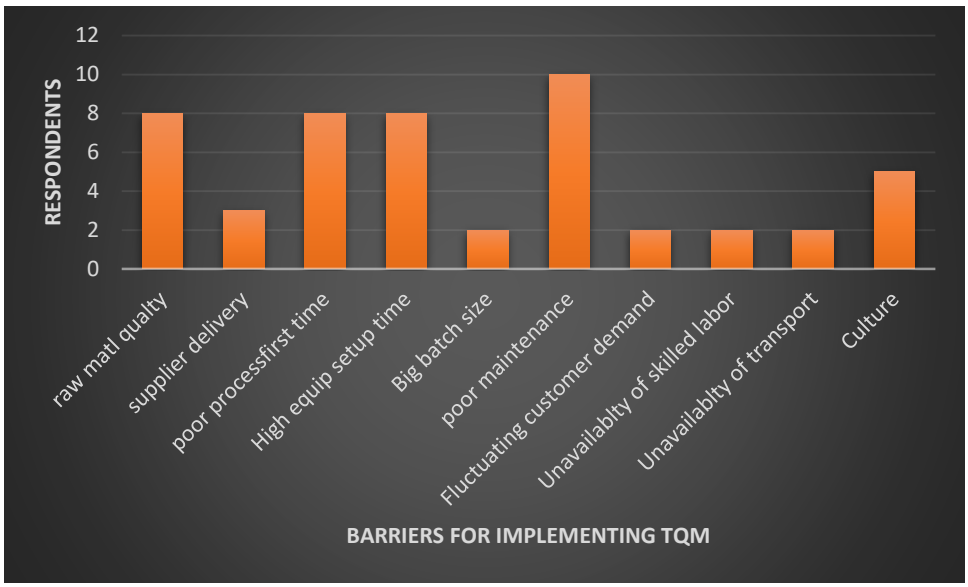
	Frequency	Percent	Valid Percent	Cumulative Percent
New equipment	5	10.0	10.0	10.0
New technology resources	4	8.0	8.0	18.0
Training	4	8.0	8.0	26.0
Materials	7	14.0	14.0	40.0
Funding	7	14.0	14.0	54.0
Addl. Man power	9	18.0	18.0	72.0
Addl. work hrs	9	18.0	18.0	90.0
Addl. Space	5	10.0	10.0	100.0
Total	50	100.0	100.0	



From the above analysis, it is found that 36% (18 +18) of respondents opined that the additional man power & work hours needed for improving the quality. Results also revealed that 28% (14+14) of respondents answered for materials and funding for the projects. Only a few respondents opined on additional space (10%), new equipment (10%), new technology resources (8%) and training (8%).

Table 14: Barriers for implementing TQM effectively in the company

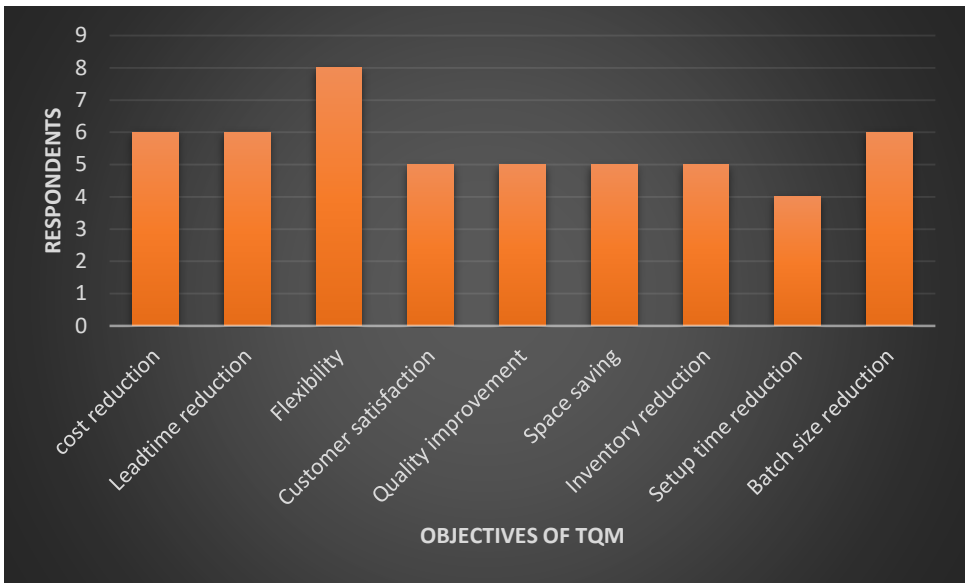
	Frequency	Percent	Valid Percent	Cumulative Percent
Raw materials quality issues	8	16	32	16
Suppliers' delivery issues	3	6	12	22
Poor process First Time Through	8	16	32	38
High equipment setup time	8	16	32	54
Big batch sizes	2	4	8	58
Poor equipment reliability and maintenance	10	20	40	78
Fluctuating customer demand	2	4	8	82
Unavailability of skilled labour	2	4	8	86
Unavailability of transport infrastructure	2	4	8	90
Culture	5	10	20	100
Total	50	100	100	



The results showed that 20% of respondents consider the poor reliability and maintenance of equipment as a barrier for implementing TQM. Also, the elements such as raw materials quality issues (16%), Poor process first time through (16%), and High equipment setup time (16%) are considered as barriers in some industries. In some industries (10%), the culture is treated as barrier. The elements namely, supplier's delivery issues (6%) unavailability of transport (4%), unavailability of skilled labour (4%) and fluctuating customer demand (4%) are consider least in some industries.

Table 15: TQM objectives that the company achieved

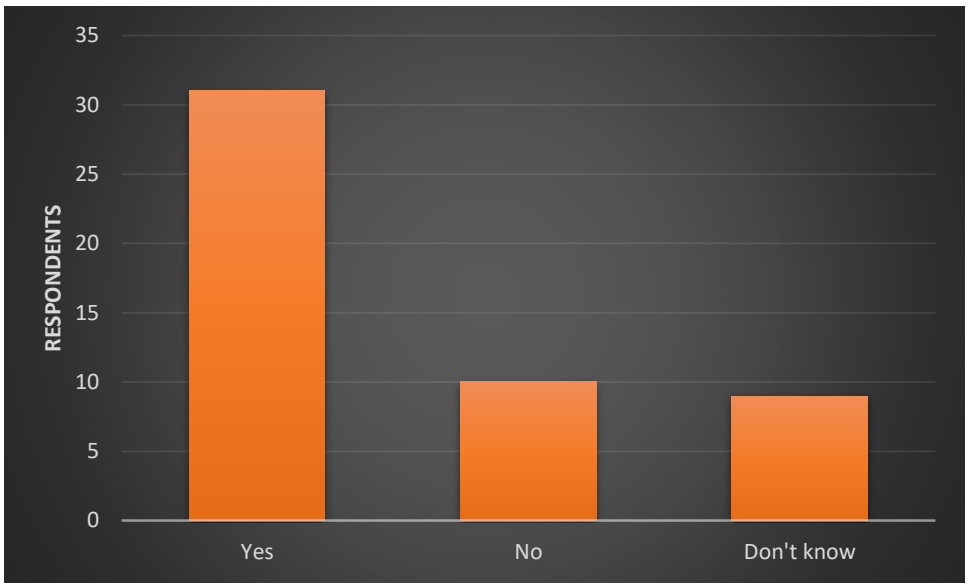
	Frequency	Percent	Valid Percent	Cumulative Percent
Cost reduction	6	12	12	12
Lead time reduction	6	12	12	24
Flexibility	8	16	16	40
Customer satisfaction	5	10	10	50
Quality improvement	5	10	10	60
Space saving	5	10	10	70
Inventory reduction	5	10	10	80
Set Up Time Reduction	4	8	8	88
Batch size reduction	6	12	12	100
Total	50	100	100	



Empirical analysis shows that 16% of industries have achieved the objective flexibility whereas the companies achieved objectives such as cost reduction, lead time reduction and batch size reduction are 12% each. On the other hand, the objectives namely, customer satisfaction, quality improvement, space saving and inventory reduction have achieved by the companies of 10% each. Only 8% of companies have achieved the objective set up time reduction.

Table 16: Need for improving TQM and CI

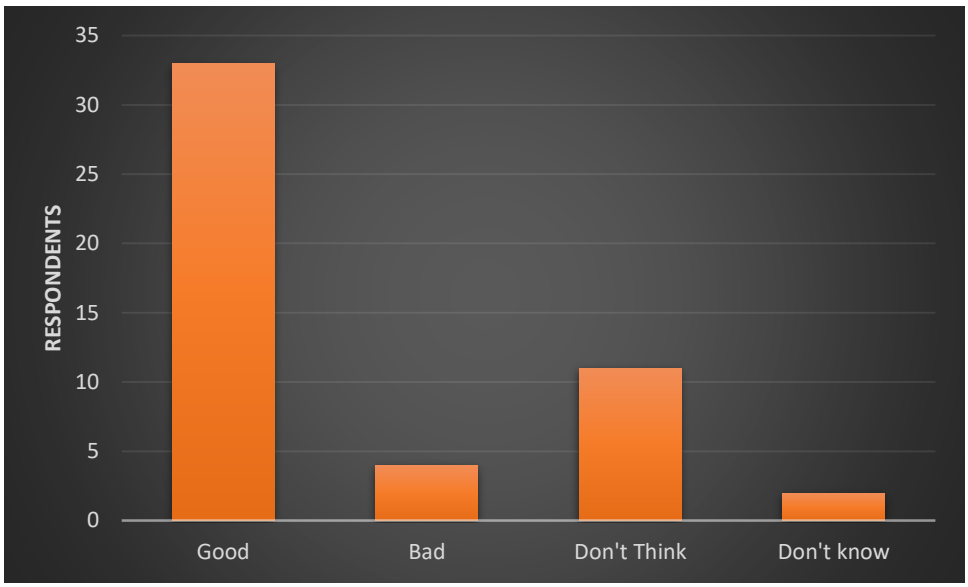
	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	31	62.0	62.0	62.0
No	10	20.0	20.0	82.0
Don't Know	9	18.0	18.0	100.0
Total	50	100.0	100.0	



Results showed that, 62% of respondents agred that there is a need to improve TQM and CI in their companies. 20% of the respondents felt that there is no need to improve TQM and CI. 18% of respondents expressed that they do not know the necessity of improving TQM and CI. This indicates that, these workers were not given information or training on TQM and CI concepts.

Table 17: Thinking of a new TQM improvement methodology that combines benefits of CI

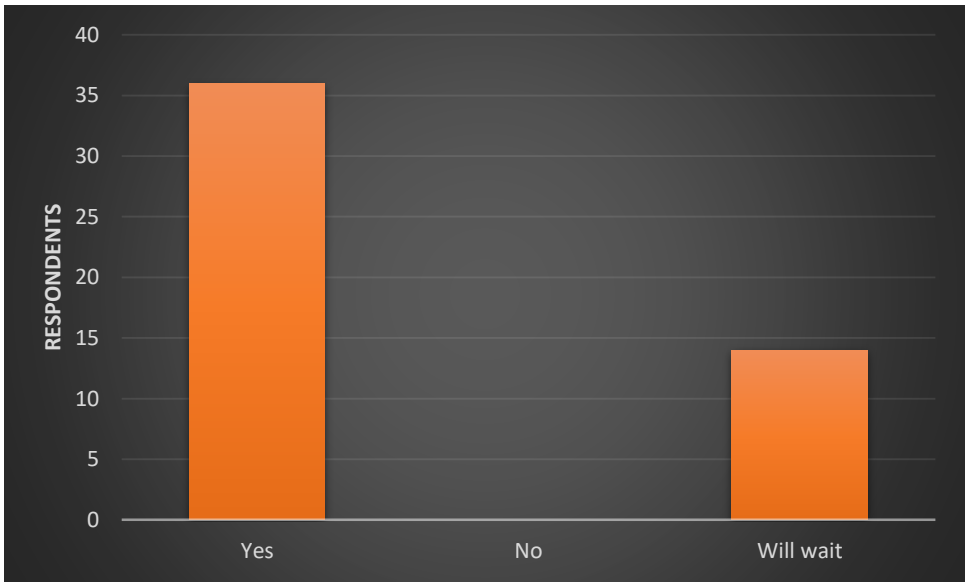
	Frequency	Percent	Valid Percent	Cumulative Percent
Good	33	66.0	66.0	66.0
Bad	4	8.0	8.0	74.0
Don’t Think	11	22.0	22.0	96.0
Don’t Know	2	4.0	4.0	100.0
Total	50	100.0	100.0	



Result shows that the majority (66%) of respondents agreed that the new TQM improvement methodology combines benefits of CI. In contrast, 8% of respondents not agreed with this statement.

Table 18: Interested in using the new improvement methodology that combines TQM and CI

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	36	72.0	72.0	72.0
No	0	0	0	0
Will Wait	14	28.0	28.0	100.0
Total	50	100.0	100.0	



Results showed that the majority (72%) of respondents interested in implementing new approach that combines TQM and CI in their companies.

5.14 Summary of Empirical Analysis

The empirical analysis provided valuable information regarding the application of TQM and CI with reference to improving quality management practices in the Arab manufacturing organisations. Main findings from the survey analysis are summarised below:

- 65% companies do not have effective inventory control system.
- In 67% of companies, failure history is not being documented properly and even no record is available in some industries.
- 74% of companies manage the materials handling and work instructions poorly.
- In 68% of companies, there is no line balancing incorporated particularly in assembly line in the majority of industries
- 71% of companies do not have effective demand – supply management.
- 72% of companies do not implement quality control policy effectively.
- Only in 38% of companies the product is produced by using standard method or procedure.
- 24% of the companies having the lead time of 3-5 days. The lead time is 0 – 0.5 day for only 22% of companies.
- Only in 38% of companies the product is produced by using standard method or procedure.
- Only in 32% of companies, the operators are given proper training before the production.

- Only 10% of the companies adopt statistical process control technique in their production.
- CI approach is used in 48% of companies
- Re-engineering approach is implemented in 30% and only 22% of companies have innovative approach.
- Only a 10% of companies has provision for additional space (10%), new equipment (10%), new technology resources (8%) and training (8%).
- It indicates that, workers are not given the awareness of TQM and CI concepts.
- Results showed that the majority (72%) of respondents are interested in implementing new approach that combines TQM and CI in their companies.
- 78% of companies suffer frequent equipment failure due to ineffective preventive maintenance system.
- Only 20% of respondents consider that poor reliability and maintenance of equipment as a barrier for implementing TQM.
- Also, elements such as raw materials quality issues (16%), poor process first time through (16%), and high equipment setup time (16%) are considered as barriers in some industries.
- In some companies (10%), culture is treated as a barrier. The elements namely, supplier's delivery issues (6%) unavailability of transport (4%), unavailability of skilled labour (4%) and fluctuating customer demand (4%) are considered least in some industries.
- Only 16% of companies have achieved flexibility whereas the companies achieved objectives such as cost reduction, lead time reduction and batch size reduction are 12% each.
- On the other hand, the objectives namely, customer satisfaction, quality improvement, space saving and inventory reduction have achieved by the companies of 10% each.

- Only 8% of companies have achieved the objective set up time reduction.

The empirical study has highlighted the existing problems, weakness, barriers and opportunities for TQM and CI implementation in the Arab manufacturing companies, thereby hindering the quality improvement programs. The analysis has also identified that the employee involvement have a measureable effect on TQM and CI program and the extent to which the amount of training and education on TQM and CI techniques affect the overall growth of the companies. It was also quite clear that the Arabic work culture presents problems to the success of quality management in the manufacturing sector. Empirical analysis shows that majority of the Arab manufacturing need improving almost all the stages and processes of manufacturing by implementing the concepts of TQM and CI. It is also being recommended that the companies to concentrate on:

- To adopt continuous improvement tools and follow TQM philosophy.
- Providing better working conditions and culture by improving the shop layout, working condition of machineries and equipment and initiating the employee satisfaction measures.
- Recognising the employees' suggestions in improving quality, making them to expertise, knowledge and to commit in adopting the quality concepts.
- Implementing the comprehensive approach of evaluating and selecting the suppliers and make them to adopt the company quality policy.
- Implementing effective information sharing system with appropriate IT tools.
- Providing comprehensive and systematic training to the employees in quality management.
- Getting feedback from the customers continuously regarding the quality of product.

CHAPTER 6
DEVELOPMENT OF CONCEPTUAL FRAMEWORK

6.0 Introduction

This chapter discusses developing the conceptual framework for TQM and validation of the model

6.1 TQM Models Based Empirical Studies

TQM model developed by Thiagarajan and Zairi (2001) based on their empirical studies considered two parts, the soft and hard categories. Organizational leadership and maximizing involvement of internal stakeholders in customer or satisfaction, CI driven processes which were regarded as hard categories. The core elements of their TQM framework were quite general and used as a basic guide to implement TQM at the early stage. Empirical studies based TQM model proposed by Husband and Mandal (1999), concentrated large organizations. Although, the authors suggested some changes and modifications in their proposed model to fit the SMEs, the suitability and applicability were still open to discussion. Application of TQM model proposed by Oakland (1993) and Mann (1997) for SMEs suffered many problems in terms of automation, mechanization and flexibility to support agile manufacturing systems. Research findings of Yusof and Aspinwall (2000) highlighted that many of TQM models proposed were too complex to use and very much tool orientated.

Success of TQM transformation in manufacturing SMEs in the Middle East is largely depends on the extent to which companies implement quality management practices successfully. These approaches have been advocated by quality experts such Crosby, Deming and Juran. Their quality concept includes product design, process management, leadership, supplier management, CI, quality data analysis, employee empowerment and

relationship and training. Although, these practices are considered to be vital but not sufficient to successful and feasible TQM transformation. According to Tamimi (2003), it is important to understand the critical issues and barriers that can slow down and successful TQM transformation.

Many researchers (Garvin 1988; Sun et al., 2003) highlighted the problems and difficulties in implementing TQM in the manufacturing SMEs particularly in the developing countries and there is a growing concern about inhibitors to TQM implementation and its success. According to Brown (2002), there were ten reasons for failure in implementing TQM. He identified the major failure was due the ineffective employee relation and social design inconsistencies. Brown emphasized on the design of human resource management policies and practices for successful TQM adaptation. Many researchers identified that majority of failures in TQM implementation were due to the lack of commitment from the top management, unrealistic expectations of time frame of TQM implementation and the overall budget to execute. Underestimation of CI tools and under or over reliance of statistical methods were also considered as the causes for the failure.

6.2 TQM Models for Manufacturing SMEs

Although many TQM models and frameworks were proposed by numerous researchers, only few focused on manufacturing SMEs; particularly not many studies carried out for SMEs manufacturing firms in the Middle East. Majority of the models are designed to fit large organizations. These models were assumed to be applicable to SMEs which is not exactly true. There is not much proven evidence that TQM models and framework designed for large organizations work well in SMEs. Taking into consideration these argument and limitation, a TQM model proposed in this research is based on empirical study on manufacturing SMEs in much depth.

6.3 Identification of Critical Success Factors for TQM

The selection of and analysis of critical success factors (CSF) for successful implementation of TQM are based on feedback obtained from the survey questionnaire carried out in this research. Supplementary data was also collected to keep ahead of survey participants, views, handle errors, and coping with lack of data, it became essential to collect additional data. As a result, there was a change in the selection of CSFs and the analysis focused on overall manufacturing sectors and other business sectors. The findings from this research based on managers in the Arab manufacturing SMEs. Survey participants were asked to rate given quality factors which they claim to be essential for successful implementation of the proposed TQM model in their companies. The finding from the empirical study in chapter 5 identified fifteen CSF to implement the TQM model successfully in the Arab manufacturing SMEs.

To enable the process of developing the TQM model suitable for SMEs, a conceptual framework to represent the initial idea was needed and has been proposed. As highlighted in chapter 4, many issues were identified with those already available including being too narrow, too complicated for SMEs or very tools and techniques orientated. This approach makes it very difficult to characterise a suitable TQM framework that is ideal for manufacturing SMEs in the Arab countries where the working practices is very different to the western organisations. To address these problems, many characteristics were taken into consideration after reviewing many existing TQM models through literature survey and the empirical study.

The main objective of the proposed model is to integrate several dimensions include, fundamental, structural, core and sustainability. Structural and core dimensions provide SMEs the rationale to implement TQM and define SMEs uniqueness. Dimensions relating to fundamental provide secondary supports such as systems, workers and measures.

Leadership, planning, risk and change management, innovation and technology are governed by sustainability dimension. The model also incorporates external factors including customers, suppliers and partners and controllable factors such as competition, stake holders, economy and government.

The features and characteristics considered for conceptual framework in this chapter are listed below:

1. Model is strategically linked business objectives.
2. Understanding customer expectation is important.
3. Employee involvement at all levels is essential.
4. Need for consistency of purpose and commitment from management.
5. Give importance to processes and performance measure.
6. Less complicated structure of the framework.
7. Structured methodology and ease of understanding.
8. Clear links between elements which are presented.
9. Flexible and general to suit a wide range of manufacturing settings.
10. Form a fundamental structure and planning strategy to implement TQM framework without much pitfall.
11. The barriers, difficulties and uncertainties.
12. The critical aspects for successful implementation.

The characteristics outlined above were considered in the development of the proposed model.

This research addresses the research questions relating TQM models for manufacture SMEs in the Gulf countries by focussing on the features, application, and performance. Elements involved in the proposed model are listed below:

1. Top Management Leadership
2. Continuous Improvement
3. Internal Measure
4. Quality Improvement System
5. Training and Education
6. Work Culture and Environment
7. Customer Focus
8. Employee Involvement
9. Supplier Relationship
10. Inventory Management System

The conceptual model (Fig 6.1) of the current study is drawn from four streams of research, i.e. customer satisfaction measure, employee satisfaction measure, financial measure and operation measure. The model consist of 4 major dimensions and 7 minor dimensions The integration of various dimensions are represented by the arrows and discussed in detail in the next paragraph.

Fig 6.1 illustrates the conceptual model with the hypothesized relationships between the constructs. These relationships deal with four different sets of hypotheses. Besides the four multiple regression model, the author framed four different function for customer satisfaction measure, employee satisfaction measure, financial measure and operation measure. The proposed model for manufacturing SMEs comprises quality improvement parameters use the four functions. This framework is represented in Figure 6.2, 6.3,6.4,6.5 and 6.6.

Customer Satisfaction Measure = f (customer focus and internal measure)…….. …….. (7)

Employee Satisfaction Measure = f (customer focus, internal measure and Working Culture and Environment)…….. .....(8)

Operation Measure = f (Top Management Leadership and Continuous Improvement)…….. (9)

Financial Measure = f (Continuous Improvement, Quality Improvement System and Supplier Relation)……. (10)

The effects of the TQM and CI are on the customer satisfaction measure, employee satisfaction measure, financial measure and operation measure.

Although there are nine TQM and CI factors related to customer satisfaction measure, employee satisfaction measure, financial measure and operation measure, from the analysis, six major variables are hypothesized as being significantly related to the customer satisfaction measure, employee satisfaction measure, financial measure and operation measure in the Arab manufacturing SMEs.

H_1. Customer focus has a direct and positive effect on Customer Satisfaction Measure.

H_2. Internal Measure has a direct and positive effect on Customer Satisfaction Measure.

H_3. Customer focus has a direct and positive effect on Employee Satisfaction Measure.

H_4. Internal Measure has a direct and positive effect on Employee Satisfaction Measure.

H_5.Working Culture and Environment has a direct and positive effect on Employee Satisfaction Measure.

H_6. Top Management Leadership has a direct and positive effect on Operation Measure.

H_7. Continuous Improvement has a direct and positive effect on Operation Measure.

H_8. Continuous Improvement has a direct and positive effect on Financial Measure.

H_9. Quality Improvement System has a direct and positive effect on Financial Measure.

H_{10}. Supplier Relation has a direct and positive effect on Financial Measure.

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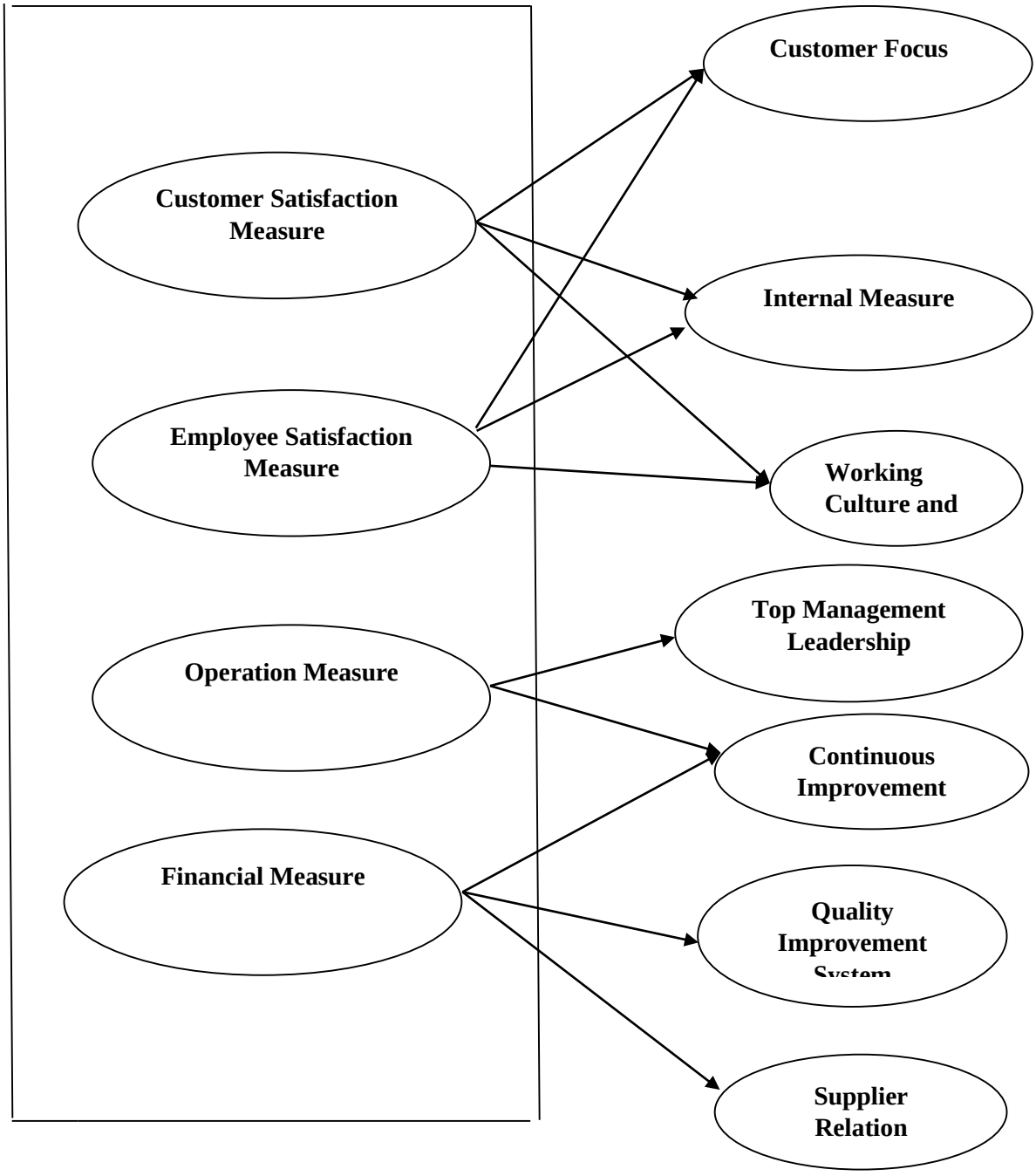


Fig 6.1: Proposed Model for Arab Manufacturing SMEs Quality Improvement Parameters

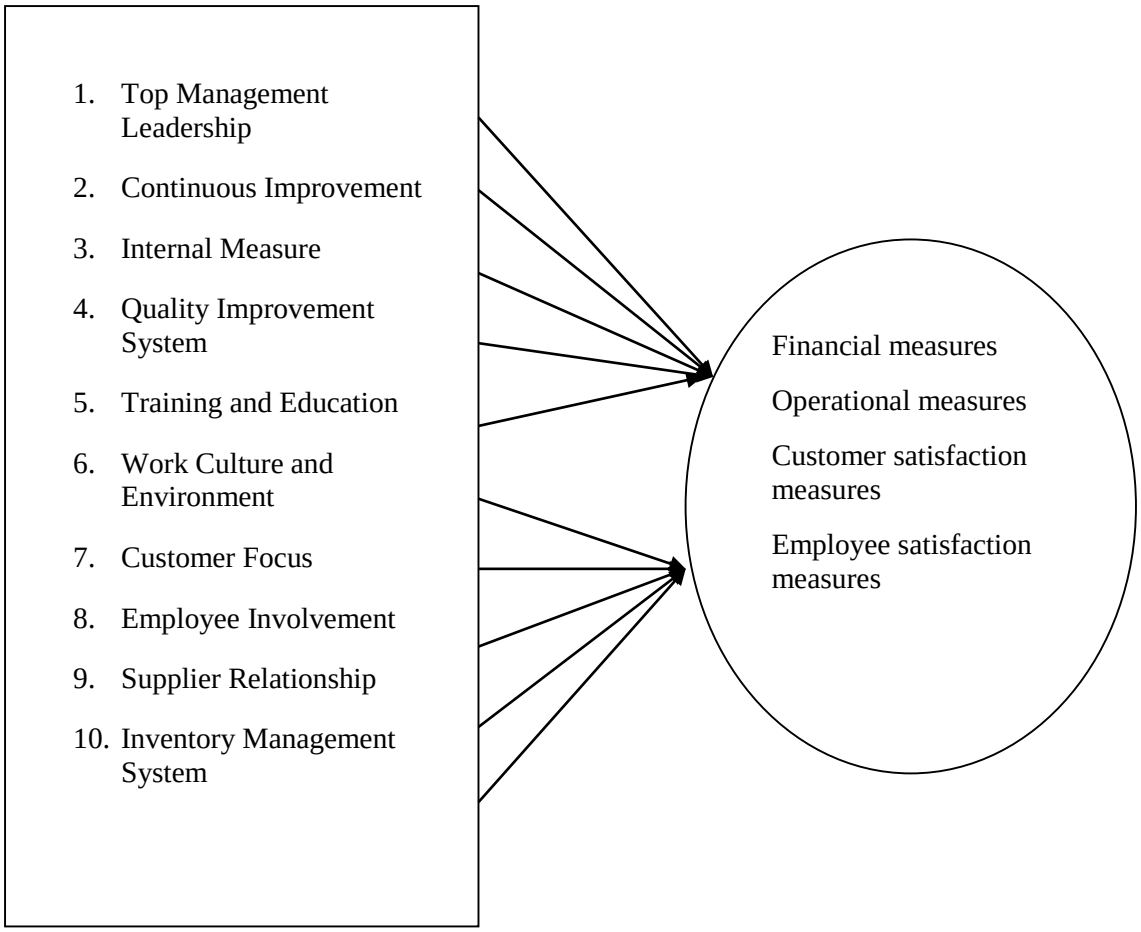


Fig 6.2: Path Diagram for Quality Improvement Measure Parameters

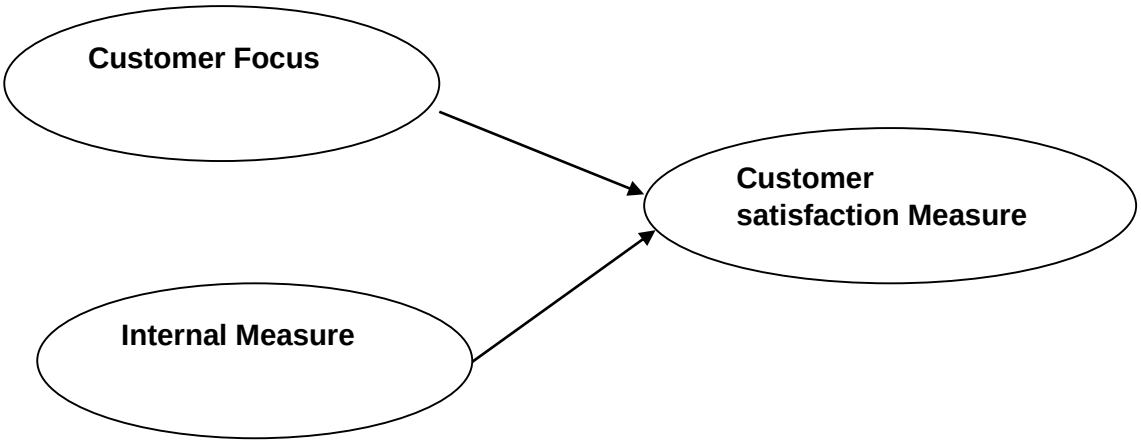


Fig 6.3: Frame Work Model for Customer Satisfaction Measure

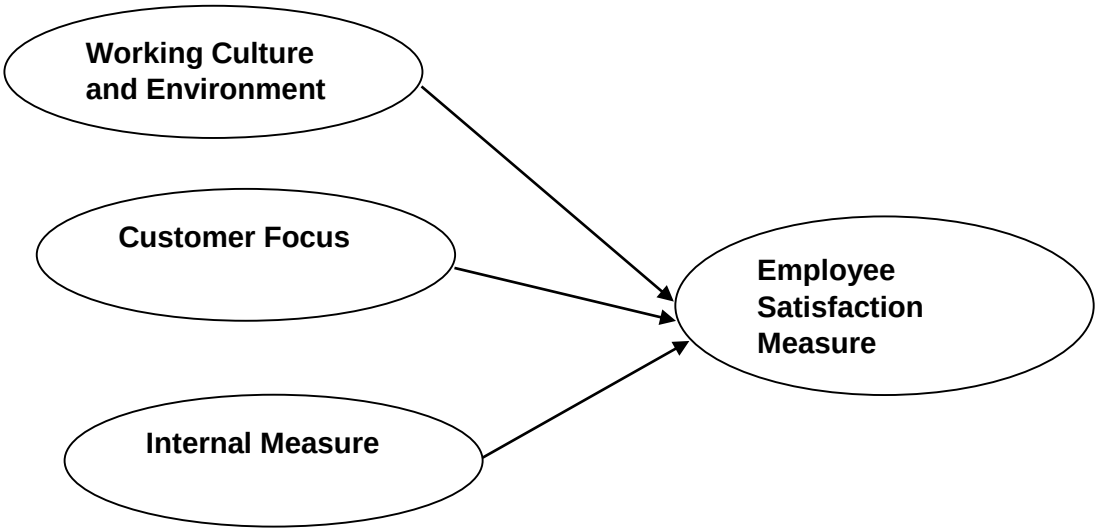


Fig 6.4: Frame Work Model for Employee Satisfaction Measure

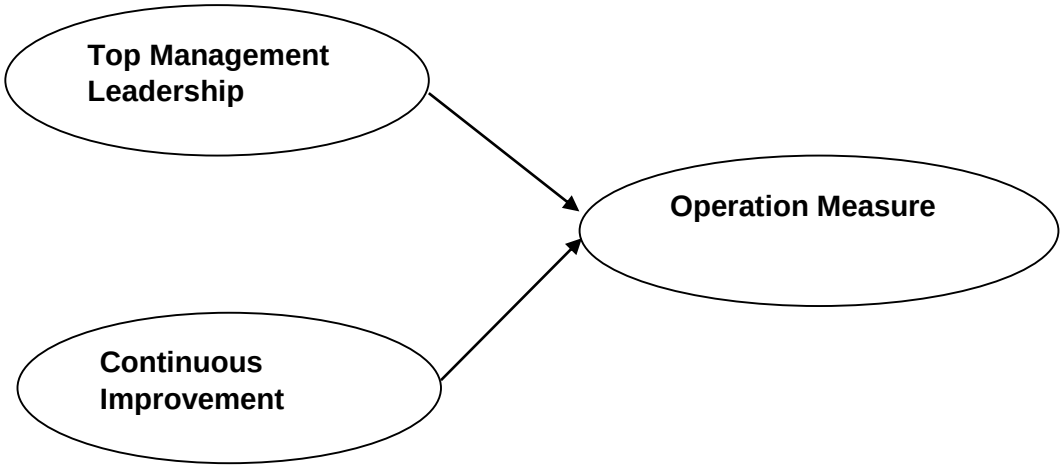


Figure 6.5: Frame Work Model for Operation Measure

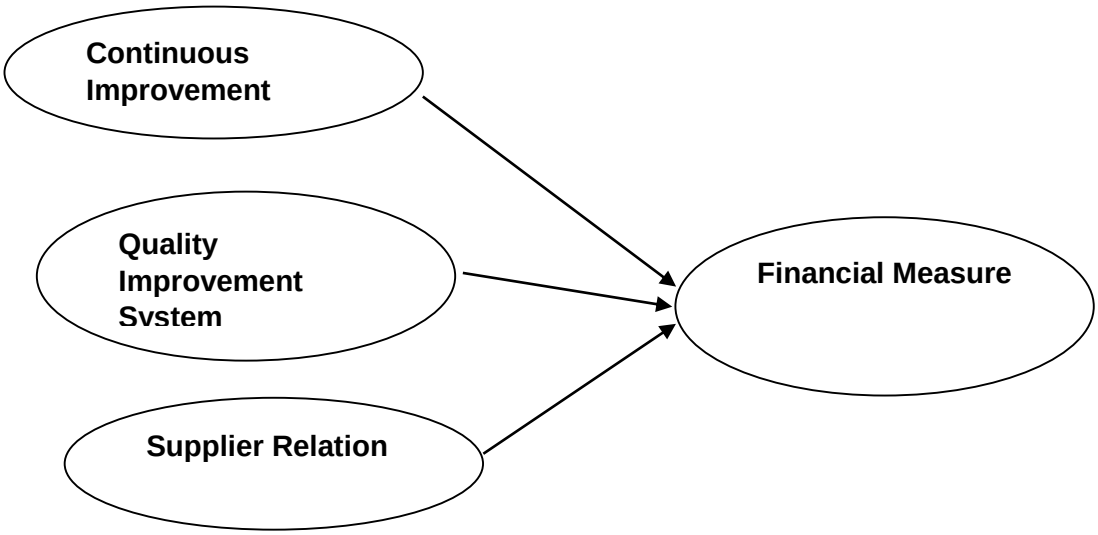


Fig 6.6: Frame Work Model for Financial Measure

CHAPTER 7
VALIDATION OF PRPOSED TQM FRAMEWORK

7.1. Introduction

This chapter outlines the scientific approach followed to validate the proposed TQM framework. The validation methodology involved a small empirical analysis of selected SMEs. 20 companies were asked to try the proposed TQM model in their companies. The study is based on the views of company participants who are experts in quality and manufacturing including the top management. The validation takes a shape of descriptive study and attempts to explain the improvement in the manufacturing processes with respect to different quality parameters such as financial measures, operational measures, customer satisfaction measures and employee satisfaction measures.

7.2 Variables of the Study

Two types of variables were used in this validation i.e. demographical and research The demography variables include the job title, no of employees, TQM programme span and status of TQM programme in the SMEs. The study identifies the following TQM and CI parameters measure in the study:

- Top management leadership
- Continuous improvement
- Internal measure
- Quality improvement system
- Training and education
- Work culture and environment
- Customer focus
- Employee Involvement

- Supplier Relationship
- Inventory Management System

Satisfactory variables

These variables consist of TQM and CI parameters measure performance that provide maximum benefits to the organization.

Dissatisfactory variables

These variables consist of TQM and CI parameters measure performance that provides minimum benefits to the organization.

7.3 Pilot Study

Pilot study is a formal exploratory exploration to find out whether there is adequate scope for the study. A pilot study is a small-scale replica and a rehearsal of the main study (Saravanavel 2000). It is concerned with administrative and organizational problems related to the whole study and the respondents. As discussed in chapter 4 and 5, a pilot study has already been conducted to know the scope of the present study among the TQM measures performance in Arab manufacturing SMEs. Formal discussions and interactions with quality and manufacturing professionals in the case companies and the management executives were conducted. Top management staffs were helpful in the validation of the framework.

7.4 Primary Objective of the Validation Study

The aim of validation is to investigate the state of TQM practice in contemporary CI tools and techniques and identify how the barriers and critical success factors that prevalent in the Arab manufacturing companies and seek potential niche opportunities for improving their manufacturing effectiveness. The objectives were:

- To evaluate the TQM and CI and their underlying concepts in the Arab manufacturing SMEs.
- To establish the current state and current level of progress after implementing the proposed model.
- To identify criteria or attributes and its inter relationship with respect to TQM measures performance in Arab manufacturing SMEs
- To formulate the data reduction model with respect to TQM measures performance benefits through factor analysis.
- To identify important influenced variables in TQM measures performance through correlation Analysis.
- To assess the suitability of the framework for Arab manufacturing companies

7.5 Limitation of the validation

- Due to time constraint samples were limited to 20 companies.
- The findings and suggestions are based on the facts and opinion given by the data set only.

7.6 Questionnaire Development

The second part of the empirical study was carried out for the validation study. The key research questions in validation study are highlighted below:

- What are were barriers and opportunities for TQM and CI implementation
- Does employee involvement have a measureable effect on the TQM and CI program?
- Does company size have a significant effect on employee involvement in CI programs?

- To what extent does the amount of training and education on TQM and CI techniques affect the overall growth of the company?
- Does the Arabic work culture affect the success of TQM?

The questionnaire was drawn up in English and aimed at measuring the TQM model's parameters and their level of importance and rating. Five point Likert type scale was used to determine the levels of agreement with each statement, (Camilleri and O'Callaghan, 1998). Totally 120 professionals participated in the survey process.

7.6 Study Unit of the Research

Different manufacturing SMEs in the Arab states which have implemented basic TQM programme modules were the focus of the study.

7.7 Target Respondents

The target respondents were professionals working in the manufacturing departments with TQM modules. Total respondent's samples size considered was 120.

7.8 Sampling Method

Simple random sampling was used in the validation study. A simple random sample (SRS) of a given size, all such subsets of the frame is given an equal probability. Every element of the frame has an equal probability of selection. In this study, the frame is not further subdivided or partitioned. The study depends primarily on key data which is collected through well framed structured questionnaire to obtain the opinions of the respondents.

7.9 Method of Study and Analysis of Variables

Analytical part of the study was mainly based on the primary data, so that the data were put into analysis with the help of descriptive analysis, (also termed as percentage analysis). At the outset, every variable was put into analysis with the help of simple percentages. The percentage is a commonly used tool to represent the characteristics of data. On the basis of majority or minority support arise from the workers, inferences were made at first. The study of satisfactory variables and dissatisfactory variables was based on the level of satisfaction of the workers. For this, '5 point Likert's scale' was used as follows: Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree. SPSS software was used accordingly to analyse the primary data.

7.10 Establishment of Hypothesis

Hypothesis is a logical assumption whose validity is subject to testing with the help of statistical tool. The analysis in this research frames the following hypotheses on the basis of the objectives and variables of the validation study.

- There is a significant difference between the TQM and CI parameters, Measure Parameters and TQM Measures.
- There is a significant difference between the TQM and CI parameters Measure Parameters and the model's benefits pairs.
- There is a significant difference between the individual TQM and CI parameters Measure.
- Distribution of sample data is normal.

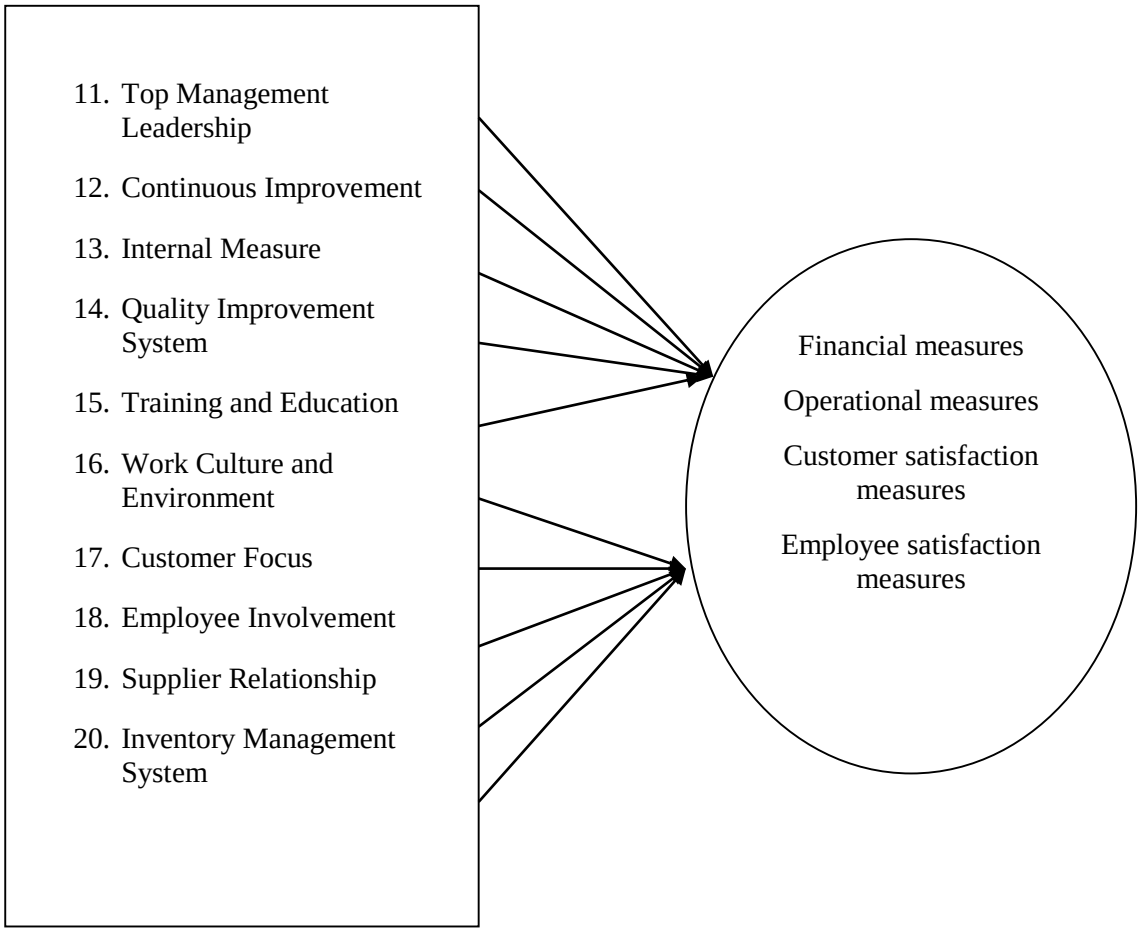


Fig 7.1: Path diagram for TQM model's quality improvement measures parameters

7.11 Data Used

Primary data and secondary data were used in this study. The primary data were collected from professionals in the participating firms. A questionnaire was used to collect the primary data from the respondents. The questionnaire consists of three divisions i.e. demography of the professional and expectation factor of the TQM and CI Measures Parameters and ten attributes with measure variables (refer to appendix A). Path Diagram for TQM and CI Measures Parameter is shown in Fig.7.1. Evaluation methodology includes objectives, tools and outcomes are shown in Fig 7.2. A total of 120 instances

have been provided with different attributes with data label, measure and domain as shown in table 7.1.

Table 7.1: Data attributes for the Arab manufacturing SMEs' quality improvement parameters measure

Data Label	Measure	Data Domain
Job Title	Ordinal	Discrete 1 – Operational Manager 2 – Project Manager 3 – Quality Manager 4- Supervisor/Engineer 5-System Engineering/Executives 6- Manufacturing Engineer
No of Employees	Ordinal	Discrete 1 – Less than 100 2 – 101-200 3- 201-400 4-401- above
TQM Programme Span	Ordinal	Discrete 1 – 1-2 yrs 2 – 2.1-4 yrs 3- 4.1-6 yrs 4- 6.1 – above yrs
TQM Programme and its Performance	Ordinal	Discrete 1 – Yes 2 – No 3 – Don't Know
TQM Programme and its Functional Integration	Ordinal	Discrete 1 – Manufacturing 2 – Marketing/Sales 3 – Project 4- Finance 5- Purchase
Improvement Approach	Ordinal	Discrete 1 – Continuous 2 – Innovative 3 – Re engineering
Resources Implication	Ordinal	Discrete 1 – New Technology/Equipment 2 – Extra Fund 3 – Additional Manpower 4- Training 5- Additional Space
Manufacturing Principles	Ordinal	Discrete 1 – Total Productive Maintenance 2 – Total Quality Control 3 – Production Levelling 4- Just in Time/Kanban 5-ISO/Internal Quality Control 6- 5 S 7- Continuous Improvement

		8- Lean/Six Sigma 9- Setup Reduction
TQM objectives	Ordinal	Discrete 1 – Cost Reduction 2 – Lead Time Reduction 3 – Customer Satisfaction 4- Employee Satisfaction 5-Inventory Reduction 6- Wastage Reduction 7- Space Saving 8- Batch Size Reduction 9- Flexibility
TQM benefits	Ordinal	Discrete 1 – Excellent Approach 2 – Good Approach 3– Bad Approach 4 – Don't Think it will make a difference 5- Don't Know
Parameter A – Top Management Leadership	Nominal	Discrete 1 – Not at all Important 2 – Slightly Important 3 - Important 4- Very Important 5- Extremely Important
Parameter B – Continuous Improvement	Nominal	Discrete 1 – Not at all Important 2 – Slightly Important 3 - Important 4- Very Important 5- Extremely Important
Parameter C – Internal Measures	Nominal	Discrete 1 – Not at all Important 2 – Slightly Important 3 - Important 4- Very Important 5- Extremely Important
Parameter D - Quality Improvement System	Nominal	Discrete 1 – Not at all Important 2 – Slightly Important 3 - Important 4- Very Important 5- Extremely Important
Parameter E – Training and Education	Nominal	Discrete 1 – Not at all Important 2 – Slightly Important 3 - Important 4- Very Important 5- Extremely Important
Parameter F – Work Culture and Environment	Nominal	
Parameter G – Customer Focus	Nominal	Discrete 1 – Not at all Important 2 – Slightly Important 3 - Important

		4- Very Important 5- Extremely Important
Parameter H – Employee Involvement	Nominal	Discrete 1 – Not at all Important 2 – Slightly Important 3 - Important 4- Very Important 5- Extremely Important
Parameter I – Supplier Relation	Nominal	Discrete 1 – Not at all Important 2 – Slightly Important 3 - Important 4- Very Important 5- Extremely Important
Parameter J – Inventory Management System	Nominal	Discrete 1 – Not at all Important 2 – Slightly Important 3 - Important 4- Very Important 5- Extremely Important
Parameter K – Customer Satisfaction Measures	Nominal	Discrete 1 – Not at all Important 2 – Slightly Important 3 - Important 4- Very Important 5- Extremely Important
Parameter L – Employee Satisfaction Measures	Nominal	Discrete 1 – Not at all Important 2 – Slightly Important 3 - Important 4- Very Important 5- Extremely Important
Parameter M – Operation Measures	Nominal	Discrete 1 – Not at all Important 2 – Slightly Important 3 - Important 4- Very Important 5- Extremely Important
Parameter N – Financial Measures	Nominal	Discrete 1 – Not at all Important 2 – Slightly Important 3 - Important 4- Very Important 5- Extremely Important

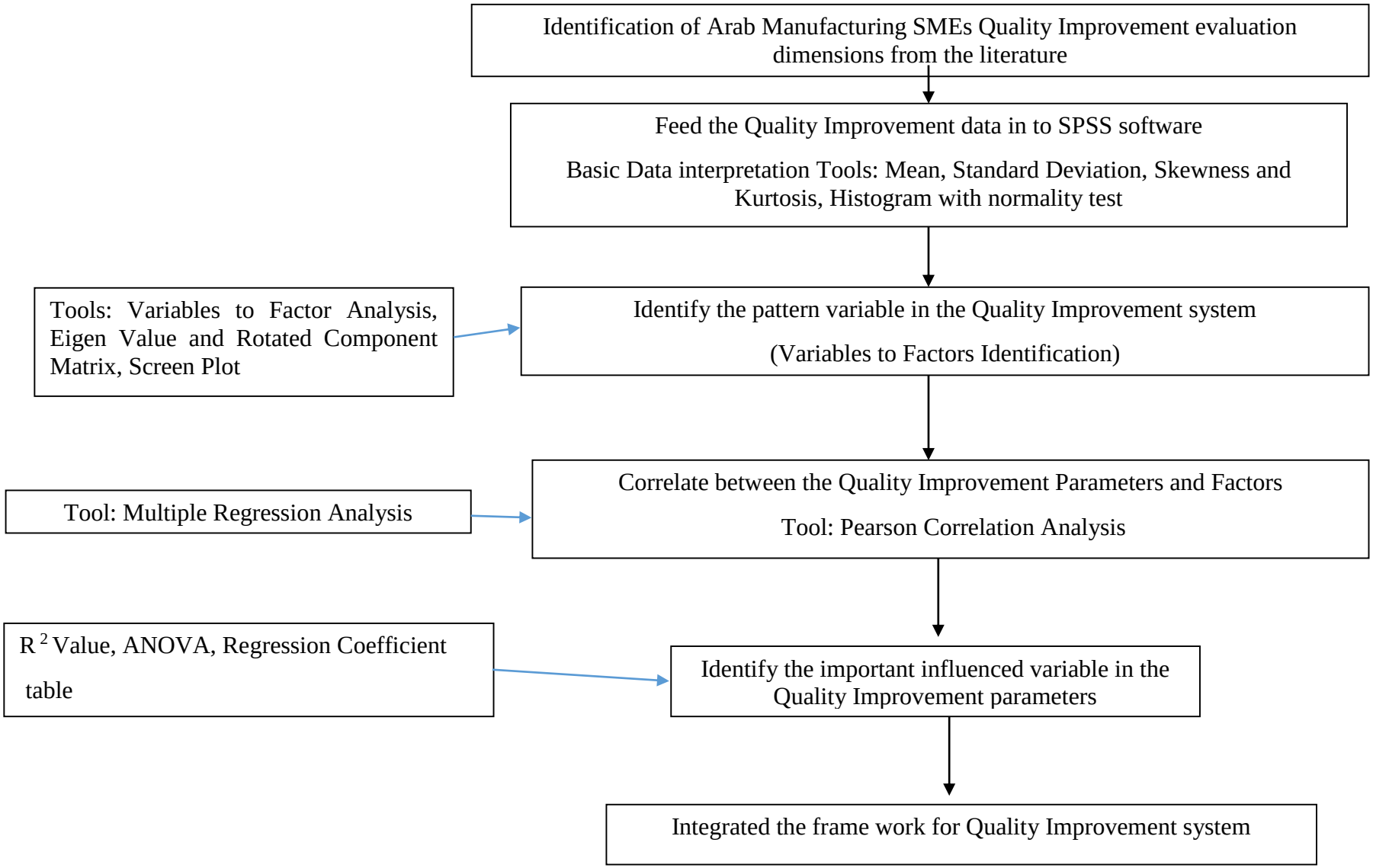


Fig 7.2: TQM model's Quality Improvement Parameters Evaluation Methodology

7.12 Data Interoperation and Analysis

In this section, the details of analysis are reported. There were eight sub-sections and their tools used are listed below:

- Margin of Error Analysis
- Demographical Analysis
- Descriptive Statistics (Mean, Standard Deviation, Skewness and Kurtosis, Normality Analysis)
- Classification Analysis (Factor Analysis)
- Data Reliability Analysis (Cronbach's Alpha Test)
- Inferential Statistics (Hypothetical Studies)
- Frame Work Development through Mathematical Modelling (Multiple Regression Analysis)
- Development of Integrated Model

7.13 Margin of Error Analysis

The analysis used Antonius's (2003) margin of error formula for the analysis:

Margin of Error = Critical Value * Standard Error * Finite Population Correction Factor 1

7.14 Critical Value

As per common research practice, the level of confident was set on 95 %. The critical value was expressed as Z score. So, the critical value is 1.96.

7.15 Standard Error

Standard Error = $\sqrt{(p*(1-p)/n)}$ = 0.045

Out of 120 respondents took part in the validation study, response rate was 92.30 and sample proportion is set as 0.5. In the formula, where the p is sample proportion (0.5) and n is sample size (120).

7.16 Finite Population Correction Factor

Standard Error = $\sqrt{(N-n)/N-1)}$ = 0.278

Where the N is population size (130) and n is sample size (120).

Critical value, standard error and finite population correction factor values are sub suited in the formula (1) and the analysis showed the Margin of Error as 2.45 %.

The above margin of error reflects that the estimate for current study is not exactly equal to the statistics, but falls around 2.45 % of the statistics because every sample is likely to differ a little from the population.

7.17 Demographical analysis

7.17.1 Job title wise respondents

The primary data was collected by means of a structured questionnaire.

Table 7.1: Percentage for respondents - Job Title

Job Title		Frequency	Percent
Valid	Operational Manager	25	20.8
	Project Manager	17	14.2
	Quality Manager	23	19.2
	Supervisor/Engineer	16	13.3
	System Engineering/Executives	18	15.0
	Manufacturing Engineer	21	17.5
	Total	120	100.0

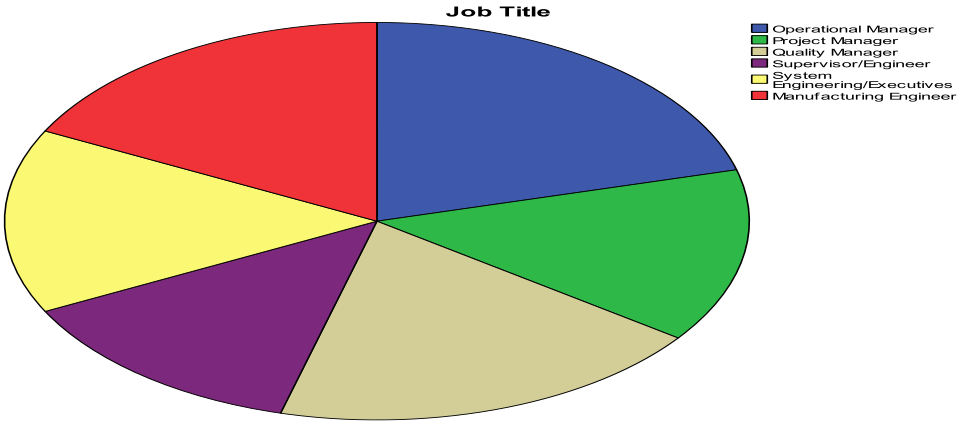


Fig 7.3: Pie Chart for Respondents' Job Title

From Fig.7.3, it is inferred that the respondents were 20.8% operational managers, 19.2% quality managers, 17.5 % manufacturing engineers,15% system engineers, 14.2% project managers 12.4% and 13.3 % supervisors.

7.17.2: No of Employees Wise respondents

Table 7.2 Percentage for Respondents' – No of Employees

No of Employee		Frequency	Percent
Valid	Less than 100	19	15.8
	101-200	27	22.5
	201-400	69	57.5
	401- above	5	4.2
	Total	120	100.0

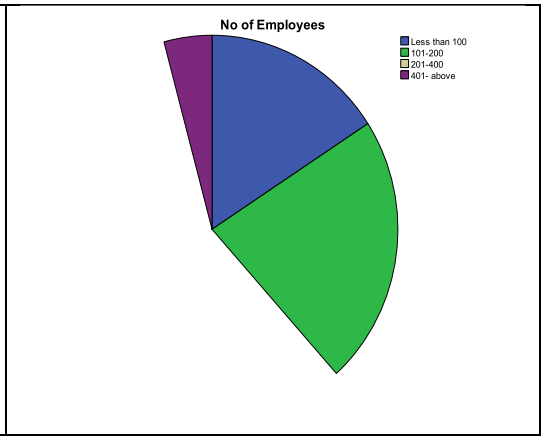


Fig 7.2: Pie chart for Respondents' No of Employee

From Fig.7.2, it is inferred that 57.5 % companies had 201-400 employees, 22.5% had 101-200 employees, 15.8% companies had less than 100 employees and 4.2% had more than 400 employees.

7.17.2 Implemented Span Wise Respondents

Table 7.3: Percentage for respondents' – TQM Implemented Span in Years

TQM Span		Frequency	Percent
Valid	1-2 yrs	34	28.3
	2.1-4 yrs	82	68.3
	4.1-6 yrs	4	3.3
	Total	120	100.0

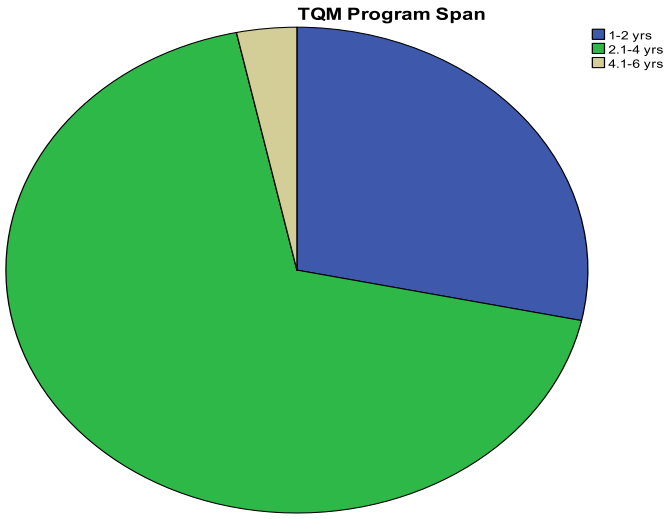


Fig 7.3: Pie chart for respondents' TQM Program Span

From Fig. 7.3, it is inferred that 68.3% of companies have implemented TQM for a span of 2.1 years -4 years, 28.3% of companies have implemented TQM for a span of 1-2 years and 3.3 % have implemented TQM for a span of 4.1 years -6 years.

7.17.3 TQM and its Performance Wise Respondents

Table 7.4 Percentages for Respondents' – TQM and its Performance Wise Respondents

TQM and its Performance		Frequency	Percent
Valid	Yes	105	87.5
	No	7	5.8
	Don't Know	8	6.7
	Total	120	100.0

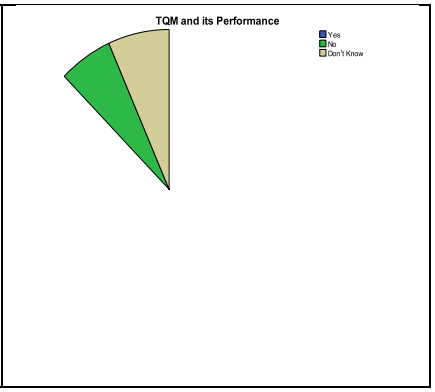


Fig 7.4: Pie Chart for Respondents' – TQM And Its Performance Wise Respondents

From Fig.7.4, it is inferred that 87.5 % of the respondents are affirmative about TQM improving the performance, 5.8% have denied TQM improving the performance and 6.7% have improved knowledge about .the TQM model.

7.17.3 TQM Function Wise Respondents

From Fig.7.5, it is inferred that 59.2% of companies implemented the model TQM in manufacturing process, 10.8% companies in sales and marketing, 11.7% in project and 9.2 % in both finance and purchase.

Table 7.5 Percentages for Respondents' – TQM Function Wise Respondents

TQM Function		Frequency	Percent
Valid	Manufacturing	71	59.2
	Marketing/Sales	13	10.8
	Project	14	11.7
	Finance	11	9.2
	Purchase	11	9.2
	Total	120	100.0

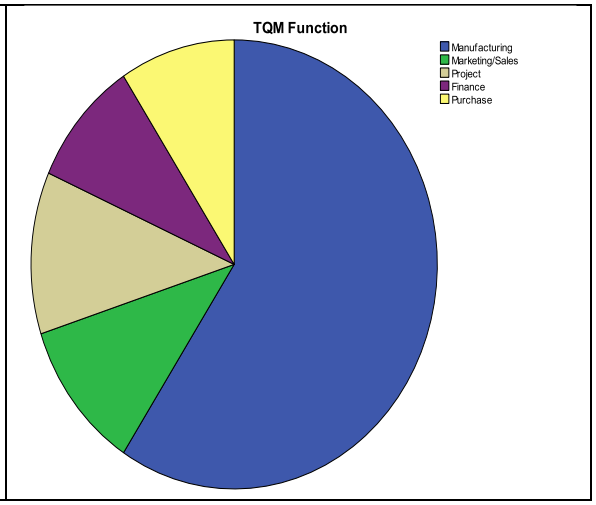


Fig7.5: Pie chart for respondents' TQM Function Wise Respondents

7.17.4 TQM Improvement Approach Wise Respondents

Table 7.6 Percentages for Respondents' – TQM Improvement Approach Wise Respondents

TQM improvement Approach		Frequency	Percent
Valid	Continuous	57	47.5
	Innovative	31	25.8
	Re engineering	32	26.7
	Total	120	100.0

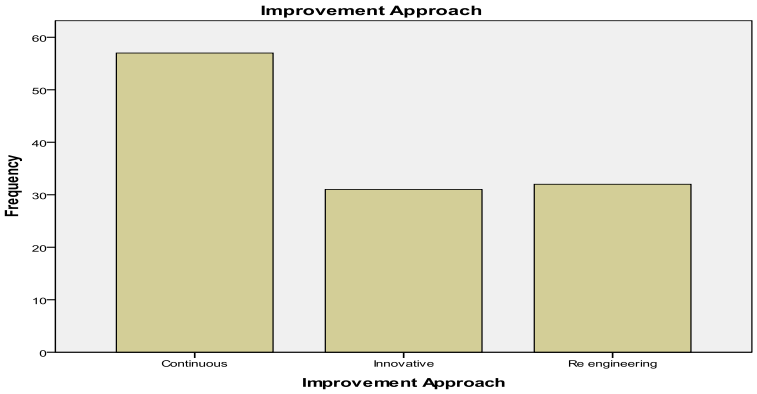


Fig 7.6: Bar chart for TQM Improvement Approach Wise Respondents

From Fig. 7.6, it is inferred that 47.5 % of the companies used CI approach, 26.7% of the companies used re-engineering and 25.8% used innovative approach.

7.17.5 TQM Improvement Resources Implication Wise Respondents

Table 7.7 Percentages for Respondents' – TQM Improvement Resources Implication Wise Respondents

Resources Implication		Frequency	Percent
Valid	New Technology/Equipment	22	18.3
	Extra Fund	14	11.7
	Additional Manpower	14	11.7
	Training	50	41.7
	Additional Space	20	16.7
	Total	120	100.0

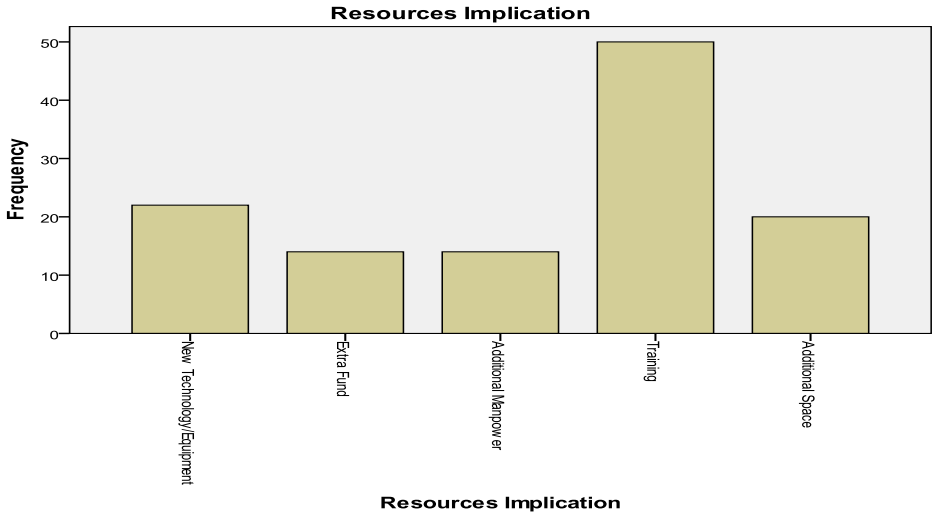


Fig 7.7: Bar chart for respondents' TQM Improvement Resources Implication Wise

From Fig.7.7, it is inferred that 41.7% of the resources is used for training, 18.3 % is used for new technology/equipment, 16.7 % for additional space and 11.7 % for additional manpower and extra fund.

7.17.6 TQM Principles Wise Respondents

Table 7.8 Percentages for respondents' – TQM Principles Wise Respondents

TQM Principles		Frequency	Percent
Valid	Total Productive Maintenance	13	10.8
	Total Quality Control	9	7.5
	ISO/Internal Quality Control	31	25.8
	5 S	23	19.2
	Lean/Six Sigma	16	13.3
	Setup Reduction	28	23.3
	Total	120	100.0

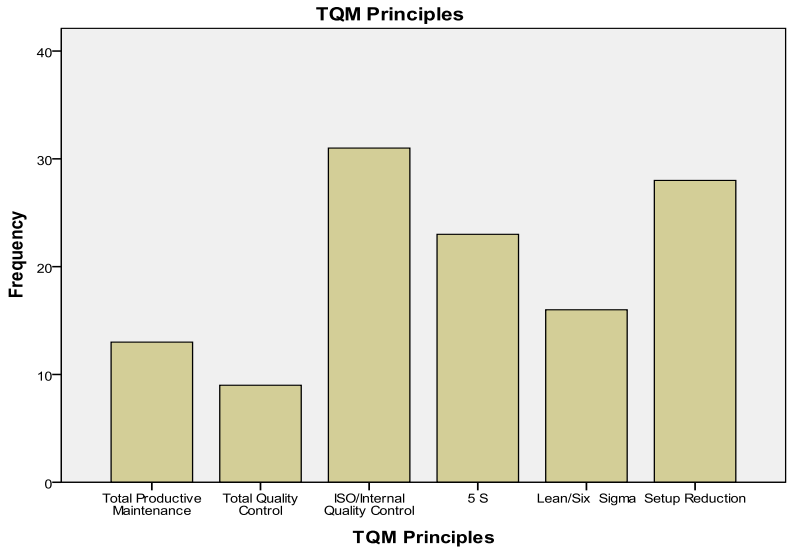


Fig 7.8: Bar Chart for Respondents' TQM Principles Wise Respondents

From Fig.7.8, it is inferred that, 25.8 % of the companies used ISO/internal quality audit, 23.3% use set-up reduction,19.2% use 5s,13.3% companies use lean/six sigma,10.8% use total productivity maintenance and 7.5 % use total quality control.

7.17.7 TQM Objective Wise Respondents

Table 7.9 Percentages for Respondents' TQM Objective Wise Respondents

TQM Objectives		Frequency	Percent
Valid	Cost Reduction	18	15.0
	Lead Time Reduction	7	5.8
	Customer Satisfaction	32	26.7
	Employee Satisfaction	26	21.7
	Inventory Reduction	7	5.8
	Wastage Reduction	18	15.0
	Space Saving	5	4.2
	Batch Size Reduction	2	1.7
	Flexibility	5	4.2
	Total	120	100.0

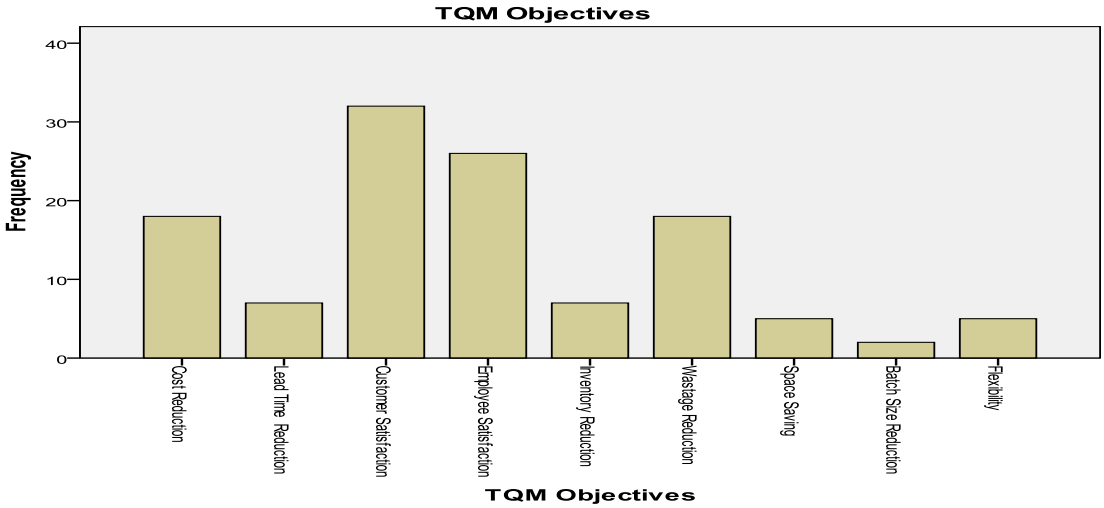


Fig 7.9: Bar Chart for Respondents' – TQM Objective Wise Respondents

From Fig. 7.9, it is inferred that 26.7% of the companies achieved customer satisfaction by implementing the proposed TQM; 21.7% achieved employee satisfaction, and 15 % achieved waste reduction and cost reduction.

7.17.8 TQM benefits Wise Respondents

Table 8.10: Percentages for Respondents' TQM Benefits Wise Respondents

TQM Benefits		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent Approach	28	23.3	23.3	23.3
	Good Approach	51	42.5	42.5	65.8
	Don't Think it will make a difference	14	11.7	11.7	77.5
	Don't Know	27	22.5	22.5	100.0
	Total	120	100.0	100.0	

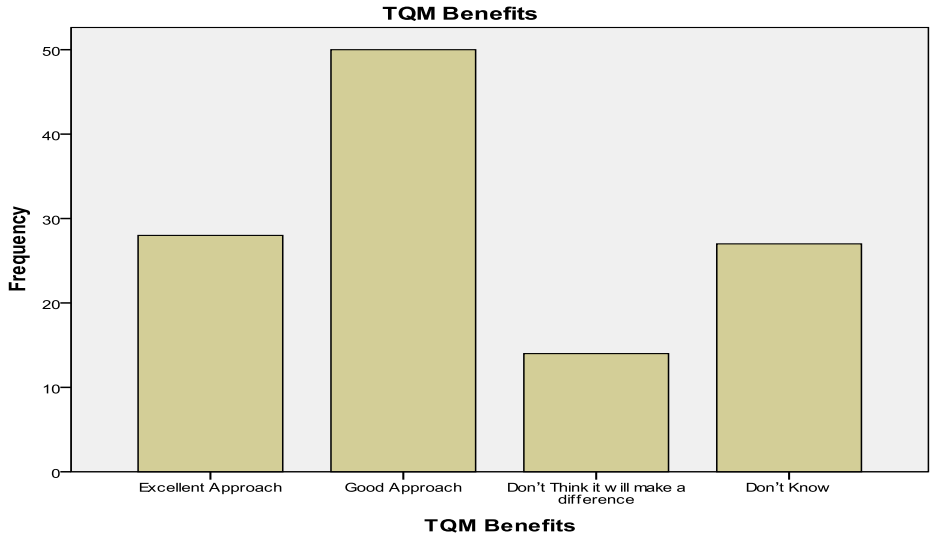


Fig 7.10: Bar Chart for Respondents' TQM Benefits Wise Respondents

From Fig.8.10 it is inferred that, 42.5 % of the respondents believed TQM is a good approach; 23.% believed that it is excellent; 11.7 % were pessimistic about the proposed TQM model i.e. it will not make any difference and 22.5% were still unclear about in-depth of the model.

7.18 Descriptive Statistics

7.18.1 Mean, Standard Deviation, Skewness and Kurtosis Quality Improvement Parameters

Table 7.11:. Mean, Standard Deviation, Skewness and Kurtosis for Top Management Leadership

Top Management Leadership	Management Commitment and Support	Communication Link	Empowering of Employees	Sufficient Resources Allocation	Quality Improvement Tools	Promotion of Staff
Mean	3.64	3.62	3.23	3.23	3.36	3.08
Std. Deviation	1.027	.918	1.083	1.073	1.027	1.055
Skewness	-.083	-.020	.369	.368	.319	.592
Std. Error of Skewness	.221	.221	.221	.221	.221	.221
Kurtosis	-1.147	-.839	-1.141	-1.120	-1.012	-.874
Std. Error of Kurtosis	.438	.438	.438	.438	.438	.438

Table 7.11 b: Mean, Standard Deviation, Skewness and Kurtosis for CI

Continuous Improvement	Philosophy and Organization	Identification of Critical Success Factors	Identification of Critical Process	Identification of Quality Dimension	Measures of Key Process
Mean	2.58	2.79	2.99	2.97	2.79
Std. Deviation	.857	.766	.930	.849	.897
Skewness	.130	.032	.335	-.103	.425
Std. Error of Skewness	.221	.221	.221	.221	.221
Kurtosis	-.670	-.661	-.292	-.422	-.325
Std. Error of Kurtosis	.438	.438	.438	.438	.438

Table 7.11 c: Mean, Standard Deviation, Skewness and Kurtosis for Internal Measure

Internal Measure	Internal Customer need	Key Process Regulation	Key Process Performance
Mean	3.99	**8**.58	3.54
Std. Deviation	.783	.895	.819
Skewness	.015	.164	.378
Std. Error of Skewness	.221	.221	.221
Kurtosis	-1.362	-.802	-.568
Std. Error of Kurtosis	.438	.438	.438

Table 7.11 d: Mean, Standard Deviation, Skewness and Kurtosis for Quality Improvement System

Quality Improvement System	Established Quality Manual	Establish**8**d Quality Policy	Established Internal Audit	Senior Management Suggestion	Customer feedback	Resource and Activities Balance
Mean	3.20	3.52	3.33	3.67	3.44	3.51
Std. Deviation	.856	.820	.813	.792	.848	.756
Skewness	.173	.178	.173	.260	.354	.506
Std. Error of Skewness	.221	.221	.221	.221	.221	.221
Kurtosis	.095	-.502	.069	-.723	-.487	-.326
Std. Error of Kurtosis	.438	.438	.438	.438	.438	.438

Table 7.11 e: Mean, Standard Deviation, Skewness and Kurtosis for Training and Education

Quality Improvement System	Conduct of Employee Training	Continuous Learning
Mean	**8**2.72	2.88
Std. Deviation	.997	.885
Skewness	.597	.767
Std. Error of Skewness	.221	.221
Kurtosis	-.033	.175
Std. Error of Kurtosis	.438	.438

Table 7.11 f: Mean, Standard Deviation, Skewness and Kurtosis for Work Culture and Environment

Work Culture and Environment	Pleasant Working Environment	Adaptation of Employee satisfaction
Mean	3.36	3.45
Std. Deviation	.968	.986
Skewness	.127	.115
Std. Error of Skewness	.221	.221
Kurtosis	-.950	-.989
Std. Error of Kurtosis	.438	.438

Table 7.11 g: Mean, Standard Deviation, Skewness and Kurtosis for Customer Focus

Customer Focus	Monitoring Customer Satisfaction Level	Capturing Customer Voice
Mean	3.69	3.63
Std. Deviation	.906	1.012
Skewness	.032	-.099
Std. Error of Skewness	.221	.221
Kurtosis	-.926	-.887
Std. Error of Kurtosis	.438	.438

Table 7.11 h; Mean, standard deviation, Skewness and Kurtosis for employee involvement

Employee Involvement	Recognition of Employees View	Commitment and Enthusiasm	Self-Assessment Tools	Expertise and Knowledge of Employees
Mean	3.31	3.36	3.68	3.78
Std. Deviation	.942	.915	.909	.918
Skewness	.141	.228	.011	-.017
Std. Error of Skewness	.221	.221	.221	.221
Kurtosis	-.892	-.717	-.894	-1.088
Std. Error of Kurtosis	.438	.438	.438	.438

Table 7.11 i: Mean, Standard Deviation, Skewness and Kurtosis for Supplier Relation

Supplier Relation	Information sharing between Supplier and Management	Involvement of Suppliers
Mean	3.71	3.25
Std. Deviation	.938	1.031
Skewness	-.003	-.193
Std. Error of Skewness	.221	.221
Kurtosis	-1.023	-.427
Std. Error of Kurtosis	.438	.438

Table 7.11 j: Mean, standard deviation, Skewness and Kurtosis for inventory management system

Inventory Management System	Average Amount of Raw material	Average Amount of Finished and Semi Finished
Mean	2.25	2.28
Std. Deviation	.689	.661
Skewness	-.372	-.188
Std. Error of Skewness	.221	.221
Kurtosis	-.858	-.491
Std. Error of Kurtosis	.438	.438

Tables 7.5(a) to 8.5 (j) represent the Arab manufacturing SMEs' quality improvement parameters that are represented by labels. The scores range between 1.00 and 5.00 for most of the parameters which indicate that the respondents are neutral, on an average but the scores range between 3.5 -4.5 which implies that they mostly agree with it and believe that the parameters are important. For some parameters the score is below 2.5 which

indicates that the parameters are slightly important. Standard deviation calculates the amount of deviation from the mean value and reflects the degree to which the values in a distribution differ from the arithmetic means (Bryman and Cramer, 2005).

In the above tables, the standard deviation for involvement of suppliers' relation (1.031) is the highest, which is the largest dispersion. The standard error of the mean will be directly proportional to the dispersion. Thus the standard error will be higher. The skewness and Kurtosis represent the indications of the symmetry and peakendness of the distribution. Positive and negative skewness represent the values clustered to the left or right of the table respectively. Positive and Negative Kurtosis represent the distribution is relatively peaked or relatively flat. The Kurtosis for most of the parameters is negative whereas for few parameters it is positive, which indicates that the responses were different than those for others (Abalo and et.al, 2007).

7.18 Normality Test

7.17.4 Skewness and Kurtosis Ratio for Quality Improvement Parameters

From the Skewness and Kurtosis Ratio table, all the Skewness and Kurtosis Ratio are less than 1.96 other than Employee Involvement Factor. It indicates that it can be assumed are assumed as normal distribution.

Table 7.12: Skewness and Kurtosis ratio for quality improvement parameters

Arab Manufacturing SMES Quality Improvement Factors	TML	CF	CI	QIS	WCE	SR	IM	KPM	EI	IM
Skewness	.403	.010	.304	.522	.210	-.193	-.015	.286	.874	-.140
Std. Error of Skewness	.221	.221	.221	.221	.221	.221	.221	.221	.221	.221
Kurtosis	-.774	-.780	-.592	-.022	-.784	-.427	-1.252	-.562	.084	-.755
Std. Error of Kurtosis	.438	.438	.438	.438	.438	.438	.438	.438	.438	.438
Skewness/ Kurtosis Ratio	**-0.52**	**-0.01**	**-0.51**	**-23.73**	**-0.27**	**0.45**	**0.01**	**-0.51**	**10.40**	**0.19**

7.19 Factor Analysis

Factor analysis is to find out major factors that contribute towards the Arab manufacturing SMEs quality improvement parameters, data reduction technique was used

7.17.5 Statistics associated with the factors analysis

In this analysis, statistics associated with the factors analysis Bartlett's test of sphericity is another method of factor analysis that are used to test the null hypothesis to conclude that the variables are not correlated with the population. The test of sphericity is based on the Chi-square transformation of the determinant of the correlation matrix. Eigen-values and Communalities A factor's Eigen value or latent route is the sum of the squares of its factor loading. It is useful to explain how a factor fits well with the data from all respondents on all the statements. Communalities are the sum of squares of a statement's factor loading, i.e. it explains how much the degree of each variable is accounted for by the factors engaged together. Bartlett's test of Sphericity and Kaiser Meyer Olk in measures of sample adequacy is used in the analysis to test the appropriateness of the factor model.

7.19.2 Kolmogorov-Smirnov test/Test for Normality

Null Hypothesis (H_0)

Distribution of sample data is normal

Alternative hypothesis (H_1)

Distribution of sample data is abnormal.

Table 7.13: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.720
Bartlett's Test of Sphericity	Approx. Chi-Square	2309.075
	df	406
	Sig.	.000

High value of KMO (0.720 > .05) of indicates that a factor analysis is useful for the present data. The significant value for Bartlett's test of Sphericity is 0.000 and is less than .05 which indicates that there exist significant relationships among the variables as seen in table-7.13. The resultant value of KMO test and Bartlett's test indicate that the present data is useful for factor analysis (Black and Porter, 1996). The KMO statistic varies between 0 and 1. A value close to one indicates that factor analysis should yield distinct and reliable factors. Furthermore, values between 0.5 and 0.7 are mediocre and values between 0.7 and 0.8 are good).

The next step in the process is to decide about the number of factors to be derived. The rule of thumb is applied to choose the number of factors for which 'Eigen values' with greater than unity is taken by using Principal Component Analysis method. The component matrix so formed is further rotated orthogonally using Varimax rotation algorithm which is the standard rotation method (Kaiser, 1958). All the statements are loaded on the twelve factors. Factor reduction table for Arab manufacturing SMEs quality improvement parameters are presented in table 7.14.

Table 7.14 shows the Factor Reduction for Arab manufacturing SMEs' Quality improvement parameters

Variables	Component											
	1	2	3	4	5	6	7	8	9	10	11	12
Quality improvement tools	.868											
Sufficient resources allocation	.867											
Empowering of Employees	.857											
Productivity improvement	.851											
Management commitment and support	.851											
Promotion of Staff	.766											
Information sharing bt Supplier and Management	.726											
Communication link	.672											
Monitoring customer satisfaction level		.935										
Self-assessment tools		.923										
Decrease customer complaints		.893										
Absenteeism reduction		.873										
Capturing customer voice		.847										
Increase number of customer		.804										
expertise and knowledge of employees		.731										
Philosophy and organization			.878									
Measures of key process			.869									
Production cost reduction			.869									
Performance improvement			.868									
Identification of critical success factors			.868									
Identification of quality dimension			.653									
Identification of critical process			.590									

Established internal audit				.889								
Customer feedback				.880								
Established quality manual				.863								
Established quality policy				.785								.420
Maintenance cost reduction				.785								.420
Senior management suggestion				.651								
Pleasant working environment					.945							
Value added cost with employee cost					.912							
Adaptation of employee satisfaction					.902							
Commitment and enthusiasm					.835							
Recognition of employees view					.739							
Inventory turnover improvement						.922						
Involvement of suppliers						.922						
Final product rejection reduction							.930					
Internal customer need							.898					
Key process performance								.892				
Key process regulation								.867				
Continuous learning									.952			
Conduct of employee training									.924			
Average amount of raw material										.745		
Average amount of finished and semi finished										.734		
Resources and activities balance											.690	
Extraction method: Principal Component Analysis. Rotation method: Varimax with Kaiser Normalization.												
a. Rotation converged in 7 iterations.												

On the basis of table 7.14, twelve components were found for 44 variables. Based on the item loadings, these factors were respectively labelled. variables listed in in table 7.15, fall under this category and explained in table 7.15. Interpretation of factors is facilitated by identifying the statements that have large loadings in the same factor. The factors can be interpreted in terms of the statement that loads high on it.

Table 7.15: Variable and factors for quality improvement parameters

Factors	**Variables**
Factor 1 (Top Management Leadership)	Quality Improvement Tools Sufficient Resources Allocation Empowering of Employees Productivity Improvement Management Commitment and Support Promotion of Staff Information sharing bt Supplier and Management Communication Link
Factor 2 (Customer Focus)	Monitoring Customer Satisfaction Level Self-Assessment Tools Decrease Customer Complaints Absenteeism Reduction Capturing Customer Voice Increase number of Customer Expertise and Knowledge of Employees
Factor 3 (Continuous improvement)	Philosophy and Organization Measures of Key Process Production Cost Reduction Performance Improvement Identification of Critical Success Factors

	Identification of Quality Dimension Identification of Critical Process
Factor 4 (Quality Improvement System)	Established Internal Audit Customer feedback Established Quality Manual Established Quality Policy Senior Management Suggestion
Factor 5 (Work Culture and Environment)	Pleasant Working Environment Value Added Cost with Employee Cost Adaptation of Employee Satisfaction Commitment and Enthusiasm Recognition of Employees View
Factor 6 (Supplier Relation)	Inventory Turnover Improvement Involvement of Suppliers
Factor 7 (Internal Measure)	Final Product Rejection Reduction Internal Customer need
Factor 8 (Key Process Monitoring and Control)	Key Process Performance Key Process Regulation
Factor 9 (Employee Involvement)	Continuous Learning Conduct of employee training
Factor 10 (Inventory Management)	Average Amount of Raw material Average Amount of Finished and Semi Finished
Factor 11 (Resources and Activities Balance)	Resources and Activities Balance
Factor 12 (Maintenance Cost Reduction)	Maintenance Cost Reduction

7.20 Variance test for Factor Analysis Result

All the above factors together were capable of explaining 81.54 % of variance as shown in table 7.16. Eigen Value is the value that represents the total variance explained by each factor, is the, percentage of the total variance attributed to each factor. Another well-known methods used in Exploratory Factor Analysis is the Principal Component Analysis (Tamimi, 1995). In this technique, the total variance of the data is considered to establish the minimum number of factors that will account for maximum variance of data. The underlying principle of this approach is that factors with a variance less than one are no better than a single variable (Fowler 2009).

Table 7.16: shows the variance table for Quality Improvement Parameters in the case studies.

Component		Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
dimension	1	6.604	15.010	15.010	6.604	15.010	15.010	5.572	12.664	12.664
	2	5.784	13.146	28.157	5.784	13.146	28.157	5.345	12.148	24.812
	3	4.990	11.340	39.497	4.990	11.340	39.497	4.684	10.646	35.458
	4	4.129	9.384	48.881	4.129	9.384	48.881	4.221	9.593	45.051
	5	3.268	7.428	56.308	3.268	7.428	56.308	4.021	9.138	54.189
	6	2.912	6.619	62.927	2.912	6.619	62.927	2.130	4.841	59.030
	7	1.870	4.249	67.176	1.870	4.249	67.176	2.000	4.545	63.575
	8	1.683	3.826	71.002	1.683	3.826	71.002	1.974	4.487	68.062
	9	1.249	2.838	73.840	1.249	2.838	73.840	1.886	4.286	72.348
	10	1.204	2.735	76.575	1.204	2.735	76.575	1.455	3.307	75.656
	11	1.135	2.580	79.155	1.135	2.580	79.155	1.338	3.040	78.696
	12	1.050	2.387	81.542	1.050	2.387	81.542	1.252	2.846	81.542
	13	.889	2.020	83.561						
	14	.858	1.951	85.512						
	15	.775	1.761	87.273						
	16	.670	1.523	88.796						
	17	.635	1.443	90.238						
	18	.521	1.183	91.421						
	19	.451	1.025	92.446						
	20	.393	.893	93.338						
	21	.339	.770	94.109						
	22	.292	.663	94.771						
	23	.285	.647	95.419						
	24	.239	.544	95.963						
	25	.223	.508	96.471						
	26	.212	.483	96.953						
	27	.201	.457	97.410						
	28	.172	.392	97.802						
	29	.153	.348	98.150						
	30	.142	.324	98.474						
	31	.131	.298	98.772						
	32	.113	.256	99.028						
	33	.096	.219	99.247						
	34	.084	.191	99.438						

	35	.078	.177	99.615						
	36	.057	.129	99.744						
	37	.048	.110	99.854						
	38	.041	.093	99.947						
	39	.023	.053	100.000						
	40	3.086E-16	7.014E-16	100.000						
	41	1.762E-16	4.004E-16	100.000						
	42	8.008E-17	1.820E-16	100.000						
	43	3.071E-17	6.980E-17	100.000						
	44	-5.541E-17	-1.259E-16	100.000						

Extraction Method: Principal Component Analysis.

Component Score Covariance Matrix

7.17 is the Component Score Covariance Matrix after calculating the score using ssion approach. The regression approach shows highest correlation between the s and factors scores. The distribution of each factor score has a mean of zero and ard deviation of 1 in principle component analysis. The matrix illustrated in table s an identify matrix which means that the factors are uncorrelated with each other.

7.17 Component Score Covariance Matrix

Component/Dimension	1	2	3	4	5	6	7	8	9	10	11	12
1	1.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
2	.000	1.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
3	.000	.000	1.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
4	.000	.000	.000	1.000	.000	.000	.000	.000	.000	.000	.000	.000
5	.000	.000	.000	.000	1.000	.000	.000	.000	.000	.000	.000	.000
6	.000	.000	.000	.000	.000	1.000	.000	.000	.000	.000	.000	.000
7	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000	.000	.000
8	.000	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000	.000
9	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
10	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.000	.000
11	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.000
12	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Component Scores.

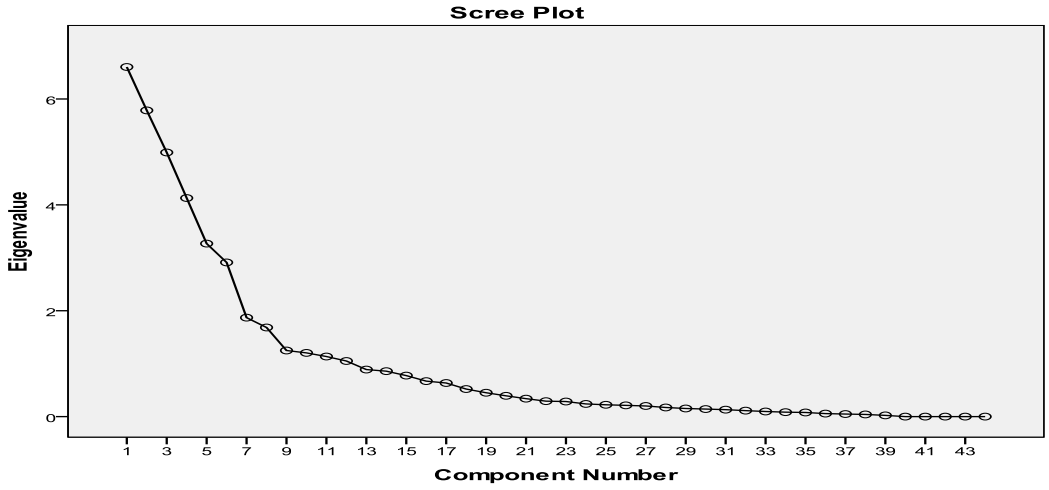


Fig 7.11: Screen plot for Arab Manufacturing SMEs Quality Improvement Parameters

The screen plot Fig 7.11 show a steep slope between the large factors. The points at which the curve first begins to straighten out this considered to indicate the maximum number

of factors to extract (Ho, 2006). The screen plot of the current study (Figure 7.11) indicates that seven factors are involved in the study.

7.22 Internal Consistency Analysis

7.22.1 Cronbach's Alpha Test for Arab Manufacturing SMEs Quality Improvement Parameters with Factors

Cronach's Alpha is the most common measure of internal consistency (reliability). It is commonly used when there are multiple Likerts' questions in a survey questionnaire that form a scale and if you want to determine whether the scale is reliable. Cronach's Alpha method is appropriate to understand whether the questions framed in the questionnaire of this research are reliable measure.

In order to run a Cronbach's Apha test for different factors, the important table is the reliability statistics table that provides the actual value for Cronbach's alpha, as shown in table 7.18.

Table 7. 18: Cronach's Alpha for Quality Improvement Factors

Factors	No of Components	Cronbach's alpha
Factor 1 (Top Management Leadership)	8	0.932
Factor 2 (Customer Focus)	7	0.943
Factor 3 (Continuous improvement)	7	0.906
Factor 4 (Quality Improvement System)	5	0.889
Factor 5 (Work Culture and Environment)	5	0.924
Factor 6 (Supplier Relation)	2	0.980
Factor 7 (Internal Measure)	2	0.840
Factor 8 (Key Process Monitoring and Control)	2	0.907
Factor 9 (Employee Involvement)	2	0.897
Factor 10 (Inventory Management)	2	0.514
Factor 11 (Resources and Activities Balance)	1	Single Components, Not Possible to run Cronbach's alpha Test

Factor 12 (Maintenance Cost Reduction)	1	Single Components, Not Possible to run Cronbach's alpha Test

From table 7.18, factor 10 inventory management Cronbach's alpha is 0.514, which indicates a low level of internal consistency for our scale with this specific sample. Factors 11 and 12, have single components, hence, it was not possible to run Cronbach's alpha test. The following nine factors (1) top management leadership (2) customer focus (3) continuous improvement (4) quality improvement system (5) work culture and environment (6) supplier relation (7) internal measure (8) key process monitoring and control (9) employee involvement together produced Cronbach's alpha range is 0.840-0.980, which indicates a high level of internal consistency for the scale with this specific sample. The accepted level of Cronbach's α is 0.7, while 0.6 is also acceptable in exploratory studies (Saraph et al., 1989). So, the in this research only nine factors were considered for further analysis.

7.23 Framework for Proposed Model

TQM practices and their contribution to organizational performance have been studied by many researchers; Brah and Lim, 2006; Demirbag et al., 2006; Sila, 2007Kapuge and Smith, 2007; (Motwani, 2001; Montes et al., 2003). Most of the research in TQM concluded a positive association between TQM practices and improved organisational performance. The objective of this work is to examine the effect of various Arab manufacturing SMEs quality improvement on customer satisfaction measure, employee satisfaction measure, operational measures and financial measures.

7.23.1 Customer satisfaction measures

Accordingly, the following hypotheses have been formulated and tested in the validation study:

H_1. Top management leadership positively impacts customer satisfaction measures

H_2. Customer focus positively impacts customer satisfaction measures

H_3. Continuous improvement positively impacts Customer Satisfaction Measures

H_4. Quality improvement system positively impacts customer satisfaction measures

H_5. Work culture and environment positively impacts customer satisfaction measures

H_6. Supplier relation positively impacts customer satisfaction measures

H_7. Internal measure positively impacts customer satisfaction measures

H_8. Key process monitoring and control positively impacts customer satisfaction measures

H_9. Employee involvement positively impacts customer satisfaction measures

Correlation analysis was conducted between nine manufacturing SMEs quality improvement parameters and customer satisfaction using Pearson's correlation. Correlation results are shown in table 7.19.

Table 7. 19: Correlation analysis for quality improvement factors with customer satisfaction measures

Customer satisfaction measure	Customer satisfaction measure	Top Management Leadership	Customer Focus	Continuous Improvement	Quality Improvement System	Working Culture and Environment	Supplier Relation	Internal Measure	Key Process Monitoring	Employee Involvement
Pearson Correlation	1	-.053	.881**	.052	-.145	.014	-.093	.445**	.274**	-.047
Sig. (2-tailed)		.563	.000	.576	.114	.884	.314	.000	.002	.611
N	120	120	120	120	120	120	120	120	120	120

Table 7.19 indicates that customer focus, internal measure and key process monitoring (three independent variables) have significant and positive association with the dependent variable (customer satisfaction measure).

Customer Satisfaction Measure = f (customer focus, internal measure and key process monitoring*)…… 2)*

Further multiple regression Analysis was carried out and key process monitoring was found to be insignificant. The regression analysis summary for customer satisfaction measure is presented in table 7.20. fraework model for customer satisfaction measure is represented in Fig 7.12. This is a clear indication that the proposed model is working very well.

Table 7. 20: Regression Analysis Summary for Customer Satisfaction Measure

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.954[a]	.911	.909	.19657

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	46.160	2	23.080	597.307	.000[a]
	Residual	4.521	117	.039		
	Total	50.681	119			

a. Predictors: (Constant), internal Measure, Customer Focus

b. Dependent Variable: Customer satisfaction measure

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.037	.120		.309	.758
	Customer Focus	.677	.022	.848	30.583	.000
	Internal Measure	.315	.024	.369	13.295	.000

a. Dependent variable: Customer satisfaction measure

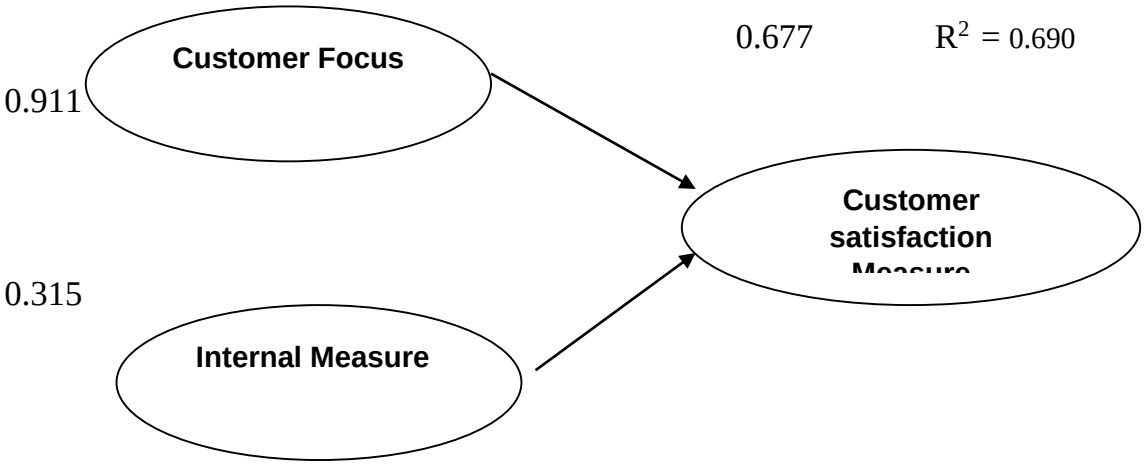


Fig 7.12: Frame Work Model for Customer Satisfaction Measure

7.23.2 Employee satisfaction measures

The following hypotheses have been formulated and tested:

H_1. Top management leadership positively impacts employee satisfaction measures

H_2. Customer focus positively impacts employee satisfaction measures

H_3. Continuous improvement positively impacts employee satisfaction measures

H_4. Quality improvement system positively impacts employee satisfaction measures

H_5. Work culture and environment positively impacts employee satisfaction measures

H_6. Supplier relation positively impacts employee satisfaction measures

H_7. Internal measure really impacts employee satisfaction measures

H_8. Key process monitoring and control positively impacts employee satisfaction measures

H_9. Employee involvement impacts employee satisfaction measures significantly

Correlation analysis was conducted between nine manufacturing SMEMS quality improvement parameters and Employee satisfaction using Pearson's correlation. Correlation results as shown in table 7.21.

Table 7.21: Correlation analysis for quality improvement factors with employee satisfaction measures

Employee satisfaction measure	Employee satisfaction measure	Top Management Leadership	Customer Focus	Continuous Improvement	Quality Improvement System	Working Culture and Environment	Supplier Relation	Internal Measure	Key Process Monitoring	Employee Involvement
Pearson Correlation	1	-.096	.563**	.101	.022	.657**	-.060	.178	.102	.043
Sig. (2-tailed)		.296	.000	.275	.815	.000	.513	.051	.268	.641
N	120	120	120	120	120	120	120	120	120	120

Table 7.21 indicates that customer focus, internal measure and working culture and environment (three independent variables) were significantly and positively associated with the dependent variable (employee satisfaction measure).

Employee Satisfaction Measure = f (customer focus, internal measure and Working Culture and Environment)…….4

Further multiple regression analysis was carried out and the above three factors are found to be significant. The regression analysis summary for employee satisfaction measure is presented in table 7.22. TQM Model for employee satisfaction measure is represented in figure 7.13.

Table 7.22: Regression analysis summary for employee satisfaction measure measures

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.891[a]	.794	.789	.30334

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	41.107	3	13.702	148.912	.000[a]
	Residual	10.674	116	.092		
	Total	51.781	119			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.366	.218		-1.678	.096
	Customer Focus	.470	.034	.583	13.755	.000
	Internal Measure	.094	.037	.109	2.563	.012
	Working Culture and Environment	.537	.033	.680	16.104	.000

Note: work culture e.g. lack of education requires substantial training and poor working Condition e.g. improper machine layout, will lead to further spending.

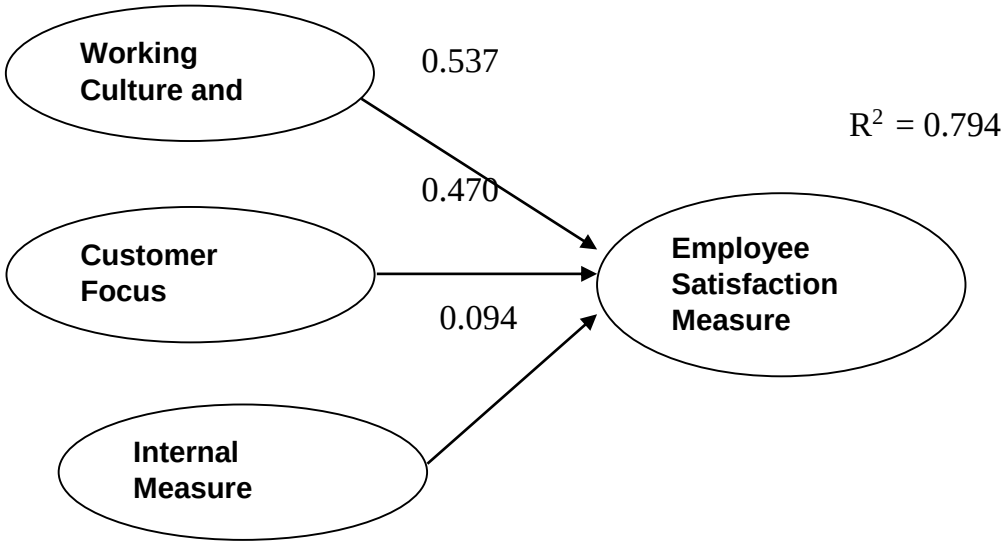


Fig 7.12: Frame Work Model for Employee Satisfaction Measure

7.23.3 Operation measures

The following hypotheses have been formulated and tested in the validation::

H_1. Top management leadership positively impacts operation measures

H_2. Customer focus positively impacts operation measures

H_3. Continuous improvement positively impacts operation measures

H_4. Quality improvement system positively impacts operation measures

H_5. Work culture and environment positively impacts operation measures

H_6. Supplier relation positively impacts operation measures

H_7. Internal Measure positively impacts Operation Measures

H_8. Key process monitoring and control positively impacts operation measures

H_9. Employee involvement positively impacts operation measures

Correlation analysis was conducted between nine manufacturing SMEMS quality improvement parameters and Operation measure using Pearson's correlation. Correlation results are shown in table 7.23.

Table 7.23: Correlation analysis quality improvement factors with operations measures

Operations measure	Operations measure	Top Management Leadership	Customer Focus	Continuous Improvement	Quality Improvement System	Working Culture and Environment	Supplier Relation	Internal Measure	Key Process Monitoring	Employee Involvement
Pearson Correlation	1	.673**	.033	.449**	.082	-.128	.215*	.048	.017	-.030
Sig. (2-tailed)		.000	.717	.000	.373	.163	.018	.602	.857	.745
N	120	120	120	120	120	120	120	120	120	120

Table 4.19 indicates that top management leadership, supplier relation and continuous improvement (three independent variables) were significantly and positively associated with the dependent variable (customer satisfaction measure).

operation measure = f (top management leadership, supplier relation and continuous improvement)……(5)

Further multiple regression analysis is carried out and supplier relation is found to be insignificant. The regression analysis summary for customer satisfaction measure is presented in table 7.23. TQM Model for customer satisfaction measure is represented in Fig 7.13.

Table 7.23: Regression analysis summary for operation measures

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.835[a]	.698	.693	.33649

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30.620	2	15.310	135.218	.000[a]
	Residual	13.247	117	.113		
	Total	43.867	119			

a. Predictors: (Constant), Continuous Improvement, Top Management Leadership

b. Dependent Variable: operational measure

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.224	.188		1.192	.236
	Top Management Leadership	.510	.037	.706	13.864	.000
	Continuous Improvement	.440	.045	.496	9.738	.000

a. Dependent Variable: operational measure

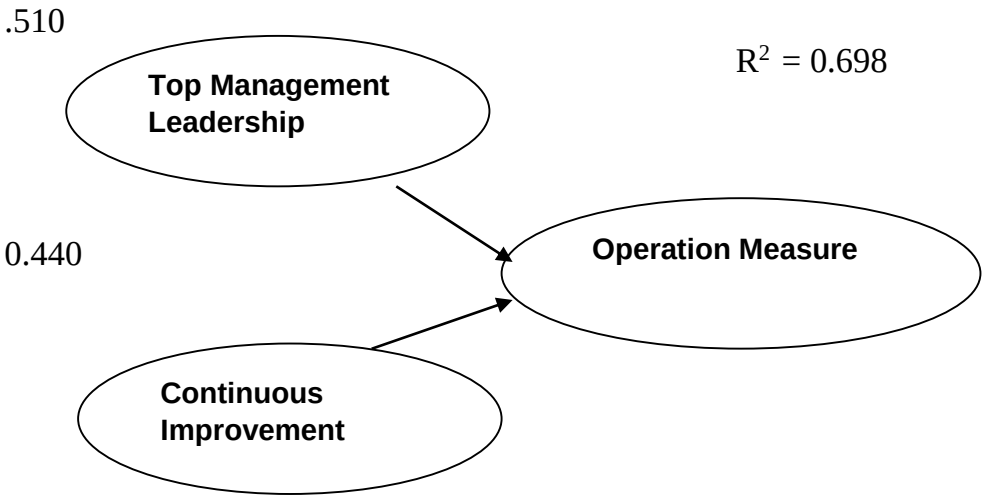


Fig 7.13: Frame Work Model for Operation Measure

7.23.4 Financial Measures

The following hypotheses have been formulated and tested:

H_1. Top management leadership positively impacts financial measures

H_2. Customer focus positively impacts financial measures

H_3. Continuous improvement positively impacts financial measures

H_4. Quality improvement system positively impacts financial measures

H_5. Work culture and environment positively impacts financial measures

H_6. Supplier relation positively impacts financial measures

H_7. Internal measure positively impacts financial measures

H_8. Key process monitoring and control positively impacts financial measures

H_9. Employee involvement positively impacts financial measures

Correlation analysis was conducted between nine manufacturing SMEs quality improvement parameters and financial measures using Pearson's correlation. Correlation results are shown in table 7.24.

Table 7. 24: Correlation analysis for quality improvement factors with financial measures

Financial measure	Financial measure	Top Management Leadership	Customer Focus	Continuous Improvement	Quality Improvement System	Working Culture and Environment	Supplier Relation	Internal Measure	Key Process Monitoring	Employee Involvement
Pearson Correlation	1	.332**	-.104	.433**	.431**	.166	.545**	-.093	-.116	.037
Sig. (2-tailed)		.000	.260	.000	.000	.069	.000	.311	.209	.692
N	120	120	120	120	120	120	120	120	120	120

Table 7.21 indicates that top management leadership, continuous improvement, quality improvement system, working culture and environment and supplier relation (five independent variables) were significantly and positively associated with the dependent variable (financial measure).

Financial Measure = f (top management leadership, continuous improvement, quality improvement system, working culture and environment and supplier relation)…….. …….. …….(6)

Further multiple regression analysis is carried out and top management leadership and working culture and environment are found to be insignificant. The regression analysis summary for financial measure is presented in table 7.25. Frame work model for operation measure is represented in Fig. 7.14.

Table 7.25: Regression analysis summary for operation measures

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.857[a]	.735	.728	.25260

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20.553	3	6.851	107.369	.000[a]
	Residual	7.402	116	.064		
	Total	27.955	119			

a. Predictors: (Constant), Supplier Relation, Quality Improvement System, Continuous Improvement

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.224	.173		1.295	.198
	Continuous Improvement	.354	.034	.499	10.351	.000
	Quality Improvement System	.297	.034	.421	8.813	.000
	Supplier Relation	.291	.023	.619	12.840	.000

a. Dependent Variable: financial measure

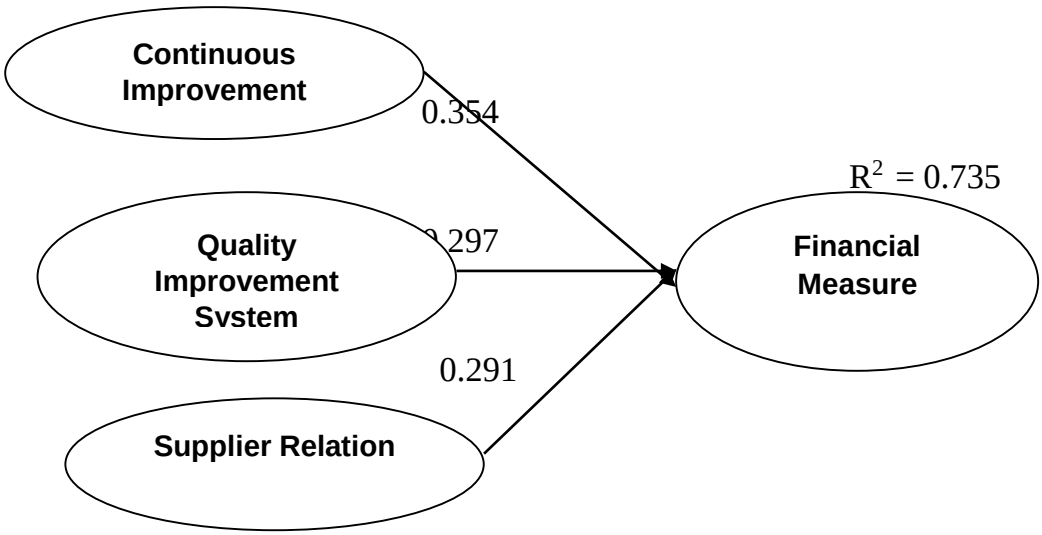


Fig 7.14: Frame Work Model for Financial Measure

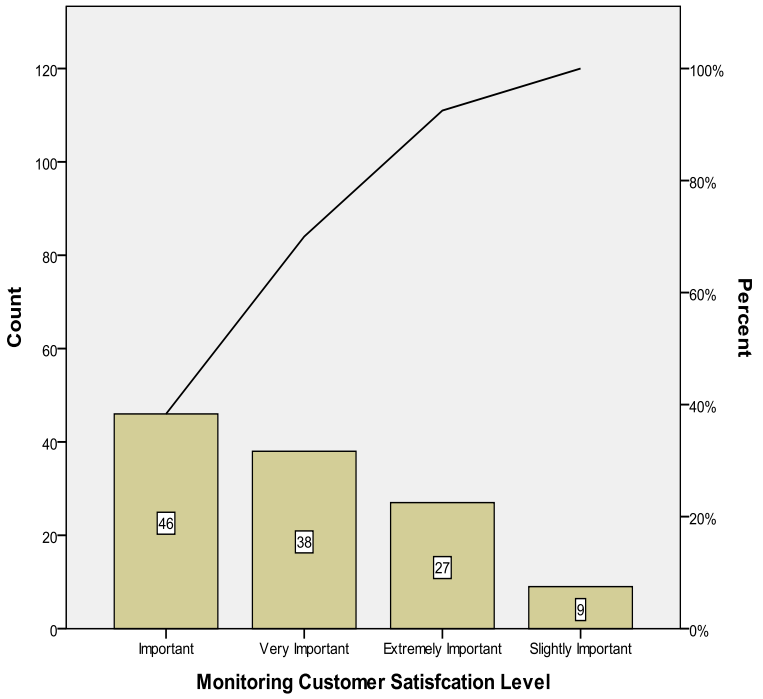
7.24.4 Pareto Analysis

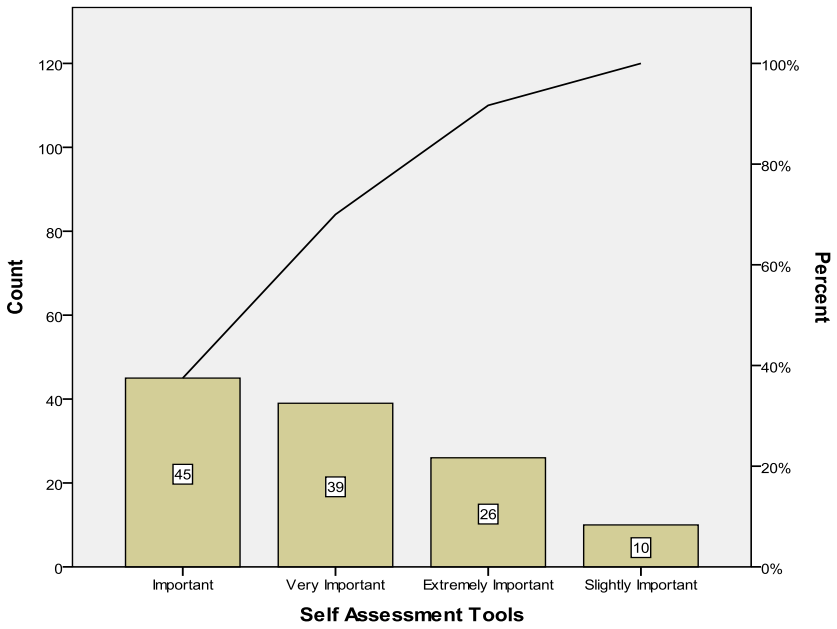
Proposed TQM model was further validated using Pareto analysis.

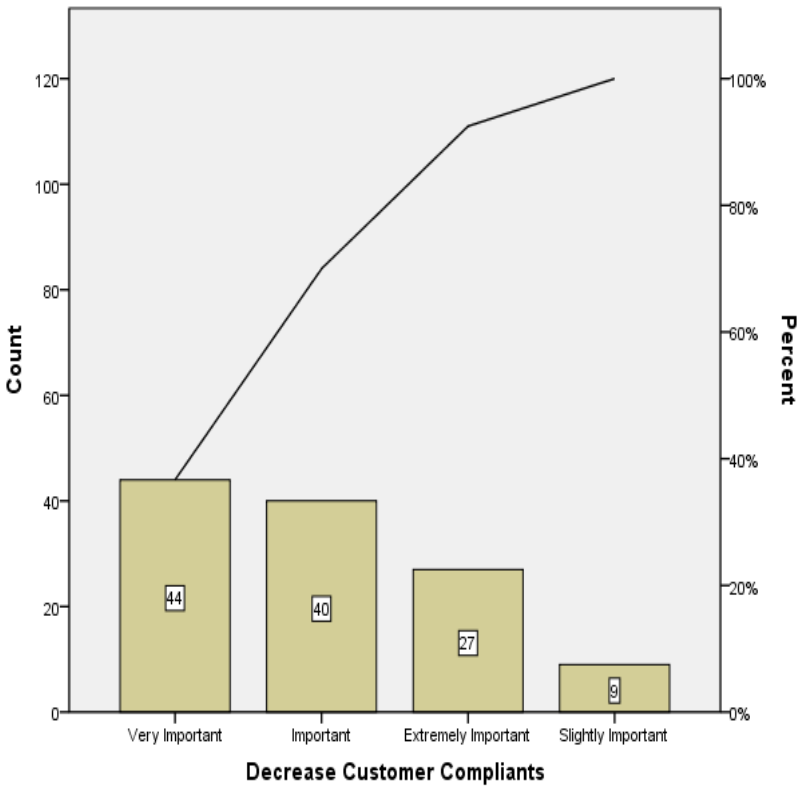
7.24.1 Pareto Analysis for Customer Focus

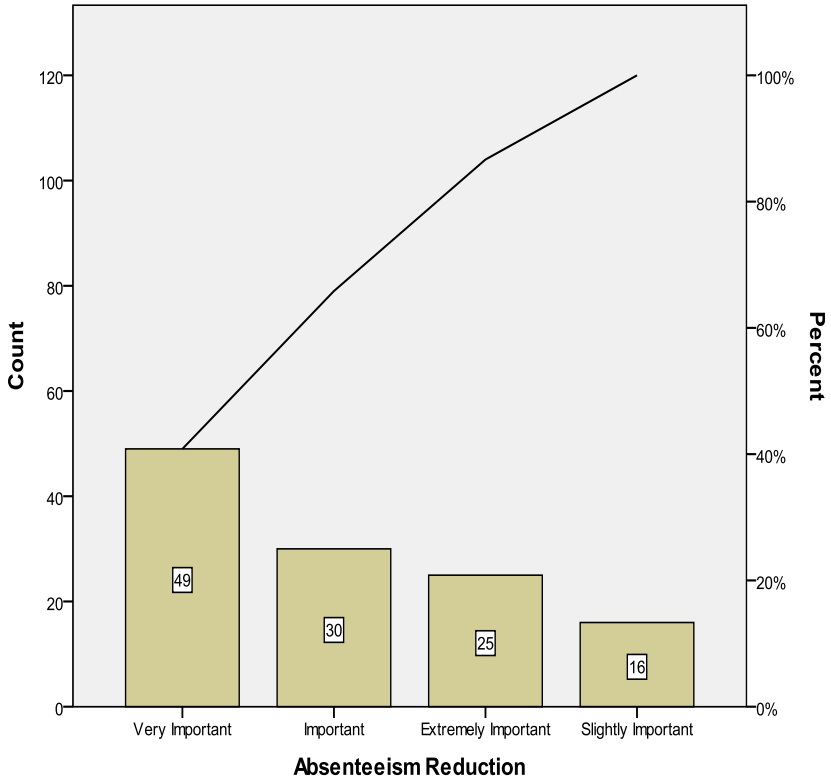
Pareto charts, shown in Fig.7.26 contains bars and a line graph, where individual values are represented by bars in descending order. Line represents cumulative total. Vertical axis in the left shows the frequency of occurrence. It can also be used to characterize cost or another significant unit of measure. The vertical axis in the left is the cumulative percentage of the total number of occurrences such as total cost or total of the particular unit of measure. The cumulative function is a concave function since the reasons are in decreasing order. In the case example here in order to reduce the number of employees arriving late by 78%, it is sufficient to solve the first three issues. The function of the Pareto chart is to emphasize the most important among a (usually large) set of factors. In quality control studies, it often represents the most frequent sources of defects, the highest occurring type of imperfections, or the most frequent causes of customer complaints, and so on. Wilkinson (2006) devised an algorithm for producing statistically based acceptance limits (similar to confidence intervals) for each bar in the Pareto chart.

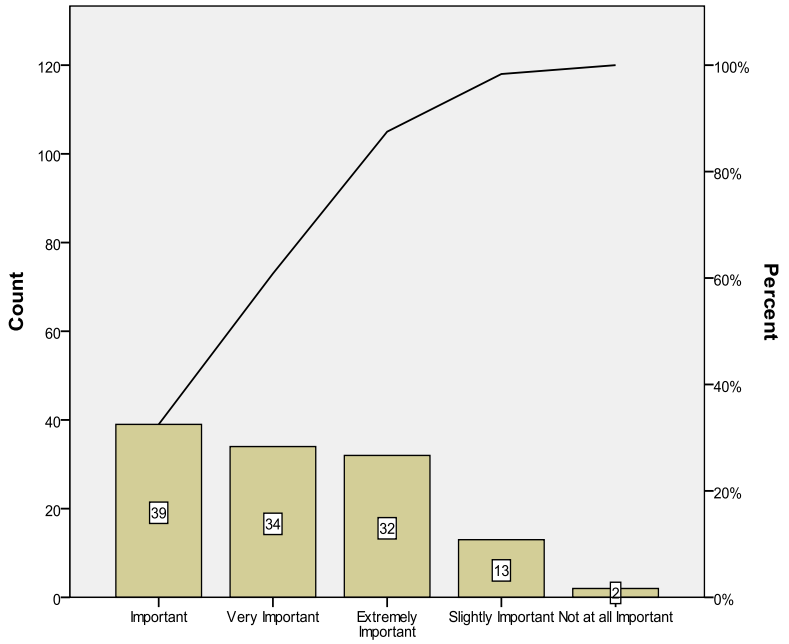
Among the 120 response, the number of slightly important and extremely important aspects of customer focus was analyzed for best search. From the search table 7.26, it is found out that 7 responses are given slightly important to expert and knowledge of the customer and 33 responses are given extremely important to expert and knowledge of the customer. Figure 7.15 shows Pareto analysis report for customer focus.

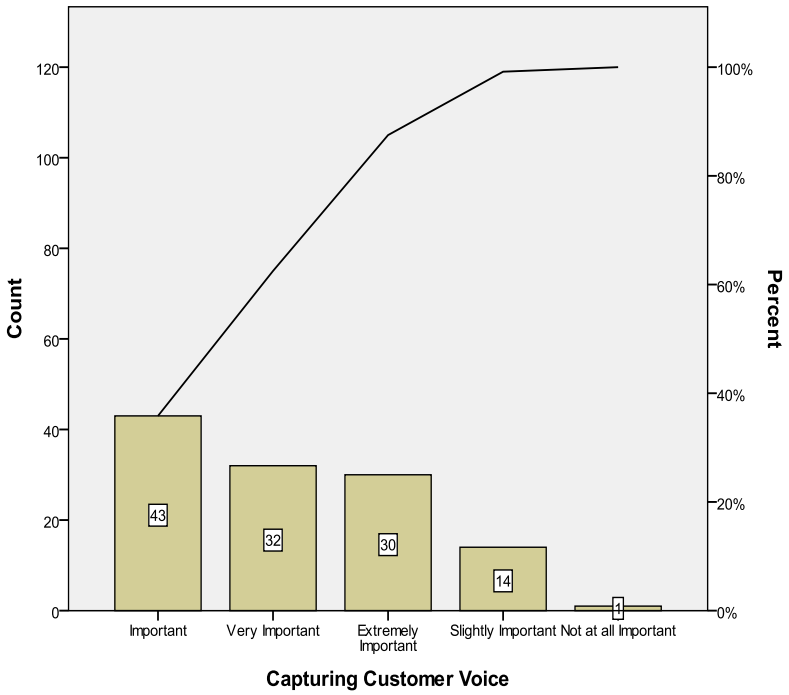

120
100
80
60
40
20
0
Count
100%
80%
60%
40%
20%
0%
Percent
46
38
27
9
Important
Very Important
Extremely Important
Slightly Important
Monitoring Customer Satisfcation Level


120
100
80
60
40
20
0
Count
100%
80%
60%
40%
20%
0%
Percent
45
39
26
10
Important
Very Important
Extremely Important
Slightly Important
Self Assessment Tools


Count
Percent
120
100
80
60
40
20
0
100%
80%
60%
40%
20%
0%
44
40
27
9
Very Important
Important
Extremely Important
Slightly Important
Decrease Customer Compliants


Count
Percent
120
100
80
60
40
20
0
100%
80%
60%
40%
20%
0%
49
30
25
16
Very Important
Important
Extremely Important
Slightly Important
Absenteeism Reduction


Count
Percent
120
100
80
60
40
20
0
100%
80%
60%
40%
20%
0%
39
34
32
13
2
Important
Very Important
Extremely Important
Slightly Important
Not at all Important
Increase number of Customer


Count
Percent
120
100
80
60
40
20
0
100%
80%
60%
40%
20%
0%
43
32
30
14
1
Important
Very Important
Extremely Important
Slightly Important
Not at all Important
Capturing Customer Voice

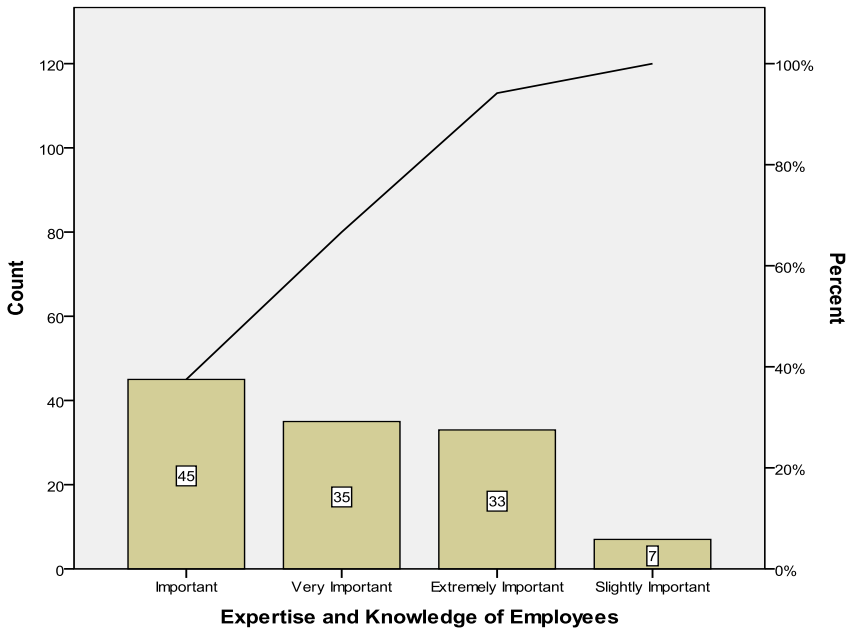
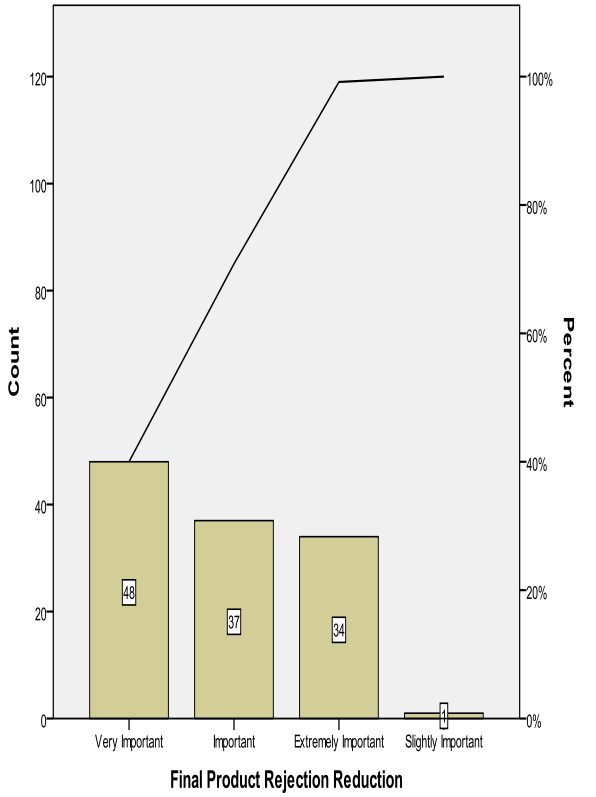


Fig 7.15: Pareto Analysis for Customer Focus Measure

Table 7.26: Pareto analysis report for customer focus measure

	Parameters	**Slightly Important**	**Extremely Important**
1	Monitoring Customer Satisfaction Level	9	27
2	Self-Assessment tool	10	26
3	Increase No of Customers	13	32
4	Decrease Customer Complaints	09	27
5	Absenteeism Reduction	16	25
6	Expert and Knowledge of the Customer	7	33
7	Capturing Customer Voice	14	30

7.25 Pareto analysis for internal measure



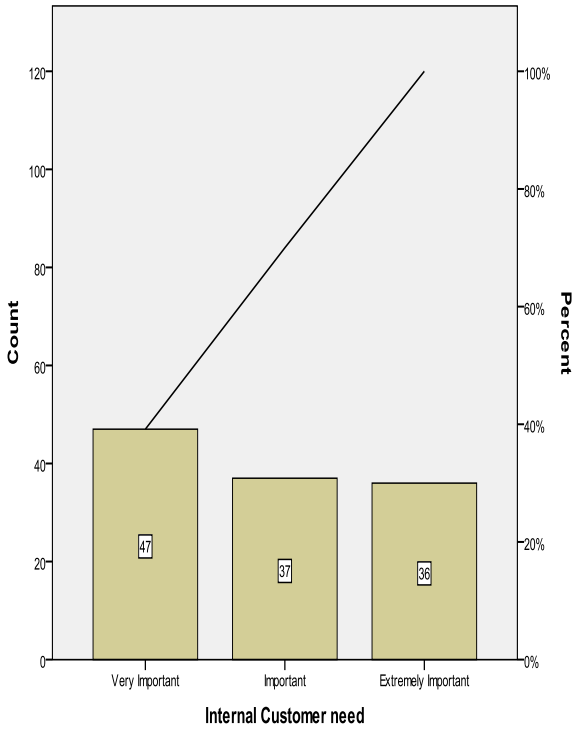


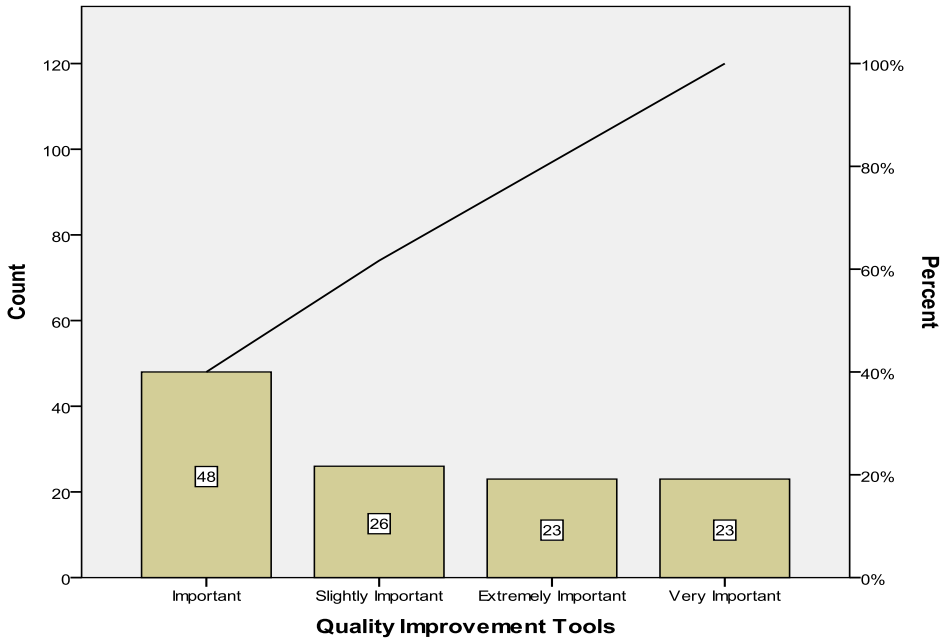
Fig 7.17: Pareto Analysis for Internal Measure

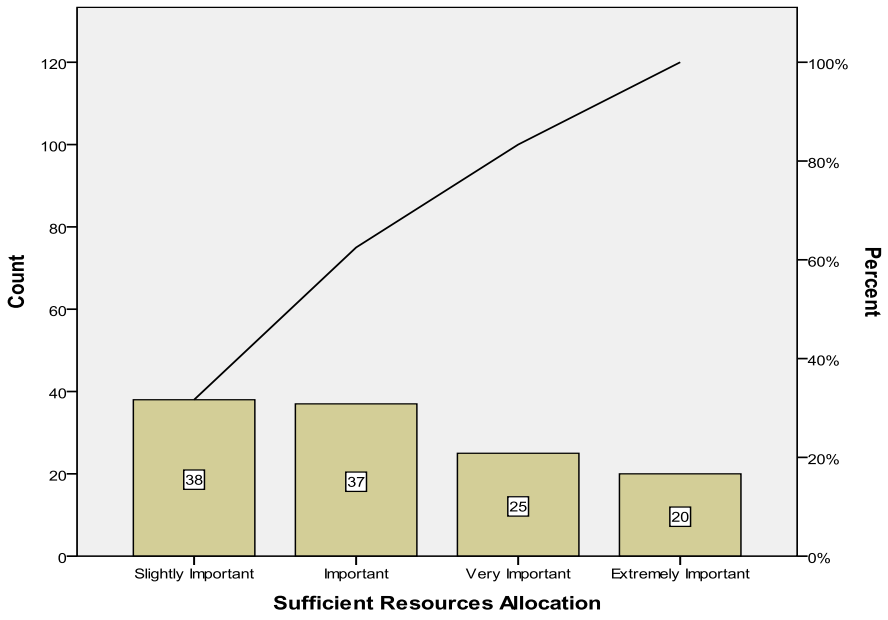
Table 7.27: Pareto analysis report for internal measure

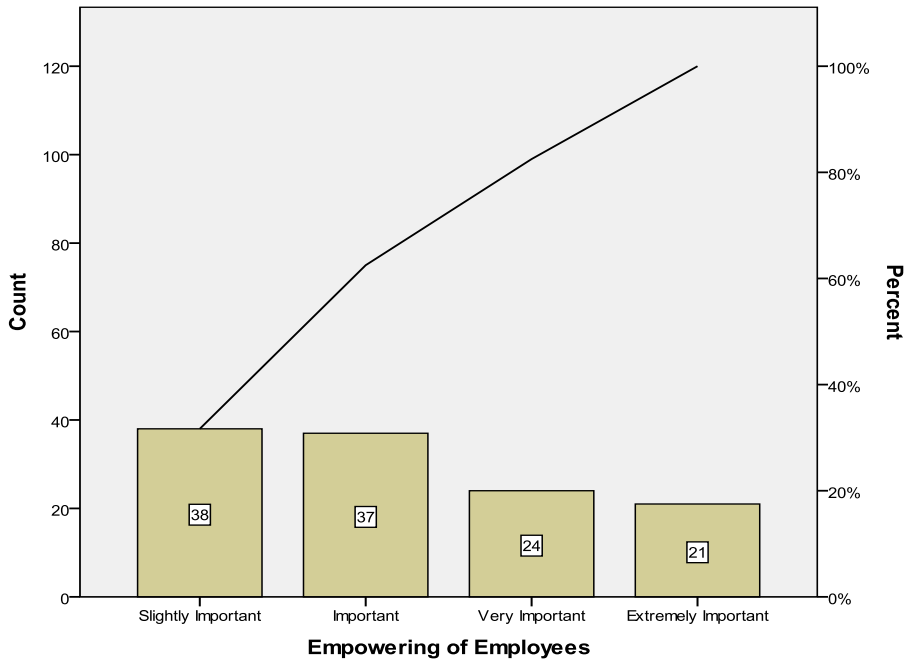
Parameters	**Important**	**Extremely Important**
Final product rejection reduction	37	34
Internal Customer need	37	36

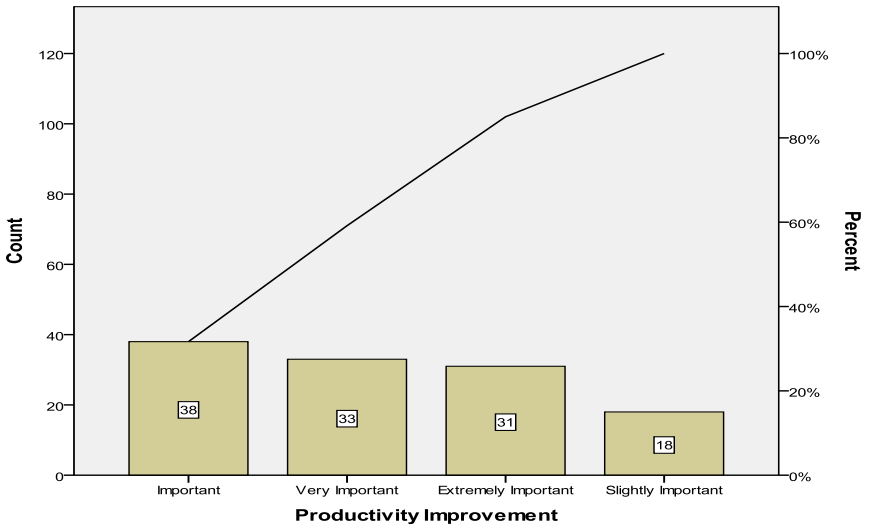
Among the 120 response, the number of extremely important aspects of internal measure was analyzed for best search. From the search table 7.27, it was found that 36 responses wee given extremely important to internal customer need. Fig 7.17 shows Pareto analysis report for internal measure.

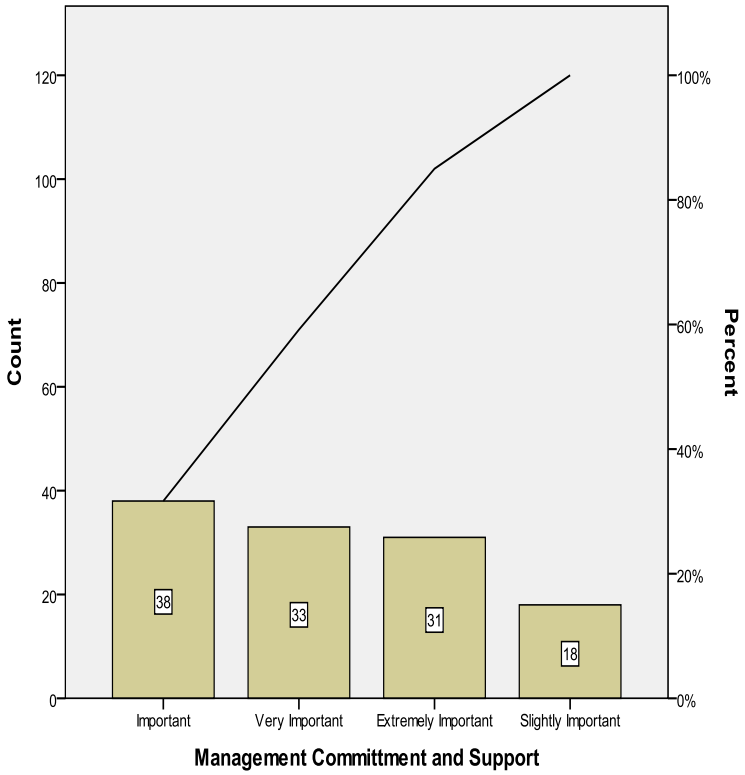
7.25.1 Pareto Analysis for Top Management Leadership

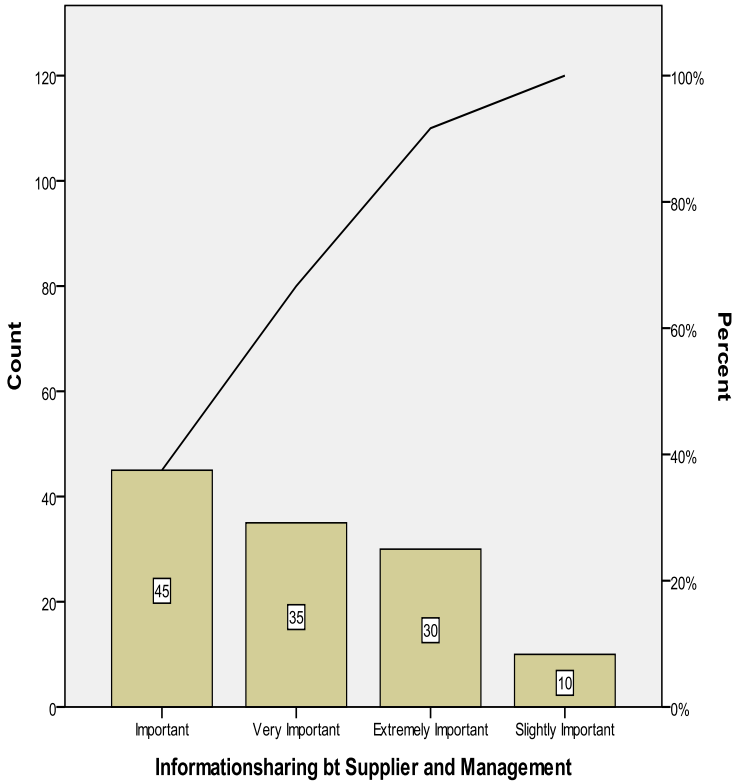



Count
Percent
120
100
80
60
40
20
0
100%
80%
60%
40%
20%
0%
38
37
25
20
Slightly Important
Important
Very Important
Extremely Important
Sufficient Resources Allocation


Count
Percent
120
100
80
60
40
20
0
100%
80%
60%
40%
20%
0%
38
37
24
21
Slightly Important
Important
Very Important
Extremely Important
Empowering of Employees


Count
Percent
120
100
80
60
40
20
0
100%
80%
60%
40%
20%
0%
38
33
31
18
Important
Very Important
Extremely Important
Slightly Important
Productivity Improvement


Count
Percent
120
100
80
60
40
20
0
100%
80%
60%
40%
20%
0%
38
33
31
18
Important
Very Important
Extremely Important
Slightly Important
Management Committment and Support


Count
Percent
120
100
80
60
40
20
0
100%
80%
60%
40%
20%
0%
45
35
30
10
Important
Very Important
Extremely Important
Slightly Important
Informationsharing bt Supplier and Management

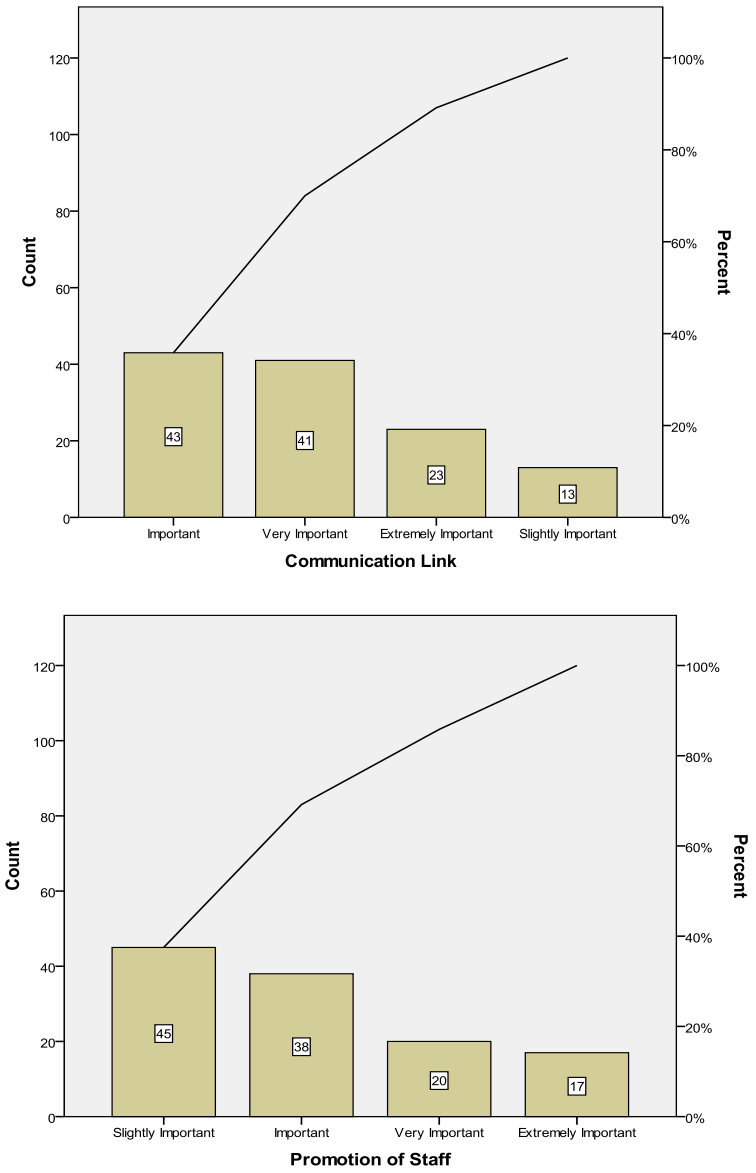


Fig 7.18: Pareto Analysis for Top Management Leadership

Table 7.28: Pareto analysis report for top management leadership

Parameters	**Slightly Important**	**Extremely Important**
Quality Improvement Tool	26	23
Suffering Resource Allocation	38	20
Empowering Employee	38	21
Productivity Improvement	18	31
Management Commitment and Support	18	31
Promotion of Staff	45	17
Information Sharing	10	30

Communication Link	13	23

Among the 120 responses, the number of slightly important and extremely important aspects of top management leadership was analysed for best search. From the search table 7.28, it is found out that thirteen responses were given slightly important to communication link and thirty responses are given extremely important to information sharing. Fig 7.18 shows Pareto analysis report for top management leadership. 7.26 Scatter Plot.

In this analysis, 3D scatter plots were used to plot data points on three axes to show the relationship between three variables. Each row in the table is represented by a marker whose position depends on its values in the columns set on the X, Y, and Z axes. The relationship between different variables is known as correlation. If the markers are near enough to making a straight line in any direction in the three-dimensional space of the 3D scatter plot, it can be considered that the correlation between the corresponding variables is high. If the markers are equally distributed in the 3D scatter plot, the correlation is low, or zero and though a correlation may appear to be present, it may not exactly exist.

7.26.1 Scatter Plot for Quality Management and CI Factor

In this section comparison is made between four different quality management and CI factor pairs through SPSS. The pairs scatter plot diagrams are presented in Fig 7.19.- 7.24

1. Customer satisfaction measure - customer focus - internal measure
2. Employee satisfaction measure-internal measure–working culture and environment
3. Employee satisfaction measure-customer focus-working culture and environment
4. Operation Measure - top management leadership - continuous improvement
5. Financial Measure - continuous improvement - supplier relation
6. Financial Measure-quality improvement system-supplier relation

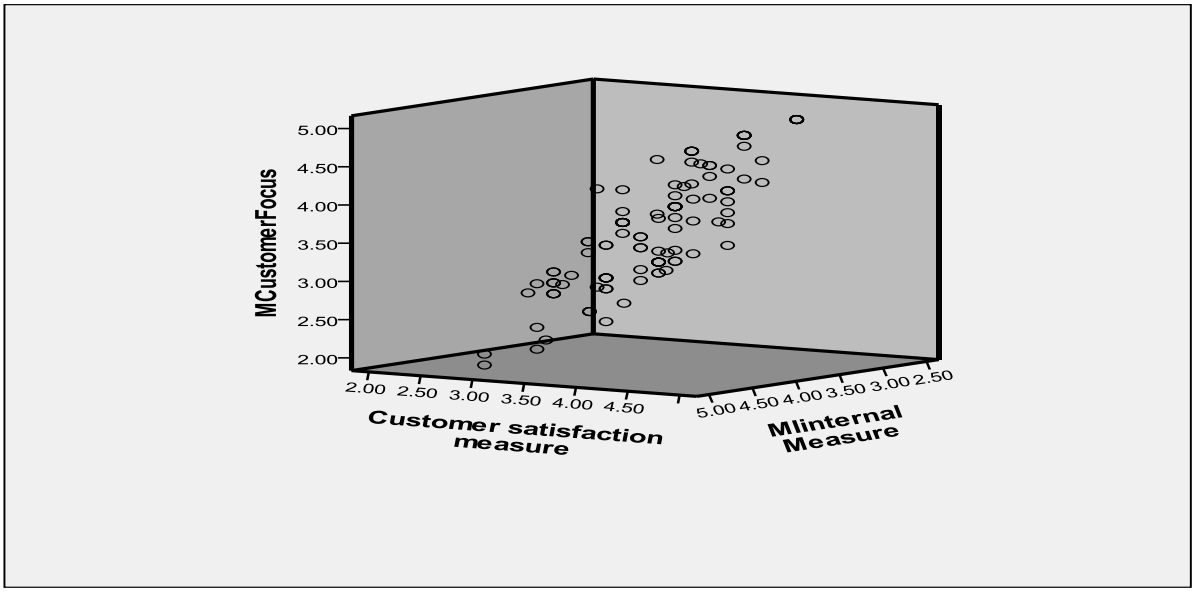


Fig 7.19: Scatter Plot Diagram for Customer Satisfaction Measure with internal Measure and Customer Focus

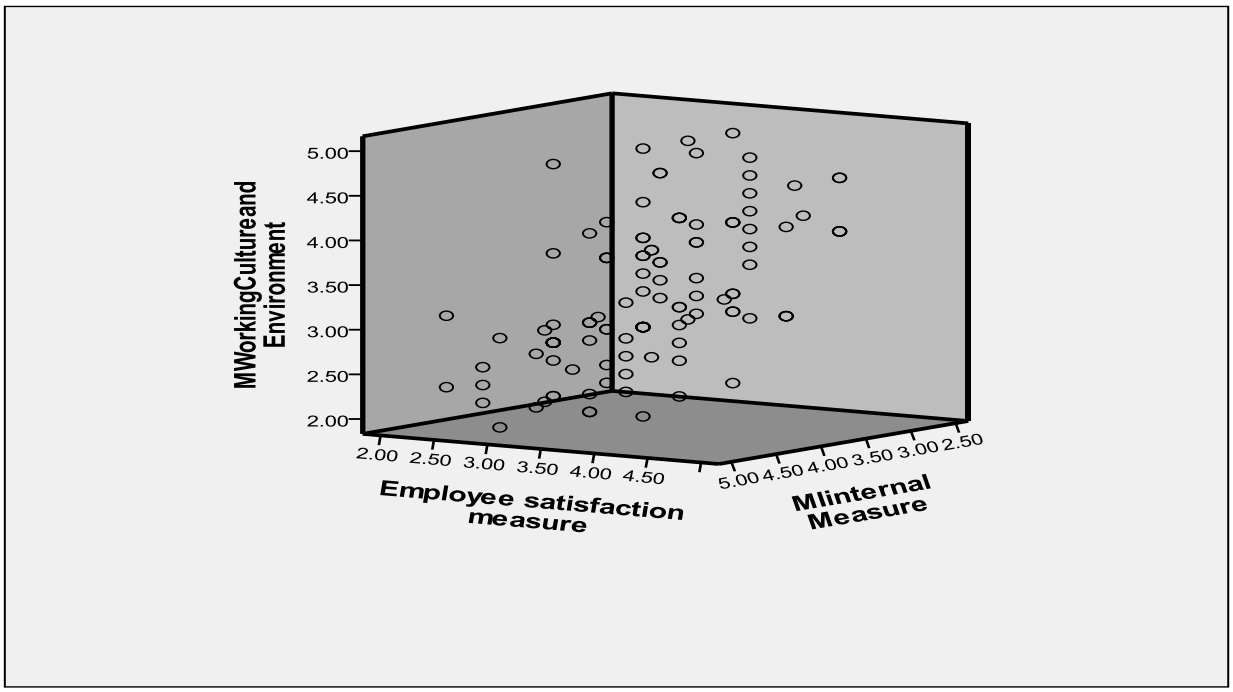


Fig 7.20: Scatter Plot Diagram for Employee Satisfaction Measure with internal Measure and Working Culture and Environment

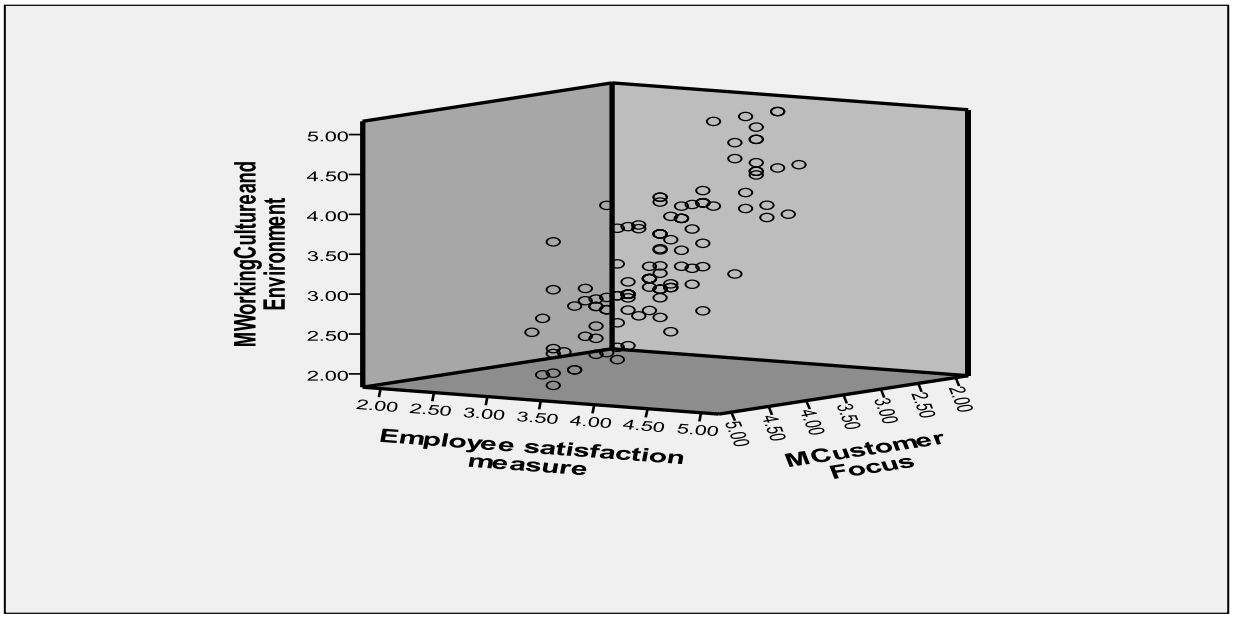


Fig 7.21: Scatter Plot Diagram for Employee Satisfaction Measure with Customer Focus Measure and Working Culture and Environment

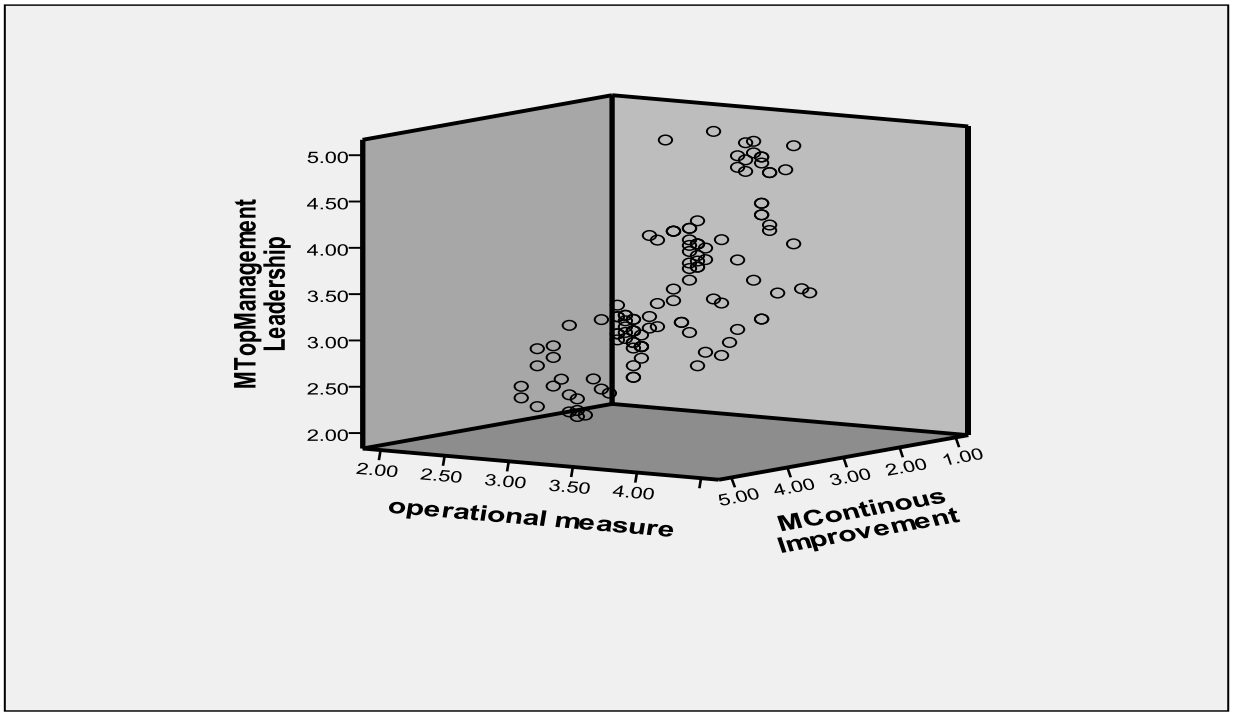


Fig7.22: Scatter Plot Diagram for Operation Measure with Top Management Leadership and Continuous Improvement

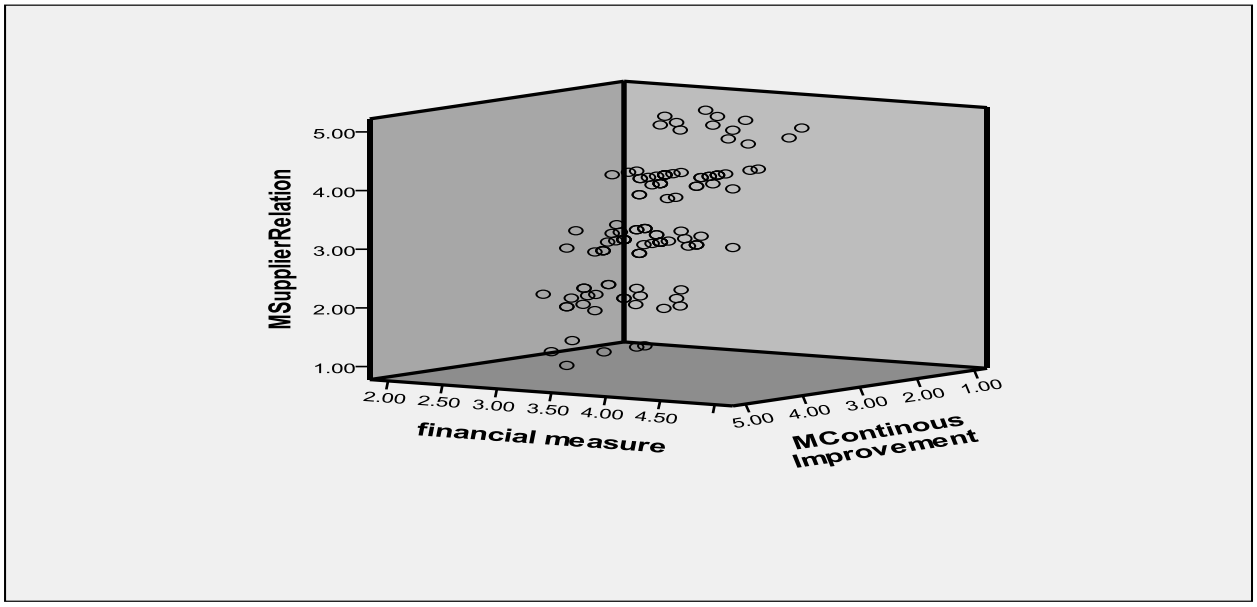


Fig 7.23: Scatter Plot Diagram for Finance Measure with Supplier Relation and Continuous Improvement

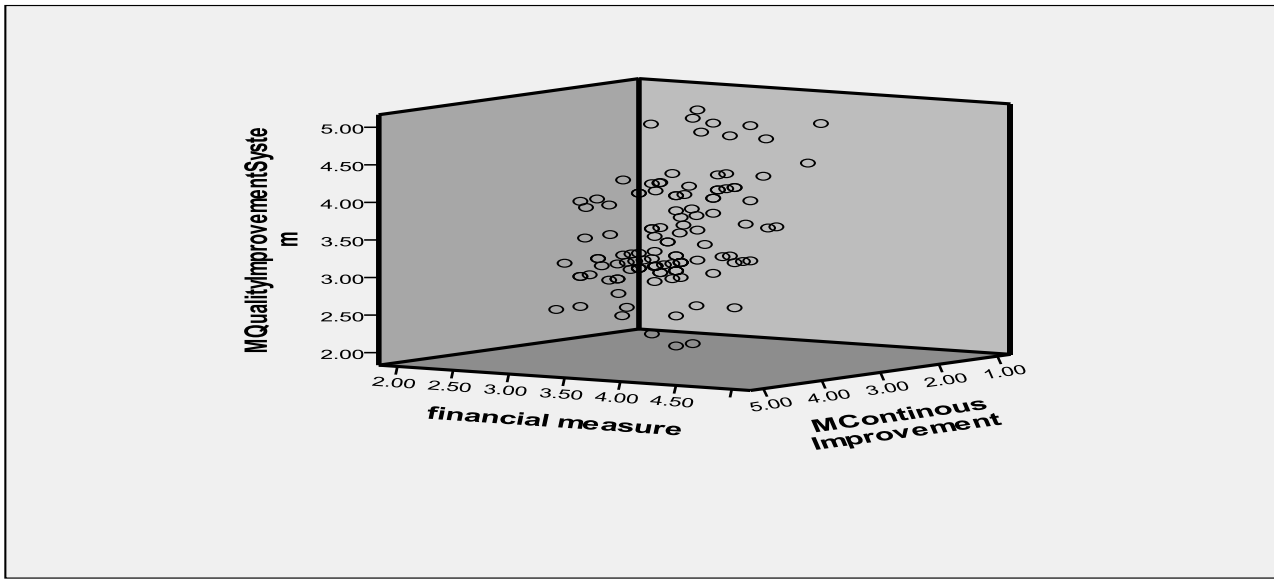


Fig 7.24: Scatter Plot Diagram for Finance Measure with Quality Improvement System and Continuous Improvement

The entire Scatter plot diagrams 7.19 is a plane because of quality management and continuous improvement factor with different responses appears as curved due to the interaction between the predictors

CHAPTER 8
CONCLUSION AND RECOMMENDATIONS

8.0 Conclusion

Manufacturing SMEs play an essential role in sustaining a developing nation's survival and growth. SMEs need to invest more to enhance employee skills in the continuous basis. TQM and CI are an approach to doing business that attempts to maximize the competitiveness through continual improvement of the quality of its products, services, people, processes, and environment. Thus, internalizing quality programs in an organization to improve quality and maintain a competitive edge is an enormous task.

The aim of this study is to investigate the extent to which the TQM and CI have been attained in SMEs with particular reference to the selected companies operating in the Arab countries. Manufacturing organizations in the Middle East whether small, medium or large must strive to take efforts towards improving their quality in order to survive in the competitive global scenario and achieve excellence to manage the competitive environment by establishing TQM culture in their organizations. There is a need to improve the performance of manufacturing SMEs, as they contribute considerably to the national economies in the world. It is to be realized that TQM is undoubtedly an important strategy, that will add value to the business operations, at all times, to meet customer expectations and a definite hinge for success in the market place.

SMEs based manufacturing firms in this research are all represented according to company profile factors, such as type of business, no of employee, year of implemented TQM and CI programme. Among the numerous listed factors highlighted in this study, there are significant factors that will motivate manufacturing SMEs based manufacturing firms to implement TQM and CI. In this research, analysis was conducted in the Arabic

manufacturing SMEs and the findings is a part of an on-going research on benchmarking implementation of TQM practices in the manufacturing companies in the Middle East

This research was designed to identify the current level of TQM implementation in Arab manufacturing SMEs and also investigate the TQM and CI Parameters that affect the performance of the companies and to identify barriers that stop them from implementing TQM in their company. The main objectives were to determine the influencing factors and response to TQM implementation within Arab Manufacturing firms, The survey conducted shows positive feedback with respect to the quality process.

The empirical data was collected and practitioners' opinions were analysed. The analysis provided valuable information regarding the application of TQM and CI to improve the quality. Based upon the empirical analysis, the author has summarized the following facts that are relevant to manufacturing SMEs in the Middle East in terms of success through TQM implementation:

Findings from Margin of Error

- The margin of error is 2.45 %. It reflects that the estimate for current study is not exactly equal to the statistics, but fall around 2.45 % of the statistics, because every sample is likely to differ a slightly from the population.

Findings from Demographical Analysis

- 20.8% operational managers, 19.2 % quality managers, 17.5 % manufacturing engineers were participated in the survey. The participants were aware and knowledgeable of quality management and CI. This indicates the reliability of the survey results. In the survey analysis, 57.5 % companies that participated have 201-400 employees. Hence, the study should focus on SMEs with more than 200 employees.

- 68.3% of companies who took part in the study have already implemented TQM for a span of 2.1 years -4 years. This raises the need to implement latest TQM and CI methodology.
- 87.5 % of the respondents are affirmative about TQM improving the performance. This shows that TQM and CI methodology brings positive changes in the SMEs.
- TQM and CI implementation in sales and marketing (10.8%), project 11.7% and in both finance and purchase (9.2 %) is very low. So, there is lot of scope to implement TQM and CI in this area.
- 41.7% of the resources for TQM and CI implementation is training. This indicates widespread scope for training resources.
- The participating companies only focused on ISO/internal quality audit, set-up reduction, lean/six sigma and achieved customer satisfaction, employee satisfaction, waste reduction and cost reduction. Other than achievement in this area, there is scope for improvement in total productivity improvement, just-in-time and inventory management.

Findings from Descriptive Statistics

- All the parameters which indicate that the respondents are neutral, on an average but the scores range between 3.5 -4.5 which implies that they mostly agree with it.
- Involvement of supplier's selection parameters has larger standard deviation. which can be disregarded since the data size is small with largest dispersion.
- Skewness/Kurtosis Ratio supports that the data is normally distributed other than employee involvement factor.

Findings from Data Reliability Analysis

- The following nine factors (1) top management leadership (2) customer focus (3) continuous improvement (4) quality improvement system (5) work culture and environment (6) supplier relation (7) internal measure (8) key process monitoring and control (9) employee involvement together produced Cronbach's alpha range is 0.840-0.980, which indicates a high level of internal consistency for the researcher's chosen scale with this specific sample.

Findings from Factor Analysis

- The Kolmogorov-Smirnov test of normality had the significant value for all the variables under consideration less than 0.05 at 5% level of significance. Thus the null hypothesis is accepted; hence progressing with factor analysis was justified
- From the factor analysis, the dimensions of the proposed TQM framework's parameters measure comprise nine components for 40 variables with 81.54 % of the variance only.

The analysis identified the following nine factors as the critical success factors for that need to be focussed in the Arab manufacturing SMEs:: (1) top management leadership (2) customer focus (3) continuous improvement (4) quality improvement system (5) work culture and environment (6) supplier relation (7) internal measure (8) key process monitoring and control (9) employee involvement.

8.6 Findings from Empirical Analysis

Through correlation analysis and hypothesis test, the researcher framed four different empirical models for TQM and CI for the Arab SMEs. For each one of these models, dependent variables, independent variables, regression coefficient value, R^2 variable were identified and presented in table 5.1 and 5.2.

Table 8.1: Regression Analysis Summary for Customer Satisfaction Measure and Employee Satisfaction Measure

Dependent Variable	Independent Variables	Regression Coefficient Value	R^2 Variable
Customer Satisfaction Measure	Customer Focus	0.677	0.911
	Internal Measure	0.315	
Employee Satisfaction Measure	Customer Focus	0.470	0.794
	Internal Measure	0.094	
	Working Culture and Environment	0.537	

- Customer focus impacts on customer satisfaction measure model and employee satisfaction measure model the most (for example, customer satisfaction measures changes when customer expectations change. This may increase employee's workload to build in the quality expectations in the product which in turn will affect the morale of the worker).
- Internal measure and customer focus are common factors in the both model.
- Study reveals that leadership and customer focus are important aspect in the SMEs.
- Working culture and environment have impact on the employee satisfaction measure model the most.
- Compared to employee satisfaction measure model with customer satisfaction measure model, internal measure factor has more impact on customer satisfaction measure model.

Table 8.2: Regression Analysis Summary for Operation Measure and Financial Measure

Dependent Variable	Independent Variable	Regression Coefficient Value	R^2 Variable
Operation Measure	Top Management Leadership	0.510	0.698
	Continuous Improvement	0.470	
Financial Measure	Continuous Improvement	0.354	0.730
	Quality Improvement System	0.297	
	Supplier Relation	0.291	

- Continuous improvement impacts on operation measure model and financial measure model the most.
- Top management leadership, continuous improvement factors have almost equal impact on operation measure model
- Continuous improvement, quality improvement system and supplier relation factors have almost equal impact on financial measure model
- Proposed framework shows that TQM principles accelerates successful financial and non-financial performance of the selected manufacturing SMEs in the case study.

Validation of TQM model is selected SMEs

The four regression model has explained the variation accounts for 91.1, 7 9.4, 69.8, 73.0 percent (R^2 of the total variation. F test (popularly known as analysis of variance -

ANOVA) was used when multiple sample case were involved. As the significance of the difference between the means of two samples can be judged through any test, the difficulty arises when one has to examine the significance of the difference amongst more than two sample means at the same time. Therefore, the F test was selected as the appropriate tool for analysis. The F ratio was significant at the 0.000 level. This shows that the results of the regression models could scarcely have occurred by random chance.

Findings from Pareto Analysis

Among the 120 respondents, the number of slightly important and extremely important were analysed for best search through Pareto analysis. Scatter plots appear as curved due to the interaction between the predictors (scatter plot analysis) in the following pair: customer satisfaction measure - customer focus - internal measure pair, employee satisfaction measure - internal measure - working culture and environment pair, employee satisfaction measure - customer focus - working culture and environment pair, operation measure - top management leadership - continuous improvement pair, financial measure - continuous improvement - supplier relation pair, financial measure - quality improvement system- supplier relation pair

The empirical study has highlighted the existing problems, weakness, barriers and opportunities for TQM and CI implementation in the Arab manufacturing SMEs,, The analysis identified that the customer focus and CI have a measureable effect on TQM and CI program and the extent to which the amount of training and education on TQM and CI techniques affect the overall growth of manufacturing SMEs in the Arab states. It was also quite clear that the Arabic work culture presents problems to the success of employee satisfaction measure model in the manufacturing sector.

The study highlights that the TQM and CI parameters measures in manufacturing SMEs in the Arab states are more than the constitutional requirements. The companies have implemented the exiting TQM and CI measures with sufficient financial support, allocated for this purpose. The researcher has analysed through empirical study the objectives of the TQM and CI parameters measures with help of hypotheses and statistical tools for the analysis. The research reveals that conceptualized research model was proved through empirical analysis.

8.1 Recommendations

Empirical analysis shows that majority of the manufacturing firms in the Middle East need improving almost all the stages and processes of manufacturing by implementing the concepts of TQM and CI. It is also being recommended that the companies to concentrate on:

- Adopting continuous improvement tools and customer focus tool and follow customised TQM model.
- Providing better working conditions and culture by improving the shop floor layout, working condition of machineries and equipment and initiating the employee satisfaction measures.
- Recognizing the employees' suggestions in improving quality, making them to expertise, knowledge and commit in adopting the quality concepts.
- Implementing the comprehensive approach of evaluating and selecting the suppliers and make them to adopt the company quality policy.
- Providing comprehensive and systematic training to the employees in quality management.
- Getting feedback from the customers continuously regarding the quality of product.

8.2 Limitation of the Proposed Model

Unlike the western countries, workers in the Middle Eastern SMEs are less knowledgeable and weak in problem solving skills. The Arabic management in SMEs offer very limited training to their workers in modern tools. Consideration the Arabic work culture, the proposed model did not include modern tools such as cloud manufacturing, additive manufacturing, six sigma techniques, Kanban systems and lean techniques in the CI. This will be affect the achievement of full scale quality improvement. No of companies in this study was small. However, it should be noted that especially the SMEs chosen in this study, represent the largest players in their kind of business. Although at certain pints in the analysis, additional data from the Arab manufacturing SMEs would have been useful, it was very difficult for the research to obtain from her academic base in England. Certainty, these additional date would have provided more information and enhanced the details in the discussion.

8.3 Further Research

This research was based on the manufacturing SMEs and the proposed TQM model could be further tested to determine whether these findings can be applied to other industries in the Middle East. The proposed model only describes the sequences in implementing TQM, hence future research should focus on implementation issues using this model.

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APPENDIX

A1 Covering letter for survey

School of Architecture, Computing
and Engineering
University of East London
4-6 University Way
London E16 2RD, UK.

15th September 2015

Subject: Questionnaire

Dear Sir/Madam,

Currently I am studying for a PhD degree at the University of East London. My research aims at improving the improving quality management system using TQM and continue Improvement strategies to enhance the production outputs in the Arab manufacturing companies.

Initially the research requires an understanding of the state of quality management practices in the Arab manufacturing environment. To accomplish this, data need to be collected through an empirical study using questionnaires. The data you provide will help me identify the appropriate parameters and strategy to establish appropriate TQM and CI tools, techniques and strategy in the existing Arab manufacturing environment.

It will be much appreciated if you could spare some time to complete the following questionnaire (as applicable to your case) and return it to me by post or as an email attachment at the earliest possible by 15th Dec 2015. The information you provide will remain highly confidential and solely used for the purpose of this research.

This research is carried out under the supervision of Dr.Subramaniam Arunachalam and Dr. Nic Snailum whose contact details are provided below.

If you have any query about the research or questionnaires, please do not hesitate to contact me at u1328692@uel.ac.uk

Thank you for your time and cooperation.

Yours sincerely

Aisha Zwet

A2 Survey Questionnaire 1

Survey on Implementation and Practices of TQM and Continuous Improvement

This is a survey to collect your views on the current practices on TQM (Total Quality Management) and CI (Continuous Improvement) in your organisation. Please spare a few minutes to respond to the survey by simply rating **(putting a tick mark)** each statement. This will help us to identify where improvements can be made so as to enhance the TQM and CI activities.

Thank you for your response.

Basic details

Name and location (town) of the Organisation:
Your Position:
No. of Employees:
When did your company start TQM program? :

SECTION I
A – Importance rating (Your Expectation)

Below is a list of requirements that may be **important** when implementing and practicing TQM and CI activities. Please indicate **how important each one** is to you by rating **(put a tick mark)** each of the listed factors on a scale from 1 – 5 (1 is not at all important and 5 is extremely important).

How important to you each of the following?	Not at all important	Slightly important	Important	Very important	Extremely important
1 MANAGEMENT LEADERSHIP					
A1 Commitment and support of management	☐	☐	☐	☐	☐

A2	Communication link between employee and management					
A3	Empowering of employees by management					
A4	Provision of sufficient resources to TQM					
A5	Use of quality improvement tools & techniques					
A6	Promotion of staff & improvement activities					
2	**EMPLOYEE INVOLVEMENT**					
A7	Recognition of employee's views & suggestions to improve quality					
A8	Commitment & Enthusiasm of employees					
A9	Use of self-assessment tools to identify and remedy weaknesses					
A10	Expertise & knowledge of employees on Quality concepts					
3	**TRAINING AND EDUCATION**					
A11	Conduct of employees training on TQM concepts					
A12	Provision of continuous learning through training & education					
4	**SUPPLIER MANAGEMENT**					
A13	Selection of suppliers based on quality aspects					

A14	Information sharing between supplier & Management	☐	☐	☐	☐	☐
A15	Involvement of supplier in quality improvement	☐	☐	☐	☐	☐
	5 CUSTOMER SATISFACTION					
A16	Measuring & Monitoring level of customer satisfaction	☐	☐	☐	☐	☐
A17	Capturing customer requirement during product development & quality improvement	☐	☐	☐	☐	☐
	6 WORK ENVIRONMENT AND CULTURE					
A18	Provision of pleasant working environment	☐	☐	☐	☐	☐
A 19	Adaptation of employee satisfaction initiatives (Suggestion Schemes, Profit sharing etc.,)	☐	☐	☐	☐	☐

SECTION II

B – Performance rating (company Performance)

We would like to ask **how well the company performs** against the requirements. Kindly indicate your ratings **(by putting a tick mark)** against each of the following on a scale from 1–5 (1 is poor and 5 is excellent) .

How do the company perform against each of the following?		**Poor**	**Fair**	**Good**	**Very Good**	**Excellent**
	1 MANAGEMENT LEADERSHIP					
B1	Commitment and support of management	☐	☐	☐	☐	☐
B2	Communication link between employee and management	☐	☐	☐	☐	☐

B3	Empowering of employees by management					
B4	Provision of sufficient resources to TQM					
B5	Use of quality improvement tools & techniques					
B6	Promotion of staff & improvement activities					
2	**EMPLOYEE INVOLVEMENT**					
B7	Recognition of employees views & suggestions to improve quality					
B8	Commitment & Enthusiasm of employees					
B9	Use of self-assessment tools to identify and remedy weaknesses					
B10	Expertise & knowledge of employees on quality concepts					
3	**TRAINING AND EDUCATION**					
B11	Conduct of employees training on TQM concepts					
B12	Provision of continuous learning through training & education					
4	**SUPPLIER MANAGEMENT**					
B13	Selection of suppliers based on quality aspects					
B14	Information sharing between supplier & Management					
B15	Involvement of supplier in quality improvement					
5	**CUSTOMER SATISFACTION**					

B16	Measuring & Monitoring level of customer satisfaction	☐	☐	☐	☐	☐
B17	Capturing customer requirement during product development & quality improvement	☐	☐	☐	☐	☐
6	**WORK ENVIRONMENT AND CULTURE**					
B18	Provision of pleasant working environment	☐	☐	☐	☐	☐
B19	Adaptation of employee satisfaction initiatives (Suggestion Schemes, Profit sharing etc)	☐	☐	☐	☐	☐

SECTION III

C – Rating on current TQM & CI Practices

This section attempts to determine the level of implementation and practice of TQM & CI activities in manufacturing industries. Kindly indicate your ratings **(by putting a tick mark)** against each of the following statements on a scale from 1–5 (1 is strongly disagree and 5 is strongly agree)

		Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	**STRATEGIC QUALITY MANAGEMENT**					
C1	Philosophy is at the heart of our organisation	☐	☐	☐	☐	☐
C2	Company has identified critical success factors	☐	☐	☐	☐	☐
C3	Company has identified critical processes	☐	☐	☐	☐	☐
C4	Company has identified the quality dimension of each key process	☐	☐	☐	☐	☐
C5	Company has appropriate measures in place for each key process	☐	☐	☐	☐	☐

2	**INTERNAL MEASUREMENT**					
C6	Internal customers' needs and expectations are known					
C7	Performance against standards for key Processes is regularly evaluated					
C8	Statistical techniques are used to monitor Performance of key processes					
3	**QUALITY SYSTEM IMPROVEMENT**					
C9	Company has established and maintains a quality manual					
C10	Quality policy and quality objectives are documented					
C11	Internal audits are performed on the quality system					
C12	Senior management acts on suggestions to improve quality					
C13	Company uses customers feedback to improve product quality					
C14	Resources and activities needed to achieve quality objectives are identified and allocated					

SECTION IV Manufacturing

Please read the questions carefully and answer them as appropriate

1. What is the average amount of raw material stocks held by your company?

☐ 0.5-1 day ☐ 2-5 days ☐ 6-14 days ☐ 15-30 days ☐ 30-180 days

2. How much finished products are held in stock by your company?

   ☐ 1-3 days ☐ 3-7 days ☐ 7-14 days ☐ 30 days or over

3. How frequent does production stop due to waiting for instructions or materials?

   ☐ Always ☐ Frequently ☐ Occasionally ☐ Rarely ☐ Never

4. How frequently does your production stop due to equipment failure/breakdown?

   ☐ Always ☐ Frequently ☐ Occasionally ☐ Rarely ☐ Never

5. What is the average equipment Mean Time Between Failures (MTBF)?

   ☐ Less than 30 days ☐ 30 - 180 days ☐ 180 - 365 days ☐ No Record

6. How frequently are products inspected before shipment to customers?

   ☐ First off ☐ 10 – 20% ☐ 30 – 50% ☐ 100% ☐ No Inspection

7. Does product move continuously between work stations?

   ☐ Moves continuously ☐ Moves most time ☐ Stops most time

8. What is your overall operation lead time?

   ☐ 0 – 0.5 day ☐ 1- 2 days ☐ 3-5 days ☐ More than 7 days

9. Are standard methods/procedures used to make products?

   ☐ Yes ☐ No

10. Do production operators receive formal training before working on production line?

    ☐ Yes ☐ No

11. Which of the following techniques are used to minimize opportunities of producing defects?

- ☐ One Piece Flow
- ☐ First In First Out (FIFO)
- ☐ GO-NO GO gauges
- ☐ First Off Check
- ☐ Statistical Process Control (SPC)
- ☐ Total Productive Maintenance (TPM)
- ☐ Error Proof (Poke Yoke)
- ☐ 100% inspection

12. What continuous improvement approach does your company use the most?

☐ Continuous ☐ Innovative ☐ Re-Engineering

13. Which of the following functions are strategically integrated in your company's TQM project? (Tick all those applicable):

- ☐ Manufacturing
- ☐ Quality
- ☐ Research & Development
- ☐ Human Resources
- ☐ Finance
- ☐ Marketing
- ☐ Purchasing
- ☐ Sales
- ☐ Logistics

14. What are the resources implications of implementing the improvement projects?

- ☐ New equipment
- ☐ New technology resources
- ☐ Training
- ☐ Materials

- ☐ Funding
- ☐ Additional man power
- ☐ Additional work hours
- ☐ Additional space

15. Please rate the following on a scale from 1 – 5 (1 is low and 5 is high) according to their significance as barriers for implementing TQM effectively in your company?
    a. Raw materials quality issues ☐
    b. Suppliers' delivery issues ☐
    c. Poor process First Time Through ☐
    d. High equipment setup time ☐
    e. Big batch sizes ☐
    f. Poor equipment reliability and maintenance ☐
    g. Fluctuating customer demand ☐
    h. Unavailability of skilled labour ☐
    i. Unavailability of transport infrastructure ☐
    j. Culture ☐

16. Which of the following manufacturing principles are you actually using? (Tick all those applicable)

- ☐ Pull system
- ☐ Total Productive Maintenance (TPM)
- ☐ Error Proofing (Poke Yoke)
- ☐ Total quality control
- ☐ Value Stream Mapping (VSM)
- ☐ Operator cross-training
- ☐ Standardisation
- ☐ Production Levelling (Hijunka)
- ☐ Cellular manufacturing

- ☐ Kanban
- ☐ Visual Management
- ☐ Small-lot sizes
- ☐ JIT deliveries from suppliers
- ☐ Supplier quality level
- ☐ Set Up Time Reduction (SMED)
- ☐ Product simplification
- ☐ Small-group activities
- ☐ Continuous improvement

17. Which ones of the TQM objectives have you achieved? Tick all those applicable:

Objective	Achieved
Cost reduction	☐
Lead time reduction	☐
Flexibility	☐
Customer satisfaction	☐
Quality improvement	☐
Space saving	☐
Inventory reduction	☐
Set Up Time Reduction	☐
Batch size reduction	☐

18. Do you see a need for improving TQM and CI?

☐ Yes ☐ No ☐ Don't Know

19. What do you think of a new TQM improvement methodology that combines benefits of CI?

☐ Good approach ☐ Bad approach ☐ Don't think it will make a difference ☐ Don't know

20. Do you think your company will be interested in using the new improvement methodology that combines TQM and CI?

☐ Yes ☐ No ☐ Will wait until success is proved.

21. How difficult do you think the following TQM/CI techniques to apply into your production? Please circle the number and rating the technique uing 1-5 scale 1=extremely difficult, 3=moderate difficulty, 5=not difficult at all, 0= don't know or not sure.

S.No	Technique	Rating
1	Value stream mapping	
2	Total productive maintenance (TPM)	
3	5S	
4	Set-up time reduction	
5	Mistake proofing (Poka Yoke)	
6	Kanban	
7	Standardization	
8	Pull	
9	Kaizen circle	
10	Takt time	
11	Heijunka	
12	Jidoka	
13	Just-in-time (JIT)	
14	Cell production	
15	U-shaped assembly line	
16	Quick changeover	

Thank you for taking part in this survey, your contribution and data you provided are important to us and will remain confidential.

A2 Survey Questionnaire

TQM AND ITS PERFORMANCE OF MANUFACTURING SMES :
STUDY OF TQM SUCESS FACTORS IN ARAB MANUFACTURING SMES

This is a survey to collect your views on the current practices on TQM after implementation of the proposed model in your organisation. Please spare few minutes to respond to the survey by simply rating (putting a tick mark) each statement. This will help us to identify areas where quality performance have been enhanced in your firm and where further improvements can be made.

Thank you for your response.

Company Name: ***Location:***

1. What is your job title?

(a) Operation Manager (b) Project Manager (c) Quality Manager (d) Supervisor/Engineers (e) Systems Engineering/Executives (f) Manufacturing Engineer

2. Approximate number of employees?

(a) Less than 100 (b) 101-200 (c) 201- 400 (d) 401 and above

3. When did your company start TQM program?

(a) 1-2 yrs (b) 2.1 -4 yrs (c) 4.1-6 yrs (d) 6.1 yrs and above

4. Do you see a need for improving TQM and its performance ?

☐ Yes ☐ No ☐ Don't Know

5. Which of the following functions are strategically integrated in your company's TQM project?

☐ Manufacturing ☐ Marketing/Sales ☐ Project ☐ Finance

☐ Purchase

6. What continuous improvement approach does your company use the most?

☐ Continuous ☐ Innovative ☐ Re-Engineering

7. What are the resources implications of implementing the improvement projects?

☐ New Technology/Equipment ☐ Extra Fund ☐ additional man power

☐ Training

☐ Additional space

8. Which of the following manufacturing principles are you actually using? (Tick all those applicable)

☐ Total Productive Maintenance (TPM) ☐ Total quality control ☐ Production Levelling (Hijunka) ☐ Just in Time/Kanban ☐ ISO /Internal Quality Audit ☐ 5 S

☐ Continuous Improvement ☐ Lean/ Six Sigma ☐ Setup time reduction

9. Which ones of the TQM objectives have you achieved? Tick all those applicable:

☐ Cost Reduction ☐ Lead time Reduction ☐ Customer Satisfaction

☐ Employee Satisfaction ☐ Inventory Reduction ☐ Wastage Reduction

☐ Space Saving ☐ Batch Size Reduction ☐ Flexibility

10. What do you think of TQM improvement methodology that combines benefits of improvement ?

☐ Excellent approach ☐ Good approach ☐ Bad approach ☐ Don't think it will make a difference ☐ Don't know

How important to you each of the following?		Not at all important	Slightly important	Important	Very important	Extremely important
	3. MANAGEMENT LEADERSHIP					
A1	Commitment and support of management	☐	☐	☐	☐	☐
A2	Communication link between employee and management	☐	☐	☐	☐	☐
A3	Empowering of employees by management	☐	☐	☐	☐	☐
A4	Provision of sufficient resources to TQM	☐	☐	☐	☐	☐

A5	Use of quality improvement tools & techniques					
A6	Promotion of staff & improvement activities					
	2 STRATEGIC QUALITY					
	ıanagement					
A7	Philosophy is at the heart of our organisation					
A8	Company has identified critical success factors					
A9	Company has identified critical processes					
A10	Company has identified the quality dimension of each key process					
A11	Company has appropriate measures in place for each key process					
	3 INTERNAL MEASURE					
A12	Internal customers' needs and expectations are known					
A13	Performance against standards for key					

	Processes is regularly evaluated					
	Statistical techniques are used to monitor					
A14	Performance of key processes					

4 QUALITY

MPORVEMENT SYSTEM

A15	Company has established and maintains a quality manual					
A16	Quality policy and quality objectives are documented					
A17	Internal audits are performed on the quality system					
A18	Senior management acts on suggestions to improve quality					
A19	Company uses customers feedback to improve product quality					
A20	Resources and activities needed to achieve quality objectives are identified and allocated					

5 TRAINING AND EDUCATION

A21	Conduct of employees training on TQM concepts	☐	☐	☐	☐	☐
A22	Provision of continuous learning through training & education	☐	☐	☐	☐	☐

6 WORK CULTURE AND ENVIRONMENT

A23	Provision of pleasant working environment	☐	☐	☐	☐	☐
A24	Adaptation of employee satisfaction initiatives (Suggestion Schemes, Profit sharing etc)	☐	☐	☐	☐	☐

TQM PERFORMANCE MEASURES

		Not at all important	Slightly important	Important	Very important	Extremely important
1.	**CUSTOMER SATISFACTION**					
B1.	Measuring & Monitoring level of customer satisfaction	☐	☐	☐	☐	☐

B2. Capturing customer requirement during product development & quality improvement

2. EMPLOYEE SATISFACTION

B3. Recognition of employees views & suggestions to improve quality

B4. Commitment & Enthusiasm of employees

B5. Use of self-assessment tools to identify and remedy weaknesses

B6. Expertise & knowledge of employees on quality concepts

3. SUPPLIER SATISFACTION

B7.Information sharing between supplier & Management

B8. Involvement of supplier in quality improvement

4. INVENTORY REDUCTION

B9.Average amount of Raw Material only Stock

B10. Average amount of Finished and semi finished only Stock

5. LEAD TIME REDUCTION

B7.Overall operation lead time					
B8. equipment Mean Time Between Failures (MTBF)					

Thank you for taking part in this survey. Your contribution and data you provided are important to us and will remain confidential.

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7 June 2016

Dear Aisha

Project Title:	**Quality Improvement Framework for Arab Manufacturing Companies Using TQM and Continuous Improvement Strategies**
Principal Investigator:	**Dr Subramaniam Arunachalam**
Researcher:	**Aisha Zwet**
Reference Number:	**EXP 1516 07**

I am writing to confirm that the application for the aforementioned proposed research study received ethical approval from the University Research Ethics Committee (UREC) on **Monday 6 June 2016.**

The decision made by members of the Committee is **Approved**. The Committee's response is based on the protocol described in the application form and supporting documentation. Your study has received ethical approval from the date of this letter.

Should you wish to make any changes in connection with your research project, this must be reported immediately to UREC. A Notification of Amendment form should be submitted for approval, accompanied by any additional or amended documents:
http://www.uel.ac.uk/wwwmedia/schools/graduate/documents/Notification-of-Amendment-to-Approved-Ethics-App-150115.doc

Any adverse events that occur in connection with this research project must be reported immediately to UREC.

Approved Research Site

I am pleased to confirm that the approval of the proposed research applies to the following research site.

Research Site	Principal Investigator / Local Collaborator
University of East London	Dr Subramaniam Arunachalam

Docklands Campus, University Way, London E16 2RD
Tel: +44 (0)20 8223 3322 Fax: +44 (0)20 8223 3394 MINICOM 020 8223 2853
Email: r.carter@uel.ac.uk

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Approved Documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
UREC application form	2.0	20 May 2016
Participant information sheet	2.0	20 May 2016
Consent form	2.0	20 May 2016
Survey	1.0	24 March 2016

Approval is given on the understanding that the UEL Code of Practice in Research is adhered to.

The University will periodically audit a random sample of applications for ethical approval, to ensure that the research study is conducted in compliance with the consent given by the ethics Committee and to the highest standards of rigour and integrity.

Please be aware it is your responsibility to retain this ethics approval letter for your records.

With the Committee's best wishes for the success of this project.

Yours sincerely,

Catherine Fleuilleteau
Research Integrity and Ethics Manager
University Research Ethics Committee (UREC)
Email: researchethics@uel.ac.uk

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