ADDIS ABABA UNIVERSITY
ADDIS ABABA INSTITUTE OF TECHNOLOGY (AAIT)

SCHOOL OF MECHANICAL AND INDUSTRIAL ENGINEERING
INDUSTRIAL ENGINEERING STREAM

Modeling the Integrated Impact of Total Quality and Knowledge Management on Production Efficiency: A Case of ASKU PLC Aquaddis Spring Water

By

Mekdes Ayalew

Advisor:

Gezahegn Tesfaye (PhD)

Co- Advisor:

Mulatu Tilahun (PhD Candidate)

A Master's Thesis Submitted to The School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for Degree of Masters of Science in Industrial Engineering Stream

October 2024

Addis Ababa, Ethiopia

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Title: Modeling the Integrated Impact of Total Quality and Knowledge Management on Production Efficiency: A Case of ASKU PLC Aquaddis Spring Water

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DECLARATION

I hereby state that the work being presented in this thesis, "**Modeling the Integrated Impact of Total Quality and Knowledge Management on Production Efficiency: A Case of ASKU PLC Aquaddis Spring Water"** is entirely original and my own work. It has not been submitted for credit more towards a degree from any other university, and all sources of information used in the writing for this thesis have been duly acknowledged.

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ABSTRACT

This study required to modeling the Integrated Impact of Total Quality Management and Knowledge Management on Production Efficiency on ASKU PLC'S Aquaddis spring water production efficiency. Aligning TQM with Knowledge management involves creating a holistic approach that emphasizes shared goals, employee engagement, continuous improvement, and effective knowledge sharing. By integrating these practices, organizations can enhance their production efficiency. The study adopts descriptive research method. While analyzing the problem, both qualitative and quantitative research method are utilized. The main tools of data collection are questionnaires and interviews. The quantitative data collect through questionnaire analyzes by creating and practicing of inferential statistics using SPSS version 20 software. The performance measurement variables and their effects on production efficiency dimensions are analyzed by involving appropriate parametric statistical methods to determine the level of association and degree of relationship based on the distribution of the collected sample data. The results of the study show a positive and strong correlation between integrated knowledge management and total quality management and overall production efficiency. The research contributes to the body of knowledge by analyzing the effects of knowledge management integration along with quality management ideas, which are helpful for increasing production efficiency. Therefore, the researcher highlights the problems involved in a very weak customer focus, employee involvement and integrated system, continuous improvement and other related activities that have to do with a production efficiency. In order to examine the links between dependent and independent variables correlation analysis was performed. The correlation matrix showed that all independent variables had positive coefficients of correlation and significantly correlated with the dependent variable. Further regression analysis was also conducted and results revealed that all the independent variables contribute to statistically significant level at (p-value = 0.001). When effectively combined, these two management practices create a powerful synergy that enhances production efficiency. Limits of the current research sample size the sample is too small, it might not be representative of the broader population, leading to issues with the generalizability of the results. Future studies should aim to include larger and more diverse populations to enhance the generalizability of the findings.

Key Words: *Total Quality Management, knowledge management, production efficiency, Integration, Aquaddis Spring Water*

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ACRONYM

TQM - Total Quality Management

KM - Knowledge Management

SPSS - Statistical Package for the social sciences

ABIG - Asku & Berhane's investment group

EBMIA - Ethiopian Beverages Manufacturing Industries Association

CHAPTER ONE

1. INTRODUCTION

1.1. Background and Research Justification

Total Quality Management (TQM) is an approach to the art of operation that began in Japanese sedulity in the 1950's and has come steadily more popular in the west since the early 1980's. The thing of producing a quality product led to the creation of the TQM conception, which ultimately involved every part of the company (Mustapha et al., 2011). Accordingly, in 1950s the proposed conception was officially presented to the company top operation, which has enabled the assiduity to move toward an advanced artificial advancement (Mustapha et al., 2011; Nur et al., 2016). TQM is a gospel that's significantly been honored for advancement in quality responsibility but it's primarily been employed in a massive company and many for small and medium associations (Azmi et al., 2016; Limpiada, 2016). In this time of globalization, with the serious competition, it's veritably grueling for a pot to survive (Alawag et al., 2020). TQM is a process of allowing about objects, companies, procedures, and people in order to make sure that the right effects are done right the first time. TQM is one element of the operations enhancement procedures, which are concerned with all angles of an operation's performance and enhancement in addition to quality. The thing of TQM is to hold each party responsible for the whole standard of the finished good or service (Sadikoglu & Zehir, 2010). Client determines whether your products are of a high quality under TQM. Client feedback is largely valued since it enables a business to further completely comprehend the requirements and specifications for the product process. Continuous improvement also fuels and strengthens a company's competitive advantage over other businesses of comparable size.

According to Jote, Getenet Entele (2020) Started with the examination generality, it's moved to the quality control generality, when it was realized that making the examination department responsible for the quality would be less productive. TQM are clearly involves an understanding and implementation concept of quality management, in every aspect and area of organization (Permana et al., 2021).Concept of quality control emphasizes tone- examination and applicable systems to assure quality by relating defectives and barring them. Subsequently the generality of quality assurance came in to practice. But the quality movement did not stop with this and the attempt is to continuously meliorate the quality and assure advanced and advanced morals of quality, offer better products and services to the customer. It was felt that quality was not only the job of quality control department but

also of other departments like deals, procurement, material handling, account, artificial relations, design, product, auguring, marketing, stores and after deals service. Thus quality is the responsibility of all the workers. The workers should run the system; directors should design and meliorate the system; while the top operation should give leader boat and team spirit. Total Quality Management (TQM) contributes to expanding employee empowerment. Increase personnel training and skill levels. Workers feel more appreciated. Naturally, whole quality management will benefit product customers by resulting in higher-quality items. Because the business attends to their demands, customers feel more taken care of. Preserve client satisfaction. TQM forces businesses to concentrate on what the market demands, motivates workers to give their best effort in every task, channels the procedures that are crucial to achieving superior results, helps to continuously test all processes to eliminate unnecessary and ineffective items, helps businesses truly understand the competition and create an effective war strategy, and helps to set up good communication procedures and reward good work. TQM helps to review what processes are needed to build a continuous development strategy (Brata & Soediantono, 2022).

Knowledge management is defined as the process of creating, identifying, and managing knowledge of an organization and structuring it for effective and efficient use among its employees and teams(de Bem Machado et al., 2022). Knowledge is one of the most valuable assets for most organizations. There are two main types of knowledge (Olubunmi, 2015): tacit and explicit. Tacit knowledge is the subjective and experience-based knowledge that cannot be documented, and typically remains only in people's minds. This type of knowledge depends on personal experience and involves intangible factors such as beliefs, perspectives, values and intuition. Tacit knowledge covers knowledge that is unarticulated and associated to the senses, movement skills, physical experiences, intuition, or implicit rules of thumb. Even if we try hard, this type of knowledge cannot be fully articulated. Explicit knowledge, in turn, represents the objective and rational knowledge that can be documented, and, thus can be accessed by multiple individuals. Explicit knowledge can be uttered and captured in drawings and writing, and can be easily used and shared. The concept of ''knowledge conversion'' explains how tacit and explicit knowledge interact along a continuum (Olubunmi, 2015). Knowledge management is the source of organizational achievement and a significant source in empowering businesses to produce innovative goods and services as well as grow new-markets and bringing sustainability in companies (Abbas et al., 2020). Successful organizations now understand why they must manage knowledge, develop plans as to how to accomplish this objective and devote time and energy to these efforts. This is because KM has been described as a key driver of production efficiency (Desouza & Paquette, 2011).

Productivity definition applies in an enterprise, a sector of economic activity or the economy as a whole. The term "productivity" can be used to assess or measure the extent to which a certain output can be extracted from a given input (Kanawaty, 1992). Productivity has been generally defined as the ratio of an extent of output to the unit of all of the resources used to produce this output. Operational efficiency is used as an indicator that reveals the level of effectiveness in using production resources such as raw materials and supplies, manpower, land, building, machine, equipment and energy. As is known, the production process uses other production inputs besides manpower. Hence, knowing efficiency levels of other inputs, which determines relationship between these inputs and production, as well as manpower, and observing trends of these inputs under various conditions and replacing one or several of these inputs by changing their qualities and quantities enable businesses to achieve the maximum level of production through the optimum input combination (Dogan & Fausten, 2003). The economic growth of a country is usually measured by its increase in production or the gross domestic product (GDP), which comes from two sources: a larger quantity of production factors used (inputs) and/or an increase in productivity. Productivity is therefore considered to be a component of growth (Galarneau & Dumas, 1993).

The idea efficiencies, in a broad sense used to characterize the use of resources, i.e. efficiency is a statement about the performance of processes converting a set of inputs into a set of outputs. Efficiency is a relative concept, meaning that an economic unit's performance needs to be measured against a reference. Setting a standard necessitates making value judgments regarding the goals of economic activity.

Effective TQM results in greater customer satisfaction, fewer defects, less waste, reduced costs, improved profitability and increased production efficiency (Garc á-Bernal & Ram írez-Ales ón, 2015). or the effectiveness of TQM programmer a careful analysis of the customer’s needs, and an assessment of the extent to which these needs are currently met, and a suitable plan to fill up the gap between the current level and expectation is necessary. For the success of TQM, top managers must provide vision mission and, reinforce values emphasizing quality, set quality goals, and deploy necessary resources for these quality programs. For this purpose, training and development free flow of information is essential. The top managers must continuously monitor, evaluate, get feedback about TQM program and take necessary steps for its improvement. Integration of Knowledge Management (KM) into the implementation of Total Quality Management (TQM) provides several key advantages that can enhance the effectiveness and sustainability of quality initiatives within an organization. The main objective of this study is to Modeling the Integrated Impact of Total Quality Management and

Knowledge Management on Production Efficiency. The past literature about the link between integrated TQM practices and knowledge management and organization performance gives contradictory results. So the purpose of this study is to develop a conceptual framework and a research model of Integrated Impact of Total Quality Management and Knowledge Management on production efficiency of case company.

The usage of treated and bottled water has been rising quickly as a result of the Ethiopia's urban population lifestyle changing; Due to this around 104 factories are involved in the production of mineral water, according to the EBMIA since 1999 first bottled water Highland springs was introduce in Ethiopia. One of the companies managed by ABIG management Services PLC is ASKU PLC. The leadership of ASKU took the strategic choice to consistently invest in guaranteeing the company's long-term future and market dominance, as is most prominently demonstrated by its vertical integration with the sister companies that supply its major manufacturing inputs. Due to this, the company has expanded and risen to the top of the bottled water market, controlling an extremely competitive niche while continuing to innovate and shape market dynamics. One of water brand in is Aquaddis, which is produced by ASKU and distributed all throughout the Ethiopian nation. It's largely regarded for its excellence and chastity. Also, ASKU is the sole ballot bottler for all RC brands for RC Cola International. Also, it creates and distributes a range of flavors of the celebrated Ethiopicana Juice. ASKU PLC produces it in 5 main SKUs (Stock Keeping Units) that are aimed at colorful request niches with is0.3 liter, 0.6 liter, 1 liter, 1.5 liter, 2 liter and 20 liter.

1.2. Problem Statement

The manufacturing sector is currently facing a significant challenge due to a shortage of skilled labor, which is affecting productivity, innovation, and overall competitiveness within the industry (Lin et al., 2023). One of the top reasons impacting the capability to retain youngish workers to manufacturing is the negative diligence perception (Sadikoglu & Zehir, 2010). Given this data, it is safe to predict that labor shortage will continue to be a bottleneck for manufacturers. According to (Alzoubi et al., 2022) the challenges manufacturing industry face customer satisfaction in the manufacturing industry is a complex interplay of quality, responsiveness, cost, and ethical practices. All this problem impact production efficiency

Furthermore, the case company is dealing with the following significant issues: They have an unplanned changeover, an unskilled labor force with limited experience, a high valid other stoppage (VOS), they are not meeting market demand, they are producing below their full capacity, they lack a

mechanism to gather feedback from customers, and they lack a long-term relationship with their suppliers and customers.

This shows they have a very weak customer focus, employee involvement and integrated system and they did not meet their common goal. These results the decreases production efficiency and market share. Using data from the company's most recent operational records, a report on the yearly production performance from 2021 to 2023 is presented. Output in 2021 was 38.5%, 2022 was 41.9% and 2023 was 61.3% .b/c of lower market demand the company loss in 2021 was 41.9%, 2022 was 19.7% and 2023 was 18.9%. (Case company budget year performance summary report, 2021-2023). Limited market demand is the highest proportion of the total percentage from non-production causes while highlighting the value of excellence in quality and performance as a worldwide competitive advantage, it honors organizations for their accomplishments in these are as a result.

Although Total Quality Management (TQM) is a complete method that can improve organizational performance and cultivate a continuous improvement culture, its practical application remains a challenge for many businesses. Organizations' capacity to accomplish continuous improvement is hampered by a lack of clear understanding of the precise variables that influence effective implementation of Total Quality Management (TQM), including employee involvement, leadership commitment, training, and the integration of quality tools and processes. The gap between TQM theory and its practical implementation as a result causes employees to become disengaged and organizations to perform below ideal levels.

After completion of this research the researcher indicate a positive and strong correlation between overall production efficiency of a case company and the integrated of following total quality management principles: "Customer Focus, Leadership, Engagement of People, Process Approach, Continuous Improvement, integrated system, Fact-Based Decision making, Relationship Management"; and knowledge management.

1.3. Research Questions

The research highlighted the following research questions for further clarification and investigation after taking into account the real-world issues that occurred in the factory and examining the literature:

I. How does the integration of Total Quality Management (TQM) practices influence production efficiency at ASKU PLC’s Aquaddis spring water facility?

II. What role does knowledge management (KM) play in enhancing the effectiveness of total quality management initiatives within the production processes at ASKU PLC?
III. What is the relationship between the combined implementation of TQM and KM strategies and overall production efficiency metrics at ASKU PLC's Aquaddis spring water production?

1.4. Research Objective

1.4.1. General Objective

The general objective was to evaluate the integrated impact of total quality management (TQM) and knowledge management (KM) on the production efficiency of Aquaddis spring water at ASKU PLC.

1.4.2. Specific Objectives

Specific objective was supposed to be:

I. To analyze the current TQM practices implemented at ASKU PLC and their effects on production processes and outputs.
II. To assess the existing knowledge management system within ASKU PLC and their contribution to enhancing production efficiency.
III. To examine the relationship between employee engagement in TQM and KM initiatives and overall production efficiency at ASKU PLC.
IV. To identify barriers to effective integration of TQM and KM practices in the production environment of Aquaddis spring water and propose strategies for improvement.

1.5. Scope and Limitation of the Study

The scope of the study was on modeling of the impact of integrated Total Quality Management and Knowledge Management on the production efficiency of the Aquaddis water bottling company. The Aquaddis water bottling company was chosen for the study's scope since the researcher has close information about the company operational trends and also finds practical problems that need further research. The study mainly focuses on continuous integration of quality improvement processes with the effective management of knowledge within an organization, including and most of the operation process incurred in this process. When the experiment was conducted, there was a limitation in selecting all the contributing factors for high production efficiency and the degree of their impact on the response variables. This was due to lack of reliable measurement in the plant operation during the data collection period and some of the measuring devices were not properly functional. The data used for the study also limited to the operational records from July 2021 to June 2023. Therefore, the researcher has

intended to apply on enhancing processes, reducing waste, and fostering a culture of continuous improvement through integrating Total Quality Management (TQM) with Knowledge Management (KM) to the production process in a bounded time frame.

1.6. Significance of the Study

The goal of the study was to find a practical solution for the case company's issues with Aquaddis production efficiency and competitiveness in the water bottling sector. The output of this research was supposed to highlight the comprehensive importance of integrating total quality management ((TQM) and knowledge managements (KM) in achieving organization efficiency and excellent. , based on the research findings. Both approaches share common goals focused on continuous improvement, customer satisfaction, and overall performance enhancement. By leveraging their interactions, organizations can create a more holistic approach to quality and knowledge, fostering a culture of continuous learning and improvement. Additionally, it will serve as a reference point for future research projects in the field of productivity through integrated Total Quality Management and know lead management.

Additionally, the research has substantial benefits for both the scientific community's ongoing research on the subject as well as the case firm, which is typically brought in to develop those methods that circle around an area of specific competency to the firm.

In order to get a comprehensive picture of how theoretical and engineering principles are useful in the real practice of companies, the study also used a variety of parties. TQM and KM can have a significant and positive impact on organizational and personnel development. By integrating the strengths of both models, organizations can foster an environment of continuous improvement, enhanced customer satisfaction, and a commitment to quality that drives long-term success.

1.7. Organization of the Research

There are six components to the research. The Background and Research Justification, problem statement, research questions, research objectives, scope and limitations, and significance of the study are all included in the first section, the introduction. It explains the company's issue with low production efficiency, provides an introduction to TQM and KM, purpose, and scope of the research. A thorough literature review, a gap analysis, and definitions of terms that illustrate the combined effects of knowledge management and total quality management on production efficiency are included in the second. The research design, methodology, data sources, and collection form the third section. In the fourth part, the collected data be analyzed using the appropriate and selected method of data analysis and the findings of the research were discussion. In the fifth part is conclusion, recommendation of the

research and further study, in this part of the research integrated TQM and KM is , leading to improved production efficiency, enhanced quality, and a stronger competitive position in the marketplace. The six parts reference appendix.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Introduction to the Literature Review

This literature review offers an overview of the existing knowledge concerning the factors and challenges that influence production efficiency. It explores various approaches and techniques that aim to address these challenges. Additionally, the literature review presents a systematic argument advocating for TQM and KM as the most effective technique among them. However, it is important to note that, like any other technique, TQM principles cannot fully address all aspects of production efficiency. This limitation is inherent to any individual approach. As a result, the literature review identifies gaps in the existing literature regarding the impact of TQM principles on production efficiency. To bridge this gap, a new perspective from knowledge management aspects are introduced. This section of the research then develops hypotheses that will be tested in the results and discussion section of the study.

2.2. Definition of Key Terms

Total Quality Management (TQM) is an integrated management philosophy aimed at continuously improving the quality of products and process to achieve better customer satisfaction and production efficiency. TQM has been well accepted by managers and quality practitioners as a change management quality approach (Luthra et al., 2020).

Knowledge Management (KM) is "the process of capturing, organizing, and storing information and experiences of workers and groups within an organization and making it available to others (Masa'deh et al., 2016a). Knowledge management is also defined as a set of activities organized by which is to find the best combination and linking of information and intellectual resources, by entering a room focused and complex operations, which include access to the underlying and the implicit of the human mind knowledge and turn it into knowledge of the phenomenon can be stored and shared with beneficiaries, and then apply the best, to be the competitive ability of the organization (S. Frey, 2016).

Product Efficiency The concept efficiencies, in a broad sense used to characterize the utilization of resources, i.e. efficiencies a statement about the performance of processes transforming set of inputs into a set of outputs. Efficiencies a relative concept: the performance of an economic unit must be

compared with a standard. Establishing a standard involves value judgments about objectives of economic activities (Førsund et al., 1974).

Customer Satisfaction is defined as a measurement that determines how happy customers are with a company's products, services, and capabilities. These include: expectations about product performance, absolute product performance, performance relative to expectations (disconfirmation level), performance level experienced during previous consumption episodes, and performance level of and expectations about competitive offerings. A closely related concept perceived service quality is also strongly associated with CS. In general, service quality is equivalent to service performance, and can be viewed as an input to CS. (Mittal & Frennea, 2010)

Integration is defined in engineering as the process of bringing together the component sub-systems into one system (an aggregation of subsystems cooperating so that the system is able to deliver the overarching functionality) and ensuring that the subsystems function together as a system. Product and production plans into components, components into sub-systems, sub-systems into systems, and systems into a quality product. We define the product development integration problem as the challenge to coordinate the engineering activities at each level in order to achieve an integrated system in the final product.

Impact is assessed alongside research outputs and environment to provide an evaluation of research taking place within an institution. The oxford English dictionary defines impact as a 'Marked effect or influence', this is clearly a very broad definition. As such research outputs, for example, knowledge generated and publications, can be translated into outcomes, for example, new products and services, and impacts or added value. (Haux, 2018)

2.3. Factors and Challenges Impacting Production Efficiency

Product effectiveness indicates how much a product unit manufactures with the given significant of resources. Measuring and tracking product effectiveness enables manufacturers to identify backups, optimize processes, and improve their overall productivity and profitability.

Effectiveness plays a pivotal part in the product process as it directly impacts the overall productivity and profitability of a business. In simple terms, effectiveness refers to the capability to maximize business while minimizing input. This can be achieved by optimizing resources, reducing waste, and streamlining operations.

Factors and challenges that can impact product effectiveness in a manufacturing or product setting can be multitudinous and varied. Then are some of the most common bones outfit trust ability and conservation Unreliable outfit or shy conservation can lead to time-out, reducing product effectiveness. Pool productivity inefficient workflows, shy training, or lack of provocation can lead to reduced productivity among workers.

The impact of technological investments on companies' production efficiency has been significant across various industries. These advancements can transform processes, improve output, reduce costs, and enhance overall productivity. The impact of technological investments on companies' production efficiency is multifaceted, driving improvements in speed, quality, and cost-effectiveness. While the initial investment may be significant, the long-term benefits often outweigh the costs, leading to better competitiveness and sustainability in a rapidly evolving market landscape (Novotn áet al., 2021).

Material quality and vacuity Poor quality accessories or force chain dislocations can cause detainments and inefficiencies. Process complexity and variability Complex processes or variable workflows can lead to crimes, rework, and dropped effectiveness. Information technology and systems shy technology, software, or data operation systems can hamper product effectiveness. Scheduling and planning Inefficient scheduling or planning can lead to backups, overtime, and dropped productivity. Force operation Poor force operation can lead to stock outs, overstocking, or inordinate force situations. Supplier performance Poor supplier performance, similar as late deliveries or quality issues, can impact product effectiveness; Environmental and safety factors Environmental enterprises, similar as pollution or waste operation, and safety issues can impact product effectiveness; Quality control and examination icing quality products while maintaining effectiveness can be grueling; Hand engagement and provocation Maintaining hand engagement and provocation is essential for maintaining high product effectiveness.

2.4. Analysis of the Various Techniques for Production Efficiency

Globalization, growing market competition, more complex products and fluctuating customer demands require efficient operation of production processes; therefore, the enterprises have to focus on cost reduction and production efficiency improvement.

This research study is very important and actual, because the production efficiency improvement and the cost reduction are very important for manufacturing industry in order to increase competitiveness.

There are various techniques impacting of production Efficiency. Application of production efficiency improvement methods leads to the improvement of KPIs (Key Performance Indicators), For example, there will be improvements in lead time, productivity, resource utilization, and operational costs (Trojanowska et al., 2018).

Over the years, many techniques that impact production efficiency have been offered. The most often used approaches for improvement include layout design, lean production (LP), and total quality management (TQM) (Hossain et al., 2014).

2.4.1. Facility Layout Technique for Production Efficiency

The definition of facility layout may be given as the arrangement of machinery and flow of materials from one facility to another. It minimizes the material handling costs, while considering any physical restrictions on such arrangement (Kovács & Kot, 2017; Tompkins et al., 2010).

The Facility Layout Problem (FLP) is relating to location of objects (e.g. machines) on a site and the material flow between these objects. Reasons for application of layout design in the production, resources (raw materials, humans, machines, etc.) are always limited. It is very important for the manufacturing companies to produce the cost-effective products which can be manufactured at the minimized production cost and higher effectiveness.

The most important reasons of design/redesign of facility layouts are the continuously fluctuating customer demands, product variety, production volume which can result in a wrong utilization of space, machines, workers, etc. (Cselényi & Illés, 2006; Zhang et al., 2011).

The optimal facility layout provides higher utilization of resources and cost reduction (Telek, 2013; Hossain et al., 2014).

Advantages and disadvantages of the facility layout design

Application of facility layout design for process improvement has many advantages and disadvantages.

Advantages of facility layout design:

Effective facility layout can reduce significantly the operational costs of the company.

Adequate facility layout can result the improvement of the performance of production lines.

Optimal layout results in the improvement of a lot of KPIs.

Disadvantages of facility layout design:

Only some layout alternatives are evaluated, not all of the possible alternatives.

Mathematic expertise and competences are required.

It is often computationally intensive and time consuming.

2.4.2. Lean Production Technique for Production Efficiency

Lean Production is an integrated socio-technical system whose main objective is to eliminate waste by on currently reducing or minimizing supplier, customer, and internal variability (Shah & Ward, 2007).The main concern of Lean Production design is to eliminate waste. The main desire is to reduce the production cycle and this would be accomplished by the elimination of waste. Lean also has a focus on retaining tasks that add value, and eliminating non-value adding tasks. Other concepts having to do with time and waste are important to Lean Production. Lean Production is normally driven by customer demand. This brings up the point about what the driver of a business process should be. NIST (2000) defines Lean: "as a systematic approach to identifying and eliminating waste through continuous improvement, following the product at the pull of the customer in pursuit of perfection". Among the several quality management concepts that have been developed, the Lean concept, as in Lean Production, and so on. Moreover, Lean principles are basically customer value driven that makes them suitable for many manufacturing and sharing conditions. Five basic principles of Lean Production are generally known: (Bidewell & Sapsford, 2015)

Customer value - Only what the customer's remark as value is important.

Value stream analysis -Having understood the value for the customers

Flow - Focus on organizing a continuous flow through the production

Pull - Demand chain management prevents producing commodities to stock

Perfection - A process of continuous improvement to eliminate of non-value-adding elements

In general, the lean theories focus primarily on the internal processes of the company to reduce development time and reduce wasted resources.

2.4.3. TQM Technique for Production Efficiency

TQM is a management manufacturing strategy. The purpose of TQM is to increase awareness of quality in all parts of the organization's processes. TQM is an integrated management philosophy and a set of practices that promotes an organization-wide focus on quality starting with top management, but involving workers at all levels of the organization. The major objective of TQM is the development of a business strategy that harnesses all of the company's resources to achieve world-class quality at reasonable costs. (Koc, 2011)

In the end, an interesting part of the TQM concept is that quality awards are offered by different foundations such as Deming Price, European Foundation of Quality Management (EFQM), and Malcom Baldridge and so on. The concept of TQM can give competence, so benchmarking could be used to accomplish this with critical success factors: Top management commitment, Suppliers quality management, Human resources management, Process management, Customer focus, Role of quality department , Product design, Quality information system and use of IT, Training, Quality citizenship. (R. Anvari et al., 2012)

In order to improve their organizational effectiveness, organizations must compete. Producers face challenges in meeting the ever-increasing demands of consumers due to the fact that customers have choices in the goods and services they demand. The increased concern of many stakeholders and their accompanying interests, influences, and requirements also results in an increase in operational performance dimensions. To address these problems and preserve businesses' growth and competitiveness, a number of concepts, related systems, methods, and methodologies have been developed. Among these several concepts, quality concept is one. “Meeting customers’“ requirements” is the simplest definition of quality concept. But quality is more than just a notion, which is why it's critical to have TQM procedures in place to ensure that the organization's internal and external operations are both run smoothly. In today's rapidly changing world, the significance of accurate weather forecasts cannot be overstated. Similarly, in the business environment, the significance of Total Quality Management and its impact on production performance cannot be overstated (Aziz & Morita, 2016). Implementing Total Quality Management in organizations can lead to improved production efficiency. The linkage between total quality management and production efficiency has also been investigated by many researchers. According to (Jaafreh & Al-abedallat, 2012), empirically examined the extent to which quality management practices and production efficiency are correlated and how total quality management practices impacts on production efficiency.

2.5. The Impacts of TQM Principles on Production Efficiency

Organizations worldwide have recognized TQM (Total Quality Management) as a means for business excellence (Sinha et al., 2016). Several businesses from various countries have increased their competitiveness by sticking to TQM principles. Implementation of TQM principles could well be a key to improve firm performance and thus attain competitive advantage. To what extent TQM has been implemented and what are the quality principles that actually promote performance (Sinha et al., 2016). Firms should improve employees’ involvement/commitment/awareness to TQM, enhance firm

structure, and provide resources to overcome the barriers that prevent effective implementation of TQM practices (Samson, 2017). The improvement of total quality management not aimed at a specific area or case, but it stretches, covers, and analyses all process of a system.

The primary components that ensure TQM application are its guiding principles. Based on the findings, it revealed that there is a significant positive relationship between all the functional measurements of TQM practices. TQM is essential for manufacturing business performance. In the present study, TQM has been conceptualized in terms of quality management principles from ISO 9001:2000. The total quality management principles (TQMPs) on which ISO 9001:2000 standard are based are: (1) Customer Focus (2) Leadership (3) Engagement of People (4) Process Approach (5) Continuous Improvement (6)Integrated system (7) Fact-based Decision Making and (8) Relationship Management (Sinha et al., 2016) .

Customer Focus

Customer focus is a fundamental to the TQM philosophy of management for the continuous improvement of products and services of quality in order to achieve higher level of production efficincy and competitive advantage (Ashraf et al., 2012).

The primary focus of quality management is to meet customer requirements and to strive to exceed customer expectations.Sustained success is achieved when an organization attracts and retains the confidence of customers and other interested parties on whom it depends. Every aspect of customer interaction provides an opportunity to create more value for the customer. Understanding the current and future needs of customers and other interested parties contributes to the sustained success of an organization. Key Benefits is an increase in customer value, increase in customer satisfaction, improvement in customer loyalty,It enhances in repeat business,It enhances in reputation of the organization, There is an expansion of the customer base, and There is an increase in revenue and market share. (Sinha et al., 2016). Providing excellent customer service keeps consumers happy and can make a big difference in your operations.

Way to provide outstanding customer service.

Customer requirement

Aware about your customers

Customer visit program

Feedback on quality and delivery

Measures customer satisfaction of external customer

Leadership

All levels of leaders set a common goal and direction and develop an environment where employees are motivated to work toward the organization's quality goals.

The creation of unity of purpose, direction, and engagement enables an organization to align its strategies, policies, processes, and resources to achieve its objectives. Key Benefits is It increases the effectiveness and efficiency in meeting the organization's quality objectives, There is better coordination of the organization's processes, There is an improvement in communication between levels and functions of the organization and It strengthens and expands the organization's and its members' capacity to produce the intended outcomes (Sinha et al., 2016).

Engagement of People

Everyone in the organization must be capable, empowered, and committed to providing value. People who are engaged, empowered, and competent at all levels of the company improve its capacity to generate value.

Respecting and involving people at all levels is essential to the effective and efficient management of a business. Acknowledgment, empowerment, and improvement of abilities and expertise encourage individuals to participate in accomplishing the goals of the company. Key Benefits is It improves understanding of the organization's quality objectives by people in the organization and increased motivation to achieve them (Sinha et al., 2016).

Process Approach

When tasks are viewed and handled as linked processes operating as a cohesive system, consistent and predictable outcomes are produced more successfully and economically.

The procedures that make up the quality management system are interconnected. Gaining an understanding of the system's output, including all of its controls, relationships, processes, and resources, enables the organization to maximize efficiency. Key Benefits is It enhances the ability to focus effort on key processes and opportunities for improvement (Sinha et al., 2016).

Continuous Improvement

Successful organizations have an ongoing focus on improvement.Improvement is essential for an organization to maintain current levels of performance, to react to changes in its internal and external conditions and to create new opportunities. Key Benefits is There are improved process performance, organizational capability, and customer satisfaction (Sinha et al., 2016).

Fact-based Decision Making

Decisions based on the analysis and evaluation of data and information are more likely to produce desired results. Key Benefits is an improvement in decision-making processes, an improvement in the assessment of process performance and ability to achieve objectives, an increased ability to review, challenge and change opinions and decisions, and an increased ability to demonstrate the effectiveness of past decisions (Sinha et al., 2016).

Integrated system

Although an organization may consist of many different functional specialties often organized into vertically structured departments, it is the horizontal processes interconnecting these functions that are the focus of TQM (Selmer, 2013).

Micro-processes add up to larger processes, and all processes aggregate into the business processes required for defining and implementing strategy. Everyone must understand the vision, mission, and guiding principles as well as the quality policies, objectives, and critical processes of the organization. Business performance must be monitored and communicated continuously.

Every organization has a unique work culture, and it is virtually impossible to achieve excellence in its products and services unless a good quality culture has been fostered. Thus, an integrated system connects business improvement elements in an attempt to continually improve and exceed the expectations of customers, employees, and other stakeholders (Sinha et al., 2016).

Relationship Management

For sustained success, organizations manage their relationships with interested parties, such as suppliers.

Interested parties influence the performance of an organization. Sustained success is more likely to be achieved when an organization manages relationships with its interested parties to optimize their impact on its performance. Relationship management with its supplier and partner network is often of particular importance (Sinha et al., 2016).

2.6. The Challenges as in the TQM Implementation

Total Quality Management (TQM) is an organization-wide approach aimed at continuously improving the quality of products, services, and processes. While the principles of TQM can lead to enhanced efficiency, customer satisfaction, and business performance, implementing TQM is fraught with challenges. Here are some key challenges that organizations often face when trying to implement TQM:

Throughout the case study, the researcher encountered certain expected difficulties and problems. However, the remarkable difficulties are shown below:

Quality definition: Most of the factory workers don't have the clear idea about what is quality and what should they do to ensure the customers' expectation (Ngwenya et al., 2016).

Commitment: commitment is one of the most important critical successful factors in the adoption of TQM framework. But the poor commitment of top management has been found as a challenge and a barrier against continuous improvement. At the same time, the researcher believes that such commitment should not be limited to the top management only, but everyone in the organization, all of whom ought to be committed to the implementation of TQM principles (Al-Maamari et al., 2021).

Culture: The researcher has found that the ongoing traditional culture of the organization or factory is one of the most remarkable challenges faced while adopting TQM framework. Everyone is set to the existing culture (Aziz & Morita, 2016).

In general, the TQM implementation in the firms of developing countries has been taking place without understanding and applying the concepts of knowledge management concepts.

2.7. Knowledge Management as an Enabler for TQM

"A firm's competitive advantage depends more than anything on its knowledge: on what it knows-how it uses what it knows – and how fast it can know something new." – HR Magazine 2009.

Knowledge is described as an essential part of KM. (Olubunmi, 2015) say that without having knowledge to manage, there would be no knowledge management. Knowledge basically refers to a collection/or a body of information. This could mean that the information is embedded in the form of theories, processes, systems, or it could be voiced in form of opinions, theories, ideas and analysis. Knowledge is a complex concept that attracts 4 many philosophers, researchers of other disciplines, and practitioners. Thus, in order for companies to fully benefit from the value of knowledge, proper management and utilization of knowledge is essential. Effective knowledge management requires consideration of four essential elements: People, Processes, Technology, and Knowledge (KP2T) (Desouza & Paquette, 2011) . In essence, the focus of KM is to connect people, processes, and technology for the purpose of leveraging knowledge.

The participation incompetent knowledge is an advantage for achieving success (Masa'deh et al., 2016b). Hence, great attention must be given to proper methods of knowledge management; KM is just like the absolute knowledge, difficult to define (Al-Busaidi et al., 2010). The proper definition of knowledge must involve an agent, who uses knowledge to perform the necessary actions to reach a goal (Obeidat et al., 2016). Knowledge must be evaluated according to decisions and actions which will lead to achieving success (Davenport, 1998). However, as mentioned before, defining what involves knowledge management may be easier than defining knowledge in general.

The subject matter of management provides us a starting point when considering, for instance, the activities which make it successful, explaining the processes of innovation or showing its main goals and objectives without the need to define what is understood by knowledge. However, in literature there are many ideas and definitions for KM than just on the absolute knowledge, although these definitions are not always clear as there are many terms related to the concept. KM is a significant factor for organizations to make sound decisions about how and when to come up with new acknowledges and utilize it in its activities (R. S. Frey, 2002). Accordingly, the role played by knowledge management through operations and practice achieve great results in the regulatory area as being the factors which enrich and enhance productivity (Shannak et al., 2012).

The number of definitions for knowledge management which researchers have come up with reflects their views toward the way they conduct their activities. Knowledge management deals with any intentional set of practices and processes designed to optimize the use of knowledge, in other words, to increase allocative efficiency in the area of knowledge production, distribution and use (Garg et al., 2018). Also knowledge management is "the process of capturing, organizing, and storing information and experiences of workers and groups within an organization and making it available to others (Masa'deh et al., 2016a). Knowledge management is also defined as a set of activities organized by which is to find the best combination and linking of information and intellectual resources, by entering a room focused and complex operations, which include access to the underlying and the implicit of the human mind knowledge and turn it into knowledge of the phenomenon can be stored and shared with beneficiaries, the best, to be the competitive ability of the organization (S. Frey, 2016) (Cheung et al., 2013) view the concept of KM from the perspective of the customer service management, as has been represented in the form of a pyramid of three layers: First layer: data assimilation and public information services which provide services to customers on the data and information form, any knowledge of the phenomenon of support for the decisions they make, as in most of the banks. The second layer: Consulting services which provide customers with advisory services with proposed

solutions to the problems, and use knowledge-based industrial in the system design systems. The third layer: knowledge and service managers and no experience in organizations that provide their customers experience, and specialists here have to keep up that business developments, and the ongoing work of the quality of service improvements.

Although knowledge is a complicated concept to be defined and measured, the definitions of knowledge range from conceptual to practical and from narrow to broad (Masa'deh et al., 2016b) Then knowledge will be defined as truth, beliefs, personal experience, information, and data (Losee, 2014). The concentration in this study is on the definition that covers the most aspect of knowledge which defines knowledge as "a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information" (Thakur, 2013). Olubunmi, (2015) assumed as a fact that KM to be the process of apprehend, an organization's collective expertise and distribute it in order to come up with the best of it as much as possible. According to (Tiwana, 2010), KM is the supervision of creative knowledge to place commercial values and lead to a reasonable advantage. KM simplifies the conception, communication, and request of all types of knowledge to attain business objectives. Darroch and McNaughton (2005) considered that knowledge management is the management purpose that generates, detects, and manages the idea of knowledge within a society to encompass that knowledge is used efficiently for the long-term benefits of the organization. As a result, KM is a policy of granting the right knowledge to the right people in a timely manner to help people share and put that knowledge into action in ways that attempt to expand organizational performance(Li et al., 2013). The description which was adopted is that knowledge management discusses a methodical and integrative procedure that helps organizations to find, organize, allocate and transfer important evidence, knowledge, and expertise which is essential for actions such as problem resolving, self-motivated learning, strategic planning, and decision-making to accomplish the goals of the organization (A. K. Gupta & Govindarajan, 2000).Based on extensive review of previous research, the following terms are key components of Knowledge Management (knowledge acquisition, knowledge storage, knowledge transfer and knowledge application).

2.7.1. Knowledge Acquisition

Pacharapha and Vathanophas (2012) defined knowledge acquisition as the process of the development and creation of insight, skill and relationships. For knowledge to be acquired there should be willingness and ability of a recipient to acquire and use knowledge are crucial elements (B. Gupta, 2008). During the process of knowledge acquisition, it is important that both source and recipient

should be willing to share. There are five motivational drivers that should be taken into consideration: attitude towards knowledge sharing, cost and benefit, subjective norms and organizational climate and perceived value of knowledge (Ford & Staples, 2010). Knowledge acquisition envisages learning from others through interaction between recipient and source. So knowledge acquisition is the process used to define the rules and ontologies required for a knowledge-based system. The phrase was first used in conjunction with expert systems to describe the initial tasks associated with developing an expert system, namely finding and interviewing domain expert and capturing their knowledge via rules, objects, and frame-based ontologies.

2.7.2. Knowledge Storage

Ernst and Young (1998) refer to knowledge management as an expansion of procedures which tie knowledge application to business strategies. The related signification is given by (Debowski, 2006) who has stated that KM is a procedure of finding, taking, organizing and distributing the intelligence assets to achieve maintainable organizational performance. KM is also defined as a procedure which helps business to recognize, select, establish and hand over critical information which resides within the organization (Turban, 2011). Stein and Zwass (2005) have highlighted that storage and retrieval of organizational knowledge are referred as administrative memory which includes knowledge residing in numerous form such as written records, documented managerial policies and measures, and organized knowledge stored in database, data warehouse or other business intelligence tools. So knowledge storage is the process of recognizing new information as relevant and essential for current and future use and storage it in reasonable forms so that anyone in the organization can access it.

2.7.3. Knowledge Transfer

Knowledge transfer is the knowledge wherever the data recipient acquires identical data because the data supplied and internalizes the data to create his/her new data (Roos, 2005). The basic framework needed to research information transfer among a corporation involves three areas of interest: the information characteristics, the activities of information transfer, and also the actual transfer performance (Cummings, 2002). Knowledge transfer performance includes such aspects as knowledge sharing (Tsai & Wu, 2011), knowledge flow (A. K. Gupta & Govindarajan, 2000). Supported these premises, the influencing factors on data transfer embody structural factors of front/back workplace, like structure and structure distance, psychological feature factors like common understanding, data distance, and data sharing, and factors within the relative dimension, like relationship quality and credibleness. This can be kind of like the essential analytical framework of the Social Capital Theory that is additionally applicable within the analysis of structured data transfer. So information transfer is

that the sensible drawback of transferring information from one a part of the organization to a different. Like information management, information transfer seeks to arrange, create, capture or distribute information and guarantee its availableness for future users. Information transfer is additional complicated as a result of information resides in structure members, tools, tasks, and their sub networks and far information in organizations is understood or arduous to articulate.

2.7.4. Knowledge Application

Knowledge application or reuse to decision-making processes, related to business strategy, task implementations, service delivery, and organizational performance and effectiveness. Knowledge application processes are those processes oriented toward the actual use of knowledge (Gold et al., 2001). Value of knowledge assets is realized when the assets are used to create products or deliver services, or when they are sold or traded for value. Davenport, (1998) also argued that the effective application of knowledge has helped companies improve their efficiency and reduce costs. Furthermore, (Alavi & Leidner, 2001) noted that while the processes of knowledge creation, storage/retrieval, and transfer do not necessarily lead to enhanced organizational performance, effective knowledge application does. The underlying assumption is that if an organization does not find it easy to locate the right kind of knowledge in the right form, the organization may find it difficult to sustain its competitive advantage.

2.8. Literature Gaps

Organizations use both knowledge management (KM) and integrated total quality management (TQM) as essential frameworks to improve production efficiency. To comprehend their combined influence, there are a few gaps in the literature. The following are some possible gaps that more research may look into:

TQM and KM individually have a significant body of literature, there is a lack of comprehensive studies exploring how these two frameworks can be integrated. Understanding this interrelationship could provide insights on how to optimize both practices for enhanced production efficiency (Zaidi & Ahmad, 2020; Yas et al., 2021). The majority of research usually focuses on particular areas or industries. Comparative studies between various industries are necessary to comprehend how TQM and KM impact production efficiency in various industries, such as manufacturing and services (Sallis, 2014; Jaafreh & Al-abedallat, 2012) (Sahibzada et al., 2022) (Karami et al., 2021). An overview of the connection between TQM, KM, and production efficiency is given by the many cross-sectional studies that are now in existence. There is a need to explore how customer knowledge can be integrated into

TQM and KM practices and the resulting impact on customer satisfaction and service quality (Yusr et al., 2022). Studies that follow these procedures throughout time could shine understanding of the advantages and difficulties that may arise in the future (Beckett et al., 2000; Ngwenya et al., 2016). There is a potential link between TQM, KM, and innovation in production processes. Investigating how integrated management practices contribute to innovative solutions and improvements in production efficiency may reveal new strategies for organizations.

These gaps in the literature highlight the need for more study on the relationship between production efficiency, knowledge management, and TQM. By addressing these gaps, researchers may give practitioners with a better understanding of how to properly integrate these principles to increase production efficiency.

2.9. Hypothesis Development to Addressing the Literature Gaps

The conceptual framework that was suggested and used as the basis for this investigation appears in the diagram below. The graphic further states that the dependent variable is production efficiency, and the TQMS principles—Customer focus, Leadership, Engagement of people, Process approach, Continuous Improvement, Fact-based decision-making, and Relationship management—altogether Independent variables include knowledge management..

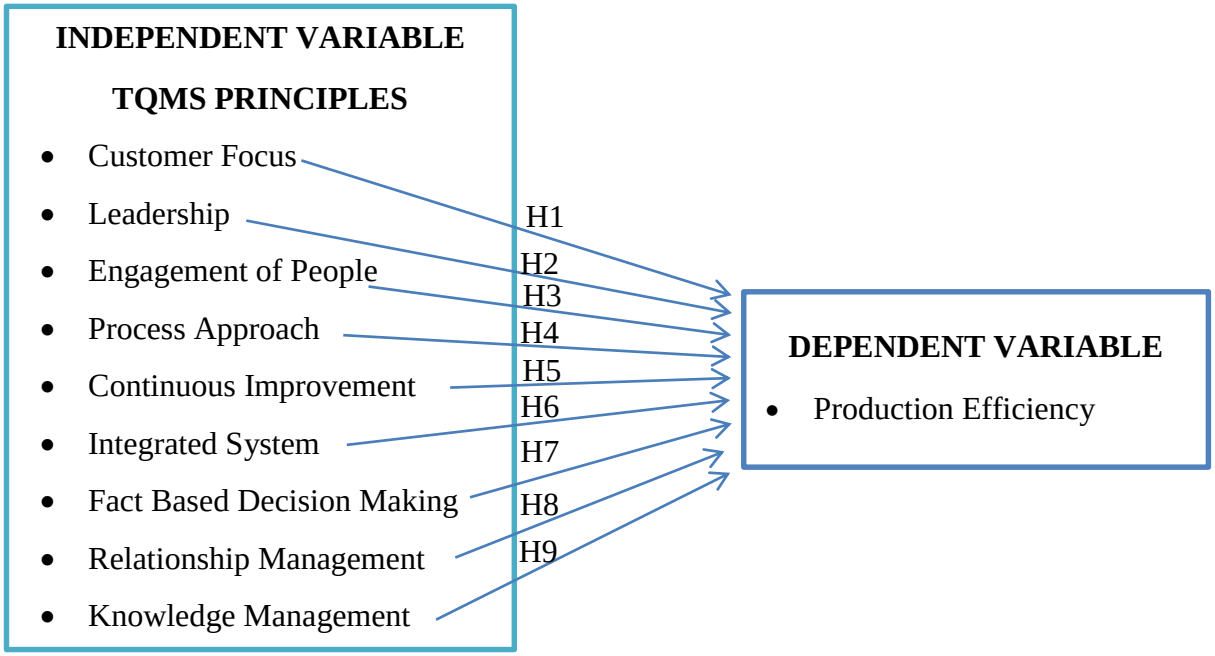

Figure 2.1 CONCEPTUAL FRAMEWORK OF THE STUDY

The literature review included a discussion of the theory that supports the development of the hypothesis.

H1: Customer focus and production efficiency are significantly and positive relationship in the ASKU PLC case of AQU ADDIS spring water.

H2: Leadership and production efficiency are significantly and positive relationship in the ASKU PLC case of AQU ADDIS spring water.

H3: Engagement of people and production efficiency are significantly and positive relationship in the ASKU PLC case of AQU ADDIS spring water.

H4: Process approach and production efficiency are significantly and positive relationship in the ASKU PLC case of AQU ADDIS spring water.

H5: Continuous Improvement and production efficiency are significantly and positive relationship in the ASKU PLC case of AQU ADDIS spring water.

H6: Integrated System and production efficiency are significantly and positive relationship in the ASKU PLC case of AQU ADDIS spring water.

H7: Fact base decision making and production efficiency are significantly and positive relationship in the ASKU PLC case of AQU ADDIS spring water.

H8: Relationship management and production efficiency are significantly and positive relationship in the ASKU PLC case of AQU ADDIS spring water.

H9: knowledge management and production efficiency are significantly and positive relationship in the ASKU PLC case of AQU ADDIS spring water.

CHAPTER THREE

3. RESEARCH METHODOLOGY

This research methodology discusses about the methods that are employed to attain the objectives of the study. It includes descriptions and justifications of the methodologies that are to be selected to collect and analyze the data and directly address the research questions. Therefore, the methodology starts with Descriptions about the study area current production data, research design, sampling techniques and procedures, sample size, data collection method, validity and reliability of the research instrument, and ethical considerations were addressed in this section.

3.1. Research Design

Descriptive research aims to interpret and explain the world as it is. It examines people, groups, organizations, institutions, techniques, and materials in order to characterize, contrast, compare, categorize, analyze, and interpret the events and factors that make up the various research disciplines. It aims to convey the current state of affairs. The study employed a descriptive survey approach to ascertain whether integrated Total Quality Management and knowledge management had an effect on the production efficiency of the case company.

The investigation for this study was conducted using a mixed-methods methodology both quantitative and qualitative. Interviews with chosen experts and members of upper and middle management provided the qualitative data. The company's management and employees served as the source of the questionnaire data. The performance measures from the questionnaire were subjected to both descriptive and inferential analysis using quantitative data. SPSS version 20 software was used to evaluate the quantitative data gathered through the use of questioners through the application of inferential statistics.

3.2. Sampling Techniques

The Aquaddis Spring Water Company's employees, department managers, and division heads who are experts for the business in addition to being the main participants in the production department were the study's target demographic. Plant managers and departmental managers were interviewed and the questionnaire was completed by all the various level managers as well as by a few employees.

The non-probabilistic sampling approach used in this study. Purposive sampling method was used to select the interviewees and respondents of the questionnaire. Purposive sampling, also known as judgmental or non-probability sampling, is a sampling technique in which the researcher selects

participants based on specific characteristics or criteria that align with the goals of the study. Purposive sampling is a strategic choice when researchers aim to gather targeted, in-depth insights from specific individuals who are most likely to contribute valuable information to the study. In short, the researcher determines what information is needed and then searches for people who are willing to share their expertise or experience in order to gather data using the purposive sampling technique.

3.3. Sample size

Sample size is a significant feature of any empirical study in which the goal is to make inferences about a population from a sample. In order to generalize from a random sample and avoid sampling errors or biases, the random sample needs to be of an adequate size. (Hamed Taherdoost, 2018). Several statistical formulas are available for determining sample size. There are numerous approaches, incorporating a number of different formulas, for calculating the sample size for categorical data. For the determination of the sample size, the research used Polonia's (2013) method that uses the sample size for the analysis of customer surveys and also explains on the different sample size formulas. Taro Yemane's (1967) has also used simplified sample size determination formula also uses an assumption of a 95% confidence level and P = 5% is to be assumed. Where: -

n: required sample size drawn from the entire population,

N: population size = 387

e: is the level of sampling error = (0.05)

$$n = \frac{N}{1+N(e)^2} = \frac{387}{1+387(0.05)^2} = \underline{196}$$

Based on the aforementioned computation, the sample size for this study is compounded us 196, and this size is distributed proportionately to the area of The Aquaddis Spring Water Company's employees. Employees, professionals, division heads, directors, and managers of the Aquaddis spring water bottling company who were willing and had an important role in production were included. Employees of Aquaddis Spring Water who were recently hired and did not know enough about the TQM were not included.

3.4. Methodological Framework

Integrating Total Quality Management (TQM) and Knowledge Management (KM) can significantly enhance production efficiency within an organization. A methodological framework for this integration can be designed using various tools and techniques, including statistical analyses via software like

SPSS (Statistical Package for the Social Sciences). A review of previous research study was conducted to address this problem. An evaluation was done based on which methodology can bring better production efficiency, using the methodology utilized in the previous literature as an input. The research tools were selected on the basis of their potential value to the case company.

The integration of TQM and KM requires a structured methodological framework designer to the organization's specific goals regarding production efficiency. Utilizing tools like SPSS for statistical analysis will provide insights that can help guide decision-making and strategy adjustments. The outcome should lead to enhanced quality, efficiency, and competitiveness in the production environment.

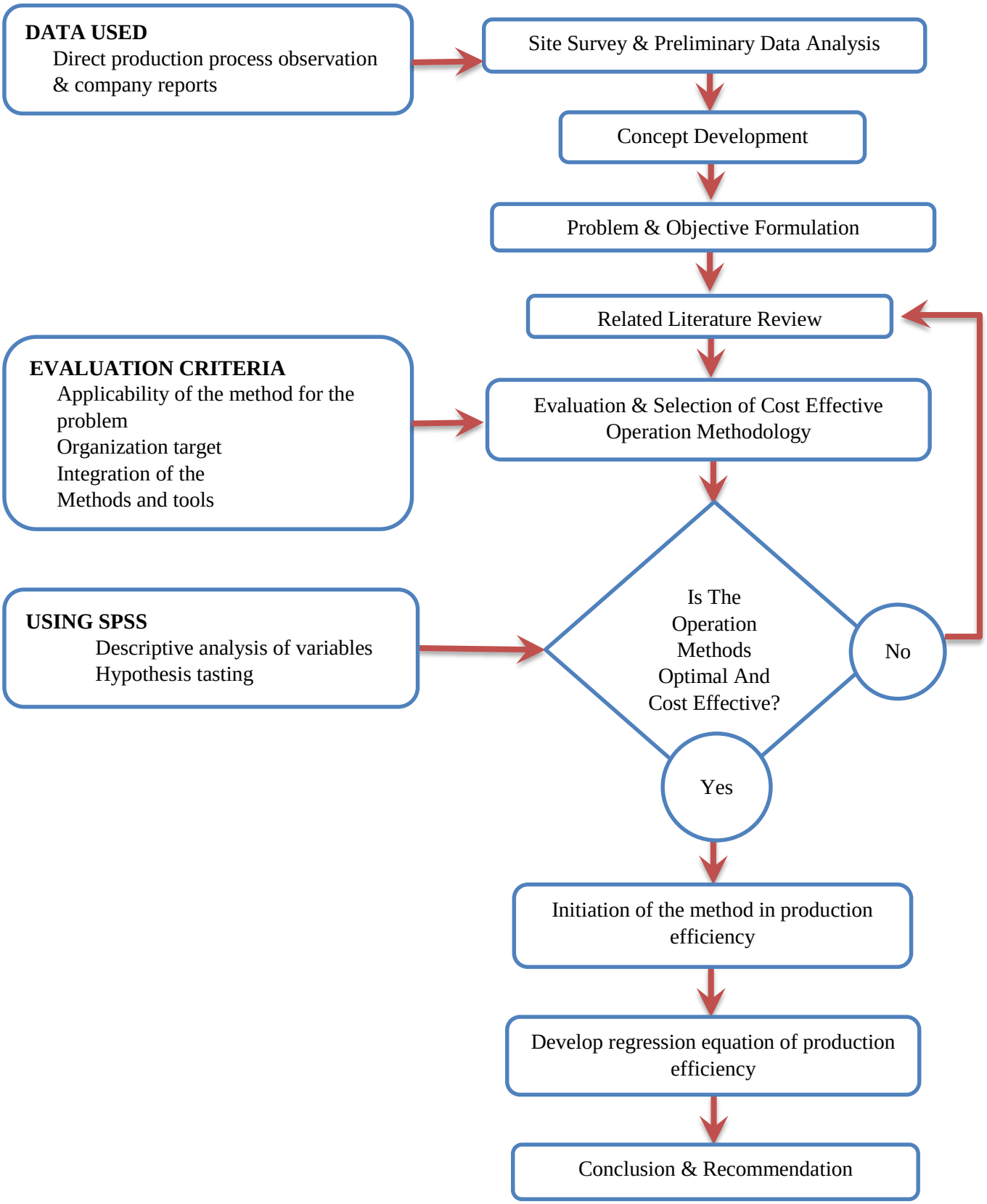

Figure 3.1 METHODOLOGICAL FRAMEWORK

3.5. Method of Data Collection

The research used a variety of data collection techniques, including in-depth interviews, operational record histories, field inspections and assessments of the current operating and production system conditions. Accordingly, the information gathered from manufacturing workers, production managers, supervisors, and equipment operators used. The research used both primary and secondary data sources. Site inspections, surveys, and interviews are examples of primary data. Secondary data includes the internet, production record histories, and any other documentation of the case firm that are related.

3.5.1. Questionnaire

The primary data collection tool was a self-administered questionnaire that was created by the researcher specifically for the study. After preparing the questionnaire, by adopting and adapting from related studies, formats, sequences, and instruments is evaluated by the academic advisor prior to the data collection to maintain the validity of the instruments. There were two sections to the questionnaire. The respondents' social background and demographic traits were evaluated in the first segment. The researcher was able to draw conclusions from the second part of the questionnaires, which was closed ended and used a five-point Likert scale with assigned scores between 1 and 5, namely Strongly Agree (5), Agree (4), Neutral (3), Disagreed (2), and Strongly Disagree (1).Selected staff members in every department received the questionnaires.

3.5.2. Interview

Members of upper management who oversaw each department's processes were interviewed. The interview questions were polite and well-structured. The lead researcher for this investigation performed the interview. For undertaking the interview, the researcher sent the consent form and interview plan to the respondents via their e-mail, which is helpful to set the date and location of the interview. The interview is constructed by an open-ended question, which takes an average time of 20 minutes for the questioning and answering session for the upper managements. The data recorded by audio and note taking.

3.6. Techniques of Data Analysis and Interpretation

SPSS version 20 software was used to evaluate the quantitative data gathered through the use of questioners through the application of inferential statistics. Using the appropriate parametric statistical methods, the performance measurement variables and their effects on the production efficiency dimensions were investigated to figure out the degree of association and direction of link based on the

distribution of the sampled data gathered. To view the descriptive statistical values of the five-point Likert scale data, the descriptive statistics were presented using tables. The method of narrative analysis was applied to the qualitative information gathered from the interviews.

The relationship between the variables of interest based on knowledge management and total quality management was described using the following methodology. Variables with dependent and independent components were developed, and outcome indicators were found, in order to evaluate the degree of integrated TQM and KM. So, the independent variables in this study were the Total Quality Management principles; Customer focus, Leadership, Engagement of people, Process approach, Continuous Improvement, Integrated System, Fact-based decision-making, Relationship management and Knowledge management and the dependent constructs were production efficiency.

Reliability of Data

A key instrument for determining the degree of consistency of an attribute that needs to be measured is the reliability test. According to Taherdoost, (2018), a measuring tool's reliability can be compared to its stability, consistency, or dependability based on how little change it causes during repeated measurements of a characteristic. One of the most widely used reliability metrics is Cronbach's alpha. It gauges how consistently the items on a scale are organized internally. It shows how closely connected the items in a questionnaire are to one another. It also indicates the multidimensionality or one-dimensionality of a scale. Better values of the Cronbach's coefficient alpha value, which normally runs from 0 to 1, indicate a better level of internal consistency. The most often recognized value for this test is 0.70, as it should be equal to or higher than to achieve internal reliability (Taherdoost, 2018). However, other authors accept different values for this test in order to achieve internal reliability. Table 3.1 below shows how reliable the data used in the present study was.

Table 3.1 CRONBACH'S ALPHA RESULT

Variables	Cronbach's Alpha	Number of Items
Customer Focus	.745	5
Leadership	.763	5
Engagement Of People	.813	5
Process Approach	.841	5
Continuous Improvement	.704	5
Fact-Based Decision-Making	.747	5
Relationship Management	.711	5
Knowledge Management	.804	5
Integration System	.812	5
Production Efficiency	.752	4

Source: Result from data collected, 2024

3.7. Ethical Consideration

When it comes to considering ethical issues, the researcher ruled and highly bound by the research code of ethics. The researcher obtains ethical clearance and permission from the School of Mechanical and Industrial Engineering, Addis Ababa Institute of Technology, Addis Ababa University. And also, before the collection of data, permission from the ASKU PLC requested. Therefore, before carrying on the collection of data, all the necessary information about the research provided to the sample respondents. This help to decide whether or not to participate in this research. Employees informed that their responses and participation kept private. This were building confidence and credibility between the researcher and the participant employees by convincing them of the research's goal and welfare while preventing the researcher or any other institution from profiting from the findings.

CHAPTER FOUR

4. DATA ANALYSIS AND DISCUSSION

This research part, the study's findings are given and examined in relation to the goal of the investigation. Descriptive statistics are used to present the sample characteristics of the respondents in the first section. Correlation and regression analyses follow, followed by a discussion of the results as they were presented.

4.1. Sample and Response Rate

After 196 questionnaires were distributed to clients, 166 completed surveys - or 85% of the total - were found. The 155 questionnaires were deemed legitimate for statistical analysis after being verified among those that were recovered. In the end, 93.4% of all the questionnaires that were delivered were evaluated; the remaining 6.6% were not.

4.2. Demographic Analysis of Respondents

Conducting a demographic analysis of respondents typically involves examining and interpreting the characteristics of the individuals who participated in a survey or study. This analysis helps in understanding the composition of the sample and can provide insights into patterns, trends, and potential biases in the data collected. Demographic variables include sex, highest qualification, and work experience [year] of respondents.

4.2.1 Sex of Respondents

Examining the sex of respondents enriches the research process, enhances its validity, and fosters deeper understanding of the complexities inherent in human behavior and social constructs. It is essential not only for accurate data interpretation but also for informing practices and strategies that are sensitive to gender-related disparities.

Table 4.1 SEX OF RESPONDENTS

Sex			
		Frequency	Percent
Valid	Male	103	66.5
	Female	52	33.5
	Total	155	100.0

Source: Result from data collected, 2024

Ninety-four percent of the completed questionnaires, or 155 in total, were used to analyze the data. The basic information questions included questions on gender, highest qualification, and experience in intended to generally identify the respondent's qualities. Male respondents made up the majority (66.5%), with only 33.5% of the sample being female. This should be remedied via adequate gender main streaming, mentoring, and promotion of female industry professionals.

4.2.2 Highest Qualification of Respondents

Examining the highest qualification of respondents is essential for ensuring the integrity of research findings, understanding potential biases, and enriching the analysis by capturing diverse perspectives. This approach ultimately enhances the overall quality and applicability of the research outcomes.

Table 4.2 HIGHEST QUALIFICATION OF THE RESPONDENTS

Qualification			
		Frequency	Percent
Valid	Diploma	29	18.7
	BA	23	14.8
	BSC	86	55.5
	Masters & above	17	11.0
	Total	155	100.0

Source: Result from data collected, 2024

According to the respondents' educational background, 18.7% of them have a diploma, 14.8% have a bachelor's degree, 55.5% have a degree, and the remaining 11% have a master's degree or above. In this regard, it appears that the majority of the total respondents hold a degree.

4.2.3 Highest Qualification of Respondents

Examining the work experience of respondents is crucial within the context of our research for several reasons. Work experience often shapes individuals' perspectives, skills, and behaviors in a professional environment. The relevance of work experience extends beyond individual perspectives; it impacts team dynamics, organizational culture, and knowledge transfer within institutions. By analyzing the years of work experience, we can gain insights into how varying levels of experience influence attitudes, decision-making processes, and overall performance in the workplace.

Table 4.3 WORK EXPERIENCE [YEAR] OF THE RESPONDENTS

Work experience [year]			
		Frequency	Percent
Valid	1-5	114	73.5
	5-10	27	17.4
	10-15	12	7.7
	Above 15	2	1.3
	Total	155	100.0

Source: Result from data collected, 2024

The According to the respondents' work experience [year], 73.5% had experience ranging from one to five years, 17.4% had experience spanning five to ten years, 7.7% had experience spanning ten to fifteen years, and 1.3% had experience spanning fifteen years or more. This suggests that the majority of responders overall have between one and five years of experience in this area.

4.3. Descriptive Analysis of Variables

The fundamental characteristics of the data were described using descriptive statistics. It offers concise summaries of the measurements and the sample. Each descriptive statistic condenses a large amount of data into a more understandable summary, which is how the researcher was able to give quantitative descriptions in a manageable format. The standard deviation quantifies the average variation of scores from the mean, while the mean value represents the average amount that receives a positive or negative response from respondents. By giving equal weight to the mean scores of each item under each dimension, the mean scores for each of the five customer focus factors have been calculated. For the customer focus dimensions, respondents were asked to score their insight or observation on a five-point Likert type scale, with 1 indicating strongly disagree and 5 indicating strongly agree. The table below displays the result.

Table 4.4 DESCRIPTIVE STATISTICS OF CUSTOMER FOCUS

Statistics				
	Number of Valid	***Number of Missing***	***Mean***	***Standard Deviation***
Your customers provide feedback on quality and delivery performance	*155*	*0*	*4.1226*	*.76732*
Your organization measures customer satisfaction of external customer	*155*	*0*	*3.8194*	*.81759*
Customer requirements are used as the basis for quality in your organization	*155*	*0*	*4.2645*	*.73039*
Your employees are aware about your customers	*155*	*0*	*3.7226*	*.84926*
Your customers visit your plant	*155*	*0*	*3.7290*	*1.24999*

Source: Result from data collected, 2024

It is seen from table 4.4 above the mean score values of customer focus ranges between 4.2645 (mean score value of Customer requirements are used as the basis for quality in your organization) with standard deviation of .73039 and 3.7226 (mean score value of employees are aware about your customers) with standard deviation of .84926. From these findings customer requirements are the basis for quality in the organization has highest mean score which implicates customer requirements is important factor in customer satisfaction.

Table 4.5 DESCRIPTIVE STATISTICS OF LEADERSHIP

Statistics				
	Number of Valid	***Number of Missing***	***Mean***	***Standard Deviation***
The top management of your organization (i.e. Top executives and major department heads) assumes responsibility for quality performance	*155*	*0*	*3.6452*	*.77913*
In your organization, major department heads participate in the production improvement process	*155*	*0*	*3.8065*	*.85354*
In your organization, "organization improved" are reviewed in top management meetings	*155*	*0*	*4.1419*	*.93586*
Senior leadership demonstrates and communicates to the entire organization its dedication to quality ideals.	*155*	*0*	*4.0387*	*1.00572*
In your organization, quality policy is developed by top management	*155*	*0*	*4.2903*	*.70220*

Source: Result from data collected, 2024

Descriptive statistics especially means, and standard deviation was used to evaluate the effect of leadership on production efficiency. It is seen from table 4.5 above the mean score values of leadership ranges between 4.2903 (mean score value of quality policy is developed by top management) with standard deviation of .70220 and 3.6452 (mean score value of top management of your organization (i.e. Top executives and major department heads) assumes responsibility for quality performance) with standard deviation of .77913. From these findings quality policy is developed by top management has the highest mean score which implicates that top management of the organization are responsible to determinant and formulate quality policy is a highest in leadership.

Table 4.6 DESCRIPTIVE STATISTICS OF ENGAGEMENT OF PEOPLE

Statistics				
	Number of Valid	***Number of Missing***	***Mean***	***Standard Deviation***
Your organization form teams to solve problems	*155*	*0*	*4.2452*	*.83232*
Your organization provides feedback to employees on their quality performance	*155*	*0*	*3.6710*	*.83829*
Employees are also involved in quality decisions in your organization	*155*	*0*	*4.4194*	*.64336*
Supervisors encourage teamwork in your organization	*155*	*0*	*4.0129*	*.91869*
Make training available for employees who need to learn new processes and who want to explore opportunities for advancement	*155*	*0*	*3.5032*	*1.18636*

Source: Result from data collected, 2024

It is seen from table 4.6 above the mean score values of engagement of people ranges between 4.4194 (mean score value of the Employees are also involved in quality decisions in your organization) with standard deviation of .64336 and 3.5032 (mean score value of Make training available for employees who need to learn new processes and who want to explore opportunities for advancement) with standard deviation of 1.18636. From these findings employees training has relatively the lowest mean score which indicates that trainings are not provided for employees and at the predictable level.

Table 4.7 DESCRIPTIVE STATISTICS OF PROCESS APPROACH

Statistics				
	Number of Valid	***Number of Missing***	***Mean***	***Standard Deviation***
Processes in your organization are designed to minimize the chances of errors	*155*	*0*	*4.2452*	*.83232*
Your organization meets daily production schedule	*155*	*0*	*3.7613*	*.73045*
In your organization, production is stopped immediately for quality problems	*155*	*0*	*4.4129*	*.64251*
Your organization provides clear process instructions	*155*	*0*	*4.0774*	*3.6645*
Your organization has adopted statistical process control	*155*	*0*	*.86442*	*1.18583*

Source: Result from data collected, 2024

Under process approach five statements were used to test the effect of process approach, It is seen from table 4.7 above the mean score values of process approach ranges between 4.4129 (mean score value of production is stopped immediately for quality problems) with standard deviation of .64251 and 3.6645 (mean score value of the organization has adopted statistical process control) with standard deviation of 1.18583. From the above results in ASKU PLC production is stopped immediately for quality problems however there is adopted statistical process control.

Table 4.8 DESCRIPTIVE STATISTICS OF CONTINUOUS IMPROVEMENT

Statistics				
	Number of Valid	***Number of Missing***	***Mean***	***Standard Deviation***
Your organization plan and conduct internal audits	*155*	*0*	*4.1032*	*.77438*
Your organization has control of non-conforming products	*155*	*0*	*4.2065*	*.67127*
Continual improvement practiced in your organization is based on the PDCA cycle	*155*	*0*	*3.8258*	*1.08202*
Top management is committed to continual improvement.	*155*	*0*	*3.9484*	*.70980*
There is emphasis of continual improvement of all operations and at all levels	*155*	*0*	*4.2452*	*.80857*

Source: Result from data collected, 2024

It is seen from table 4.8 above the mean score values of improvement ranges between 4.2452 (mean score value of There is emphasis of continual improvement of all operations and at all levels) with standard deviation of .80857 and 3.8258 (mean score value of Continual improvement practiced in your organization is based on the PDCA cycle.) with standard deviation of 1.08202. From these findings presence of emphasis of continual improvement of all operations and at all levels has relatively the highest mean score which indicates that the organization does not PDCA cycle continuous improvement.

Table 4.9 DESCRIPTIVE STATISTICS OF INTEGRATION SYSTEM

Statistics				
	Number of Valid	***Number of Missing***	***Mean***	***Standard Deviation***
How would you rate the ease of use of the current integration system	*155*	*0*	*4.2645*	*.72145*
The integration system helps your day-to-day activities	*155*	*0*	*3.3355*	*1.11237*
Has anyone received training on the integration system from your organization	*155*	*0*	*3.0903*	*1.04053*
Your organization measure its integration system	*155*	*0*	*3.3548*	*1.32284*
How satisfied are you with the level of support and documentation provided for the integration system	*155*	*0*	*4.2581*	*.71930*

Source: Result from data collected, 2024

It is seen from table 4.9 Integration system question (rate the ease of use of the current integration system) mean and standard deviation respectively are 4.2645 and .72145, on the other hand question (received training on the integration system from your organization) the lowest mean and standard deviation respectively are 3.0903 and 1.04053. We may conclude that the ASKU PLC current integration system is not supported by training based on the description and table presented above.

Table 4.10 DESCRIPTIVE STATISTICS OF FACT BASED DECISION MAKING

Statistics				
	Number of Valid	***Number of Missing***	***Mean***	***Standard Deviation***
Your organization compiles and record useful data pertaining to quality	*155*	*0*	*3.8645*	*.96751*
In your organization, data are accessible to managers, supervisors, and engineers	*155*	*0*	*3.9677*	*.81718*
Your organization manages data timely	*155*	*0*	*3.9613*	*.73753*
Your organization use data for managing quality	*155*	*0*	*4.0710*	*.79044*
Your organization use data for evaluating supervisory as well as managerial performance	*155*	*0*	*4.2774*	*.76901*

Source: Result from data collected, 2024

It is seen from table 4.10 above, fact-based decision making was measured using five items the mean score of which ranging between 4.2774 mean values with standard deviation of .76901 respondents who said the organization use data for evaluating supervisory as well as managerial performance and lowest overall mean score 3.8645 and standard deviation .96751 organization compiles and record useful data pertaining to quality. Therefore, from the analyzed data it is possible to roughly define that ASKU PLC gives more attention to evaluate supervisory as well as managerial performance but not for quality.

Table 4.11 DESCRIPTIVE STATISTICS OF RELATIONSHIP MANAGEMENT

Statistics				
	Number of Valid	***Number of Missing***	***Mean***	***Standard Deviation***
Your organization believes in long-term relationships with suppliers and takes effort for the same	*155*	*0*	*4.1548*	*.79888*
Your organization trusts on a small number of high-quality suppliers	*155*	*0*	*4.1742*	*.79893*
Your organization evaluates suppliers based on parameters related to quality, delivery and price	*155*	*0*	*3.6065*	*1.41190*
Your organization has a systematic supplier rating system	*155*	*0*	*3.5097*	*1.16979*
Your organization is working with suppliers to ensure that expectations met	*155*	*0*	*4.3548*	*.61096*

Source: Result from data collected, 2024

It is seen from table 4.11 above, relationship management was measured by five questions with highest mean score of 4.3548 and standard deviation .61096 states about the organization is working with suppliers to ensure that expectations met. Lowest mean and standard deviation respectively 3.5097 and 1.16979 stating organization has a systematic supplier rating system. This is understandable that organization is working with suppliers to ensure that expectations met however there is no systematic supplier rating system.

Table 4.12 DESCRIPTIVE STATISTICS OF KNOWLEDGE MANAGEMENT

Statistics				
	Number of Valid	***Number of Missing***	***Mean***	***Standard Deviation***
Organization has knowledge management department	*155*	*0*	*4.2194*	*.75825*
There is free flow of relevant information in the organization.	*155*	*0*	*3.3484*	*1.32211*
Employees can influence the management decisions related to work.	*155*	*0*	*3.4258*	*1.25847*
Organization provides better environment for improving work knowledge of the employees	*155*	*0*	*3.3290*	*1.11139*
Management of the organization encourages people to reflect on information and data, and reframe them at the strategic level.	*155*	*0*	*4.1677*	*.69150*

Source: Result from data collected, 2024

It is seen from table 4.12 above the mean score values of Knowledge management ranges between 4.2194 (mean score value of Organization has knowledge management department) with standard deviation of .75825 and 3.3290 (mean score value of Organization provides better environment for improving work knowledge of the employees) with standard deviation of 1.25847. From these findings Knowledge management department of organization are exists but not working efficiently to utilize employees knowledge to influence management decision.

Table 4.13 DESCRIPTIVE STATISTICS OF ALL VARIABLES

Statistics				
	Number of Valid	***Number of Missing***	***Mean***	***Standard Deviation***
Customer Focus	*155*	*0*	*4.0619*	*.63228*
Leader ship	*155*	*0*	*4.1006*	*.61385*
Engagement of people	*155*	*0*	*3.9703*	*.68292*
Process approach	*155*	*0*	*4.0323*	*.67937*
Continuous Improvement	*155*	*0*	*4.1406*	*.50410*
Fact base decision Making	*155*	*0*	*4.2284*	*.54484*
Relationship Management	*155*	*0*	*4.2903*	*.67543*
Integration system	*155*	*0*	*3.6606*	*.76017*
Knowledge Management	*155*	*0*	*3.6981*	*.79654*
Production Efficiency (Dependent variable)	*155*	*0*	*4.1677*	*.87177*

Source: Result from data collected, 2024

4.4. Correlation Analysis

The Statistical Package for Social Science was used to assess the correlation between the independent and dependent variables (SPSS). The correlation matrix below shows the correlation between the variables in the questionnaire using the Pearson Correlation coefficient. The correlation between the variables included in the survey is shown in Table 4.14.

Table 4.14 CORRELATIONS ANALYSIS

Correlations											
		PE	**CF**	**LP**	**EP**	**PA**	**CI**	**DM**	**RM**	**IS**	**KM**
Production Efficiency (PE)	Pearson Correlation	1	.639	.591	.672**	.781	.601**	.920	.855	.640	.688
	Sig. (2-tailed)		.000	.001	.003	.000	.000	.000	.000	.001	.000
	N	155	155	155	155	155	155	155	155	155	155
Customer Focus (CF)	Pearson Correlation	.759	1	.489	.543**	.685	.470**	.652**	.680*	.561**	.591*
	Sig. (2-tailed)	.000		.001	.000	.000	.000	.002	.000	.001	.001
	N	155	155	155	155	155	155	155	155	155	155
Leadership (LP)	Pearson Correlation	.599	.489	1	.515*	.685*	.430**	.451**	.512	.735**	.657
	Sig. (2-tailed)	.001	.001		.000	.001	.000	.000	.000	.002	.000
	N	155	155	155	155	155	155	155	155	155	155
Engagement Of People (EP)	Pearson Correlation	.787**	.543**	.565*	1	.480**	.346**	.572**	.556**	.763*	.688
	Sig. (2-tailed)	.001	.000	.000		.000	.000	.001	.000	.000	.000
	N	155	155	155	155	155	155	155	155	155	155
Process Approach (PA)	Pearson Correlation	.842	.574	.559*	.480**	1	.728**	.424**	.518**	.502	.772*
	Sig. (2-tailed)	.000	.000	.000	.000		.001	.000	.000	.000	.000
	N	155	155	155	155	155	155	155	155	155	155
Continuous Improvement (Ci)	Pearson Correlation	.718**	.470**	.430**	.546**	.638**	1	.507**	.481**	.614**	.694**
	Sig. (2-tailed)	.000	.000	.000	.000	.003		.000	.000	.000	.000
	N	155	155	155	155	155	155	155	155	155	155
Fact Base Decision Making (DM)	Pearson Correlation	.921	.695**	.551**	.672**	.624**	.787**	1	.696**	.601**	.772**
	Sig. (2-tailed)	.000	.001	.000	.001	.000	.000		.000	.000	.000
	N	155	155	155	155	155	155	155	155	155	155
Relationship Management (Rm)	Pearson Correlation	.875	.550*	.502	.356**	.418**	.481**	.496**	1	.556**	.848**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		.000	.000
	N	155	155	155	155	155	155	155	155	155	155
Integration System (Is)	Pearson Correlation	.642	.461**	.535**	.453*	.652	.614**	.601**	.556**	1	.695**
	Sig. (2-tailed)	.002	.001	.003	.043	.000	.000	.000	.000		.000
	N	155	155	155	155	155	155	155	155	155	155
Knowledge Management (Km)	Pearson Correlation	.687	.549*	.508	.626	.769*	.596**	.472**	.848**	.695**	1
	Sig. (2-tailed)	.000	.001	.000	.000	.000	.000	.000	.000	.000	
	N	155	155	155	155	155	155	155	155	155	155
**. Correlation is significant at the 0.01 level (2-tailed).											
*. Correlation is significant at the 0.05 level (2-tailed).											

The correlation matrix presented above shows a positive and high association between production efficiency and the TQMS principle factors. Fact-Based Decision Making and production efficiency have the strongest link in this study ($r = 0.921$, $n = 155$, $p < 0.00$). It suggests that production efficiency and fact-based decision making have a strong beneficial link. The relationship management variable and production efficiency have the second-highest strong coefficient of correlation ($r = 0.875$, $n = 155$, $p < 0.00$). Therefore, there is a strong correlation between production efficiency and relationship management. The process approach variable and production efficiency have the third-highest strong coefficient of association ($r = 0.842$, $n = 155$, $p < 0.00$). As a result, production efficiency and process approach have a strong positive correlation. The Engagement of People variable and production efficiency have the fourth-highest strong association ($r = 0.787$, $n = 155$, $p \leq 0.01$). As a result, there is a strong correlation between production efficiency and employee engagement. The customer focus variable and production efficiency have the fifth-highest strong coefficient of correlation ($r = 0.759$, $n = 155$, $p < 0.00$). Therefore, there is a strong correlation between production efficiency and customer focus. The Continuous Improvement variable and production efficiency have the sixth-highest strong coefficient of correlation ($r = 0.718$, $n = 155$, $p < 0.00$). The knowledge management variable and production efficiency have the seventh-highest strong coefficient of correlation ($r = 0.687$, $n = 155$, $p < 0.00$). Hence, there is a strong correlation between production efficiency and knowledge management. The production efficiency and integration system variable have the eighth-highest strong coefficient of correlation ($r = 0.642$, $n = 155$, $p \leq 0.02$). As a result, production efficiency and integration system have a strong beneficial link. The leadership variable and production efficiency had the least high link ($r = 0.595$, $n = 155$, $p < 0.01$). As a result, there is a strong correlation between production efficiency and leadership. In general, all independent factors have a positive and strong correlation with the dependent variable, as indicated by the correlation matrix above.

The values next to Sig. (2-tailed) in the correlation table above indicate that all are (.000). The convention states that if this number is less than .05, then the correlation is deemed to be significant (meaning that the researcher can be 95% convinced that the link between variables is not due to chance). The researcher may propose that there is a strong relationship between knowledge management, TQMS principles, and total production efficiency.

4.5. Regression Analysis of the Variables

Using one or more independent variables and a regression analysis, one can forecast the value of a dependent variable (Russell & Bobko, 1992). One statistical method for examining relationships between variables is regression analysis. Usually, the goal of the investigation is to determine which

variable impacts which other variable. In order to investigate such questions, the researcher gathers information on the relevant underlying variables and uses regression analysis to calculate the quantitative impact of the causal variables on the variable under investigation. The degree of confidence that the genuine relationship is close to the estimated relationship, or the "statistical significance" of the estimated correlations, is another common assessment made by the investigator (Malhotra, 2007).

Linear Regression Analysis

Regression analysis assumptions must be met in order to verify that the data collected accurately reflected the sample and that the researcher has produced the best findings (Hair et al., 1998).

Multi-Collinearity

If any of the independent variables have strong connections with one another, it is advisable to look for the multicollinearity problem. The Variance Inflation Factor (VIF), which measures how much independent variable correlations affect regression estimates' accuracy, is used in the study to verify this. Ideally, the VIF factor should be around to one and not more than five. Tolerance, which is determined using formula $1\text{-}R^2$ for each variable, is a measure of how much of the variability of the given independent variable is not explained by the other independent variables in the model. An extremely small number (less than 0.10) suggests the likelihood of multicollinearity since it shows a high multiple correlation with other variables. An acceptable regression model shouldn't have multicollinearity or a strong correlation between its independent variables. It should also have a tolerance level greater than 0.2 and a variance inflation factor (VIF) value between 1 and 5 (SPSS Inc., 2007).

Table 4.15 MULTICOLLINEARITY TEST

Coefficients [a]			
Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Customer Focus	.275	3.634
	Leadership	.256	3.905
	Engagement of People	.454	2.198
	Process Approach	.456	2.191
	Continuous Improvement	.207	4.812
	Fact Base Decision Making	.309	3.228
	Relationship Management	.512	1.952
	Integration System	.280	3.563
	Knowledge Management	.200	4.978

Dependent Variable: Production Efficiency

The computed variance inflation factor (VIF) for all independent variables was found to be between 1 and 5, as indicated in the above table, based on the coefficients output (Collinearity statistics), indicating that there is no multicollinearity problem.

Homoscedasticity

In regression analysis, homoscedasticity refers to the assumption that the variances of the residuals at each level of the predictor variables are identical. That is, the residual spread should be fairly constant along each given predictor variable. To conduct a basic analysis, the researcher first creates a scatter plot in SPSS by plotting ZRESID (Y-axis) against ZPRED (X-axis). This allows the researcher to see if the assumptions of homoscedasticity and random errors have been met. ZRESID and ZPRED's graph should look a randomly distributed set of dots that have equal spacing around zero. It is likely that there is heteroscedasticity in the data if this graph funnels out. It is likely that the data have defied the linearity assumption if this graph shows any kind of curve. The scatter figure below shows how the data conforms to the linearity assumptions.

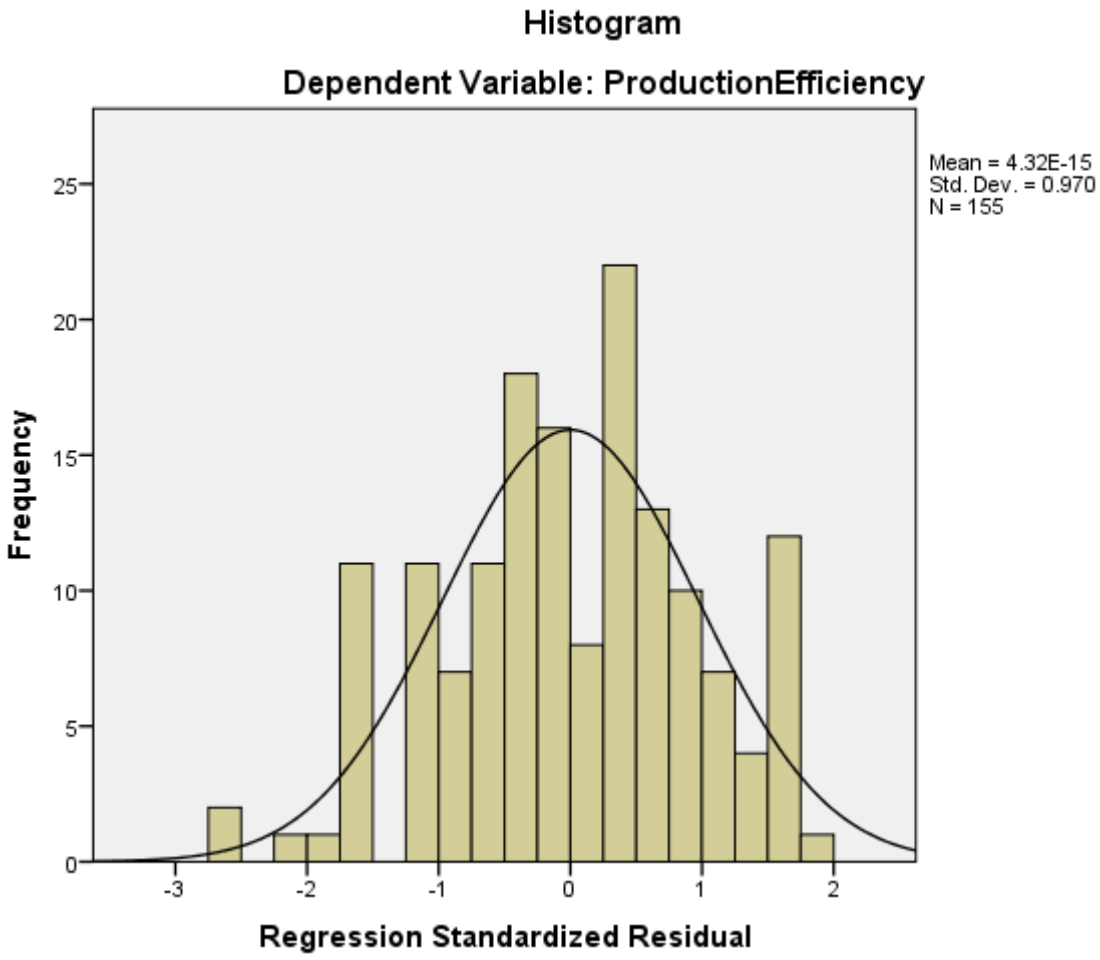

Figure 4.1 HOMOSCEDASTICITY GRAPH

Source: Result from data collected, 2024

On the above homoscedasticity graph, one typically plots the residuals on the y-axis against the predicted values or the independent variable on the x-axis. Here's what to look for in a satisfactory model of homoscedasticity: on this assumption holds true, it suggests that the model provides a good fit across all ranges of the data.

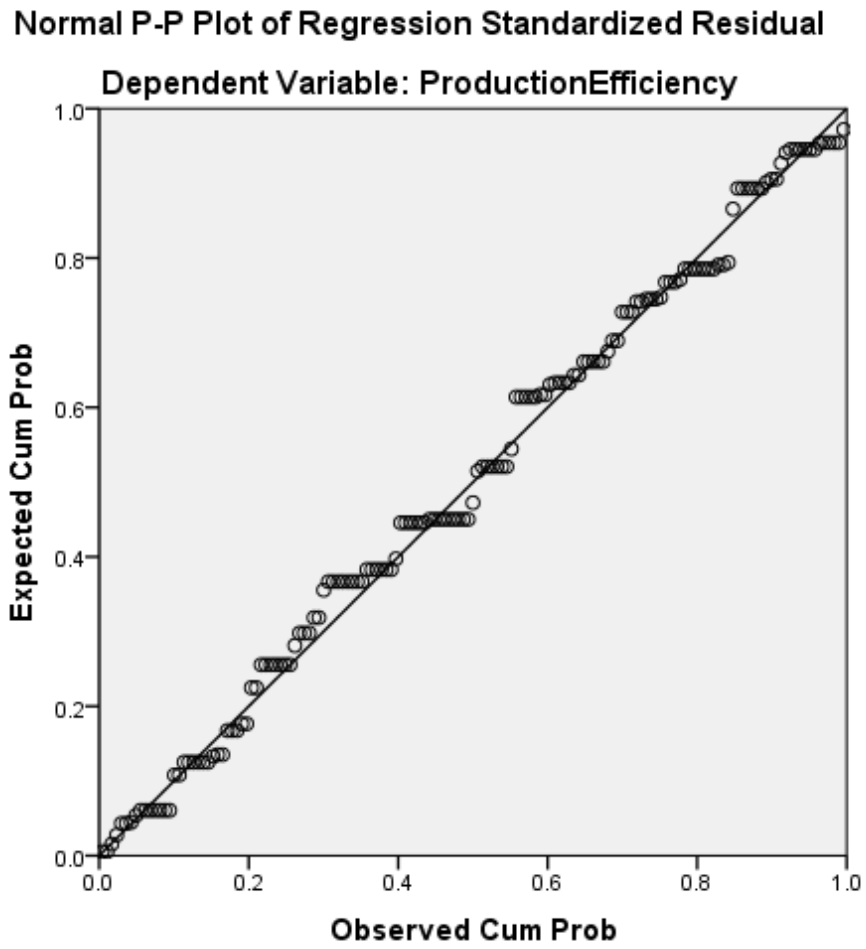

Figure 4.2 HOMOSCEDASTICITY GRAPH

Source: Result from data collected, 2024

On this Graph, a "satisfactory model of homoscedasticity" the residuals show constant variance and random distribution free from patterns, supporting the validity of the statistical inferential techniques applied to the regression model. When this condition is satisfied, the model fits the data well in terms of the spread of the residuals.

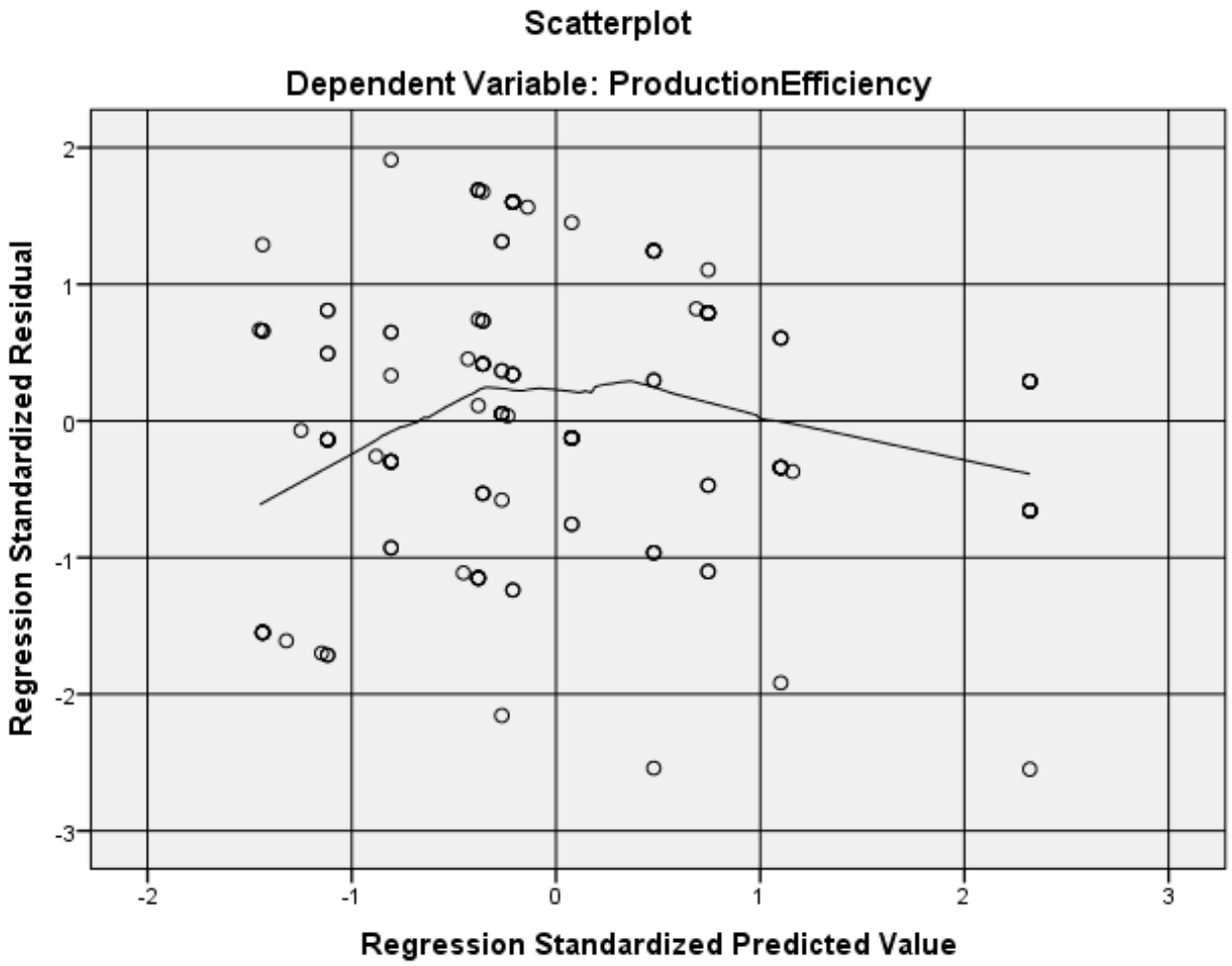

Figure 4.3 SCATTER PLOT

Source: Result from data collected, 2024

A scatter plot is a statistical representation that effectively captures the relationship between two variables represented in the plot, fits the data well, accounts for variability, and is easy to understand and interpret.

Linearity

The degree to which a change in the dependent variable is related to a change in the independent variable is indicated by the linearity of the relationship between the two variables (Hair et al., 1998). A constant unit change (slope) of the dependent variable for a constant unit change of the independent variable is how linear models, in their most basic form, predict values falling in a straight line (Hair et al., 1998). Examining scatter plots of TQMS principles and knowledge management against production efficiency, the study determines whether a linear relationship exists between them and whether the assumptions are met. The graph above shows the linear relationship between production efficiency, TQMS concepts, and knowledge management.

Independent errors

The remaining terms should be independent or uncorrelated for any two observations. This phenomenon is occasionally referred to as an absence of autocorrelation. The Durbin-Watson test, which looks for serial correlations between errors, can be used to verify this assumption. It specifically looks for correlation between nearby residuals. A score of 2 indicates that there is no correlation between the residuals, and the test statistic might range from 0 to 4 (Field, 2005). The Durbin-Watson test result value in Table 4.16 (Model Summary for Production Efficiency) is 2.208, which is extremely near to 2, indicating that the residuals are uncorrelated (or independent).

4.6. Multiple Linear Regression Analysis

By using one or more independent variables that can most accurately predict the value of the dependent variable, linear regression calculates the coefficients of the linear equation(Field, 2005). In order to find the relationship and identify the most important variables that affected production efficiency, multiple linear regression was used to assess the explanatory power of the independent variables (Customer Focus, Leadership, Engagement of People, Process Approach, Continuous Improvement, Fact-Based Decision Making, Relationship Management, Integration System, and Knowledge Management). The significance level of 0.05 with 95% confidence interval was used. Multiple regression analysis was used in order to evaluate the direct impact of integrated TQM and KM factors on production efficiency. The regression analysis's model summary is displayed in table 4.16.

Table 4.16 MODEL SUMMARY FOR PRODUCTION EFFICIENCY WITHOUT KNOWLEDGE MANAGEMENT

Model Summary [b]										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.942[a]	.0.887	.882	.71250	.887	145.9	9	145	.000	2.208
a. Predictors: (Constant), Leadership, Engagement of people, Process approach, Customer Focus, Fact base decision Making, Integration System, Continuous Improvement, Relationship Management										
b. Dependent Variable: Production Efficiency										

Source: Result from data collected, 2024

The above regression model shows the extent to which the underlying TQMS variables account for the variance in the production efficiency measure. Moreover, to provide a detailed explanation of R, R^2, adjusted R^2, and Durbin-Watson: -

R – Indicates the multiple correlation coefficient value between the outcome and the predictors. The value ranges from 0 to 1, where 1 denotes an equation that completely predicts the observed value and bigger values indicate a larger correlation (Pedhazur & Kerlinger, 1982). The model summary (R = 0.942) suggests that the dependent variable (production efficiency) is highly predicted by the linear combination of the eight independent variables (customer focus, leadership, engagement of people, process approach, continuous improvement, fact-based decision making, relationship management, and integrated system).

The R Square (R^2) **-** measure shows how much of the variance in the dependent variable can be accounted for by the linear combination of the independent variables. In another way, R^2 is a measurement of the extent to which the predictors account for the variability in the result. R^2 has values between 0 and 1, as well (Pedhazur & Kerlinger, 1982). The linear combination of TQMS variables or predictors‟ i.e Customer Focus, Leadership, Engagement of People, Process Approach, Continuous Improvement, Fact-Based Decision making, Relationship Management and Integrated System explains 88.7 % of the variance in Production Efficiency and the remaining 11.3 % is explained by extraneous variables, which have not been included in this regression model.

Adjusted R Square (R^2) – The adjusted R^2 gives some idea of how well the model generalizes and its value to be the same, or very close to the value of R^2. That means it adjusts the value of R^2 to more accurately represent the population under study (Pedhazur & Kerlinger, 1982). The difference for the final model is small (in fact the difference between R^2 and Adjusted R^2 is $(0.887 - 0.882 = 0.005)$ which is about 0.5%. This shrinkage means that if the model were derived from the population rather than a sample it would account for approximately 0.5% less variance in the outcome.

Durbin-Watson- the Durbin–Watson statistic expresses that whether the assumption of independent errors is acceptable or not. As the conservative rule suggested that, values less than 1 or greater than 3 should definitely raise alarm bells (Field, 2005). So that the desirable result is when the value is closer to 2, and for this data the value is 2.208, which is so close to 2 that the assumption has almost certainly been met.

Table 4.17 MODEL SUMMARY FOR PRODUCTION EFFICIENCY WITH KNOWLEDGE MANAGEMENT

Model Summary [b]										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.978[a]	.0.956	.951	.79250	.956	45.9	9	145	.000	2.208
a. Predictors: (Constant), Knowledge Management, Leadership, Engagement of people, Process approach, Customer Focus, Fact base decision Making, Integration System, Continuous Improvement, Relationship Management										
b. Dependent Variable: Production Efficiency										

Source: Result from data collected, 2024

The above regression model presents how much of the variance in the measure of production efficiency is explained by the underlying TQMS variables. Furthermore, to explain R, R^2, adjusted R^2 and Durbin–Watson in detail: -

R – Indicates the multiple correlation coefficient value between the outcome and the predictors. The value ranges from 0 to 1, where 1 denotes an equation that completely predicts the observed value and bigger values indicate a larger correlation (Pedhazur & Kerlinger, 1982). The model summary (R = 0.978) suggests that the dependent variable (production efficiency) is highly predicted by the linear combination of the eight independent variables (customer focus, leadership, engagement of people, process approach, continuous improvement, fact-based decision making, relationship management, and integrated system) and knowledge management.

R Square (R^2) – The R Square (R2) measure shows how much of the variance in the dependent variable can be accounted for by the linear combination of the independent variables. Put another way, R2 is a measurement of the extent to which the predictors account for the variability in the result. R2 has values between 0 and 1, as well (Pedhazur & Kerlinger, 1982). 95.6 percent of the variance in production efficiency is explained by the linear combination of TQMS variables or predictors, which include Customer Focus, Leadership, Engagement of People, Process Approach, Continuous Improvement, Fact-Based Decision Making, Relationship Management, Integrated System, and Knowledge Management. Extraneous variables, which are not included in this regression model, account for the remaining 4.4% of the variance.

Adjusted R Square (R^2) – The adjusted R^2 gives some idea of how well the model generalizes and its value to be the same, or very close to the value of R^2. That means it adjusts the value of R^2 to more accurately represent the population under study (Pedhazur & Kerlinger, 1982). The difference for the final model is small (in fact the difference between R^2 and Adjusted R^2 is (0.956 − 0.951 = 0.005) which is about 0.5%. This shrinkage means that if the model were derived from the population rather than a sample it would account for approximately 0.5% less variance in the outcome.

Durbin-Watson- the Durbin–Watson statistic expresses that whether the assumption of independent errors is acceptable or not. As the conservative rule suggested that, values less than 1 or greater than 3 should definitely raise alarm bells (Field, 2005). So that the desirable result is when the value is closer to 2, and for this data the value is 2.208, which is so close to 2 that the assumption has almost certainly been met.

Table 4.18 ANOVA OF PRODUCTION EFFICIENCY

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.269	9	0.918	145.9	.000[b]
	Residual	.369	145	.002		
	Total	8.639	154			
a. Dependent Variable: Production Efficiency						
b. Predictors: (Constant), Knowledge Management, Leadership, Engagement of people, Process approach, Customer Focus, Fact base decision Making, Integration System, Improvement, Relationship Management						

Source: Result from data collected, 2024

The next part of the SPSS output reports an analysis of variance (ANOVA). The summary table shows the various sum of squares described in the table above and the degrees of freedom associated with each. From these two values, the average sums of squares (the mean squares) can be calculated by dividing the sums of squares by the associated degrees of freedom. The most important part of the table is the F-ratio, which is a test of the null hypothesis that the regression coefficients are all equal to zero. Put in another way, this F statistics tests weather the R^2 proportion of variance in the dependent variables accounted for by the predictors is zero and the table also shows the associated significance value that F-ratio (Field, 2007). For this data, F is 45.9, which is significant at P<.0001(because the value in the column labeled Sig.is less than 0.001). This result tells us that there is less than a 0.1% chance that an F-ratio this large would happen. If the null hypothesis proposed about F- ratio were true.

Therefore, we can conclude that our regression model results in significantly better prediction of production efficiency and that the regression model overall predicts production efficiency significantly well.

The regression coefficient -This study intends to identify the most contributing independent variable in the prediction of the dependent variable. Thus, the strength of each predictor (independent variable) influencing the criterion (dependent variable) can be investigated via standardized Beta coefficient.

The regression coefficient explains the average amount of change in the dependent variable that is caused by a unit change in the independent variable. The larger value of Beta coefficient an independent variable has, brings the more support to the independent variable as the more important determinant in predicting the dependent variable.

Table 4.19 SUMMARY OF COEFFICIENT ON PRODUCTION EFFICIENCY

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.6140	.157		5.457	.000
Customer Focus	0.105	.016	0.159	5.299	.000
Leader Ship	0.111	.023	0.155	4.108	.000
Engagement of People	0.134	.031	0.166	3.129	.002
Process Approach	0.083	.019	0.123	3.597	.000
Continuous Improvement	0.072	.017	0.107	4.365	.001
Fact Base Decision Making	0.152	.041	0.219	3.812	.000
Relationship Management	0.107	.049	0.152	5.282	.002
Integrated System	0.067	.016	0.098	3.261	.001
Knowledge Management	0.103	.030	0.147	4.124	.000
a. Dependent Variable: Production Efficiency					

Source: Result from data collected, 2024

The marked column B is the value for the intercept (a) in the regression equation on the first row, labeled (constant). The numbers below the column „„βeta““ are the values for the regression

coefficients for Customer Focus, Leadership, Engagement of People, Process Approach, Continuous Improvement, Fact-Based Decision making, Relationship Management, Integrated System, and knowledge management . In the multiple regression, this standardized regression coefficient Beta (β) is useful, because it allows you to compare the relative strength of each independent variable's relationship with the dependent variable (Pedhazur & Kerlinger, 1982).

The above coefficient table shows the constant beta value (β) and p-value of the variables to examine the significance of the hypothesis. The significance level of each variable (P-value) is: .000, .000, .002, .000, .001, .000, .002, .001, .000 and their standardized coefficients are .105, .111, .134, .083, .072, .152, .107, .067 & .103 respectively. The p-value of all the independent variables is below 0.05 which implies all have a significant relationship with the dependent variable (Production Efficiency).

Based on these results, the regression equation that predicts overall production efficiency based on the linear combination of Customer Focus, Leadership, Engagement of People, Process Approach, Continuous Improvement, Fact-Based Decision making, Relationship Management, Integrated System and Knowledge Management as follows:

Equation 4.1 REGRESSION EQUATION OF PRODUCTION EFFICIENCY

Y =0.614+0.105X1 + 0.111 X2 + 0. 134X3 + 0.083X4 +0.072X5 +0.152X6 +0.107X7 +0.67X8 +0.103X9 +e

Where: X1 = Customer Focus	X2 = Leadership
X3 = Engagement of People	X4 = Process Approach
X5 = Continuous Improvement	X6 = Fact-Based Decision making
X7 = Relationship Management	X8= Integrated System
X9= Knowledge Management	e = Sampling Error
Y= Production Efficiency	

4.7. Hypothesis Testing

Hypothesis 1: Customer focus and production efficiency are significantly and positive relationship in the ASKU PLC case of Aquaddis spring water.

The above result indicates, first, the intercept is 0.614, when all independent variables have a value of zero. Then, moving through the equation, holding Leadership, Engagement of People, Process Approach, Continuous Improvement, Fact-Based Decision making, Relationship Management,

Knowledge Management and Integration System remain constant, the Customer Focus increase the chance of improved production efficiency by 0.105 for each additional customer focus level increment. This implies that a one percent increase in customer focus results in 10.5 percent increase in production efficiency. The p-value for this coefficient is statistically significant ($p<0.05$), meaning that customer focus is a significant predictor of production efficiency. Accordingly, the first hypothesis which states there is a significant and positive relationship between Customer Focus production efficiency is supported by the data collected on this survey as ($P< 0.05$; $\beta=0.105$) hence, the hypothesis is accepted.

Hypothesis 2: Leadership and production efficiency are significantly and positive relationship in the ASKU PLC case of Aquaddis spring water.

The second hypothesis which states that there is a significant and positive relation between Leadership and Production efficiency is also supported because the P-value of Leadership which is ($P<0.05$; $\beta=0.111$) hence Leadership has a significant and positive relationship with production efficiency, the value of beta ($\beta=0.111$) implies that a one percent increase in Leadership results in 11.1 percent increase in Production efficiency, others factors remaining constant. Thus, the hypothesis is accepted.

Hypothesis 3: Engagement of people and production efficiency are significantly and positive relationship in the ASKU PLC case of Aquaddis spring water.

The third hypothesis which states that there is a significant and positive relation between Engagement of People and Production efficiency is also supported because the P-value of Engagement of People which is ($P<0.05$; $\beta=0.134$) hence Engagement of People has a significant and positive relationship with Production efficiency, the value of beta ($\beta=0.134$) implies that a one percent increase in Engagement of People results in 13.4 percent increase in production efficiency, others factors remaining constant. Thus, the hypothesis is accepted.

Hypothesis 4: Process approach and production efficiency are significantly and positive relationship in the ASKU PLC case of Aquaddis spring water.

The fourth hypothesis which states that there is a significant and positive relation between Process Approach and Production efficiency is also supported because the P-value of Process Approach which is ($P<0.05$; $\beta=0.083$) hence Process Approach has a significant and positive relationship with Production efficiency, the value of beta ($\beta=0.083$) implies that a one percent increase in Process Approach results in 8.3 percent increase in Production efficiency, others factors remaining constant. Thus, the hypothesis is accepted.

Hypothesis 5: Continuous Improvement and production efficiency are significantly and positive relationship in the ASKU PLC case of Aquaddis spring water.

The fifth hypothesis which states that there is a significant and positive relation between continuous Improvement and Production efficiency is also supported because the P-value of Improvement which is ($P<0.05$; $\beta=0.072$) hence Improvement has a significant and positive relationship with Production efficiency, the value of beta ($\beta=0.072$) implies that a one percent increase in Continuous Improvement results in 7.2 percent increase in Production efficiency, others factors remaining constant. Thus, the hypothesis is accepted.

Hypothesis 6: Fact base decision making and production efficiency are significantly and positive relationship in the ASKU PLC case of Aquaddis spring water.

The sixth hypothesis which states that there is a significant and positive relation between Fact-Based Decision making and Production efficiency is also supported because the P-value of Improvement which is ($P<0.05$; $\beta=0.152$) hence Fact-Based Decision making has a significant and positive relationship with Production efficiency, the value of beta ($\beta=0.152$) implies that a one percent increase in Fact-Based Decision making results in 15.2 percent increase in Production efficiency, others factors remaining constant. Thus, the hypothesis is accepted.

Hypothesis 7: Relationship management and production efficiency are significantly and positive relationship in the ASKU PLC case of Aquaddis spring water.

The seventh hypothesis which states that there is a significant and positive relation between Relationship Management and Production efficiency is also supported because the P-value of Relationship Management which is ($P<0.05$; $\beta=0.107$) hence Relationship Management has a significant and positive relationship with Production efficiency, the value of beta ($\beta=0.107$) implies that a one percent increase in Relationship Management results in 10.7 percent increase in Production efficiency, others factors remaining constant. Thus, the hypothesis is accepted.

Hypothesis 8: knowledge management and production efficiency are significantly and positive relationship in the ASKU PLC case of Aquaddis spring water.

The eighth hypothesis which states that there is a significant and positive relation between knowledge management and production efficiency is also supported because the P-value of knowledge management which is ($P<0.05$; $\beta=0.067$) hence knowledge management has a significant and positive relationship with production efficiency, the value of beta ($\beta=0.067$) implies that a one percent increase

in knowledge management results in 6.7 percent increase in Production efficiency, others factors remaining constant. Thus, the hypothesis is accepted.

Hypothesis 9: Integrated System and production efficiency are significantly and positive relationship in the ASKU PLC case of Aquaddis spring water.

Finally there is a significant and positive relation between Integrated System and production efficiency is also supported because the P-value of Integrated System which is ($P<0.05$; $\beta=0.103$) hence Integrated System has a significant and positive relationship with production efficiency, the value of beta ($\beta=0.103$) implies that a one percent increase in Integrated System in 10.3 percent increase in production efficiency, others factors remaining constant. Thus, the hypothesis is accepted.

4.8. Interview Question Analysis

Including the case company's top management members, there were 12 different people from the middle management and experts as key informants which were interviewed for the purpose of this study. The questions were 12 as depicted in Appendix B.

The interviewees defined TQM as a customer-focused approach that aims for continuous improvement and high-quality outcomes as well as increasing product quality, decreasing defects, improving quality information communication, improving market performance, increasing customer satisfaction and knowledge management. This is why the company needed a total quality management system. All of the top management members aspired to improve the company's reputation by implementing a management system that would boost sales and improve the company's performance in the market.

To what extent are TQM principles incorporated into day-to-day operations? Every interviewee gave the same response when asked how to better align your organization's goals with those of your customers: conduct research, gain an understanding of their requirements and expectations. The interviewer also asked them to explain how senior management shows its commitment in light of this understanding. Assume responsibility for the management system's effectiveness. Stated differently, senior leadership must set a role model.

Employees are often tasked with overseeing quality and are encouraged to contribute their ideas to the Total Quality Management (TQM) process, according to the interviews. They possessed to gather, examine, and provide information on the value of projects, goods, or services, quality measurement tools are important. Among the most popular methods for this are checklists and control charts. Flowcharts are graphical tools that show the order of steps or activities in a process and highlight

possible sources of variance or waste. Checklists are simple lists of items or tasks that need to be performed or validated for quality assurance or control.

There were some misconceptions among the interviewees when it came to using the TQMS principles. Some of them, primarily the heads of quality and members of top management, responded that the TQMS was implemented using the ISO 9001:2015 QMS conceptual model, which was created by the ISO organization. The framework was thought to be pertinent in order to determine the expected degree of success from the system implementation. The ISO 9001:2015 QMS's conceptual model incorporates the principles. In order to achieve continual performance improvement, the principles must be effectively applied, beginning with raising awareness and going through certification and implementation status control.

By asking the interviewees, "What approach does the organization take to foster an environment of continuous improvement?" we were able to learn about their experiences with the strategy for creating such an environment. They all gave essentially the same response. Encourage an attitude of ongoing learning and development among the staff: Innovating ideas are accepted and supported in a workplace that challenges the status quo and motivates staff to continuously look for better ways to do things.

“Can you explain the concept of knowledge management and its importance in organizations?" was the question posed to the interviewers. Nearly all of them responded, saying, "The aim is to enhance learning, innovation, and decision-making within the organization. Another interviewees was" What strategies would you recommend for integrating KM practices into a TQM framework?" was the question posed to the interviewers. Nearly all of them responded, saying, “Integrating Knowledge Management (KM) practices into a Total Quality Management (TQM) framework can enhance organizational performance by fostering a culture of continuous improvement and shared knowledge.”

4.9. Discussion of the Result

This section discusses the main findings of the research and makes comparisons with findings of previous researches.

The current research finding show that there is significant and positive relationship between overall production efficiency and customer focus, leadership, engagement of people, process approach, continuous improvement Fact-Based decision making, Relationship management, Integrated System and knowledge management. Results show that implementing integrated total quality management systems and knowledge management is essential for firms for a number of reasons, including meeting

regulatory requirements, improving marketing overseas, improving efficiency, lowering costs, and improving product/service quality. The degree to which top management takes ownership of quality performance, engages in the process of improving production efficiency, reviews "quality issues" in meetings, regards quality performance as a primary goal, and develops quality policies themselves is a key indicator of the strength of this relationship with leadership. The connection between employee involvement and overall Production efficiency, as determined by team formation, employee feedback on quality performance, employee participation in quality choices, and teamwork supervision and encouragement.

The relationship between process approach and overall production efficiency which is measured in terms of designing processes to minimize the chances of errors, maintain daily production schedule, providing clear process instructions, stopping production immediately for quality problems and adopting statistical process control. The correlation between continuous improvement and total production efficiency is determined by doing internal audits, monitoring non-conforming items, applying the PDCA cycle, and, lastly, by the leadership's dedication to ongoing improvement. The relationship between Fact-Based decision making and overall production efficiency which is measured in terms of compiling and recording useful data pertaining to quality, making data accessible to managers, supervisors, and engineers, managing data timely using data for managing quality and finally using data for evaluating supervisory as well as managerial performance.

The relationship between Relationship management and overall production efficiency which is measured in terms of believing in long-term relationships with suppliers & takes effort for the same, trusting on a small number of high-quality suppliers, having a systematic supplier rating system evaluating suppliers based on parameters related to quality, delivery and price.. Improving production efficiency is largely dependent on system integration. Organizations can significantly increase their production capabilities by reducing processes, enhancing data availability, and encouraging cooperation. In the end, this beneficial relationship results in higher customer satisfaction, a competitive advantage, and enhanced profitability. A better environment for increasing work knowledge is provided by the knowledge management strategy, which also encourages individuals to reflect on information and data and reframe strategic issues. Free flow of pertinent information is also a key component of the approach. Effective KM not only leads to immediate improvements in efficiency but also builds a resilient workforce capable of adapting to future challenges.

The Principles of Total Quality Management are enabled by Knowledge Management

Total Quality Management (TQM) and Knowledge Management (KM) are closely interconnected concepts that enhance Production efficiency. Let's explain into how KM supports the principles of TQM:

1. **Customer Focus:** Knowledge Management helps organizations systematize the feedback received from customers, which is crucial for TQM. By analyzing this feedback, organizations can better understand customer needs and adjust their processes and offerings accordingly. The main principle is to create value for the customer, which indicates how well the business meets present and future consumer needs, expectations, and satisfaction while also offering efficient customer relationship management (Mele & Colurcio, 2006).

2. **Leadership:** is positively related to knowledge management behaviors (i.e. Knowledge Acquisition, Knowledge Storage, Knowledge Transfer and Knowledge Application). Integrating knowledge management into leadership practices is essential for fostering an adaptable and innovative organizational culture. By prioritizing KM, leaders can enhance the capability of their organizations to learn, adapt, and thrive in an increasingly complex and competitive landscape. The interplay between effective leadership and knowledge management is crucial for driving sustainable success and achieving strategic objectives (Ali Ashraf, 2016).

3. **Engagement of Employees:** KM practices empower employees by involving them in the knowledge-sharing process. When employees feel their knowledge is valued, they are more likely to contribute to quality improvement initiatives, resulting in enhanced ownership and engagement. Making employees committed and loyal to their employer. This is fundamental because, if employees are not committed and loyal to their organizations, there is a risk of losing knowledge possessed by the employees through staff turnover. Recruitment and selection processes by employers can be utilized, as well, to support KM activities. This can be used to recruit people whose values are compatible with the existing organizational culture and whose personalities are conducive to knowledge sharing (Hislop et al., 2018).

4. **Processes Approach:** Knowledge Management supports the creation and maintenance of standardized procedures. By documenting best practices and lessons learned, organizations can develop guidelines that help maintain quality consistency across various divisions and locations.

5. **Continuous Improvement:** TQM emphasizes continuous improvement, and KM supports this by ensuring that best practices, innovative ideas, and insights are shared across the organization.

This culture of sharing knowledge fosters an environment where employees are encouraged to contribute to quality enhancements (Beckett et al., 2000).

6. **Integrated System :** Knowledge Management (KM) and integrated systems are concepts that play crucial roles in how organizations manage, utilize, and share information and knowledge effectively (Ruževičius, 2006). effective Knowledge Management and strong integrated systems are essential for organizations aiming to leverage knowledge as a strategic asset (Ali Ashraf, 2016). Together, they enhance the capacity of businesses to innovate, respond to market changes, and maintain a competitive edge in a rapidly evolving environment. By fostering a culture of continuous learning and collaboration, organizations can maximize their knowledge potential and improve production efficiency.

7. **Fact Based Decision Making:** Fact-based decision making and knowledge management are two interconnected concepts that play a crucial role in effective production and organizational management. an Intersection of Fact-Based Decision Making and Knowledge Management; Knowledge management supports fact-based decision making by providing access to relevant data, insights, and best practices that inform decisions (Ruževičius, 2006). KM practices help ensure the data being used is accurate, relevant, and timely, which is vital for fact-based analysis (Garg et al., 2018).Collecting insights from decisions and outcomes can feed back into the knowledge base, improving both decision-making processes and future KM efforts. Both approaches foster a culture of learning and improvement, which can lead to a more agile and responsive organization.

8. **Relationship Management**: Relationship management and knowledge management are two distinct but interrelated concepts that play critical roles in organizational success. Intersection of Relationship Management and Knowledge Management; Effective relationship management fosters open communication channels, which are essential for the dissemination of knowledge. Strong relationships within an organization encourage employees to share their knowledge more freely, enabling collaborative efforts and collective problem-solving (Ruževičius, 2006). Engaged stakeholders provide valuable feedback that can inform knowledge management processes, helping organizations to refine their strategies based on real-world experiences (Azizi et al., 2016). In CRM, understanding customer relationships can lead to the collection of insights that contribute to knowledge management, enhancing product development and service offerings (Olubunmi, 2015). By managing relationships effectively, organizations can promote

a culture of continuous learning, where lessons learned from various interactions can be documented and shared.

9. **Knowledge Management** serves as an energetic enabler of Total Quality Management, enhancing its principles through effective communication, collaboration, learning, and continuous improvement. By integrating KM practices with TQM efforts, organizations can achieve higher levels of quality and performance.

4.10. Summary of Major Findings

The study addressed Modeling the Integrated Impact of Total Quality Management and Knowledge Management on Production Efficiency. On the basis of this, the research's general conclusions and summaries were as follows;

The average descriptive statistics for production efficiency (dependent variable) result has shown that, the mean score was above the midpoint (3.00) i.e. 4.16 of the Likert scale, which means respondents responded that overall production efficiency, came from the total quality management principles and knowledge management. Namely Customer Focus, Leadership, Engagement of People, Process Approach, Continuous Improvement, Fact-Based Decision making, Relationship Management, Integrated System impact and knowledge management were accumulated above the midpoint & inclined to agree.

The result of independent variable of descriptive statistics has shown that, the mean score of TQMS variables i.e. Customer Focus, Leadership, Engagement of People Customer Focus, Leadership, Engagement of People, Process Approach, Continuous Improvement, Fact-Based Decision making, Relationship Management, Integrated System and knowledge management has been 4.06, 4.10, 3.97, 4.03, 4.14, 4.22, 4.29, 3.66 & 3.69 respectively. The result indicated that, the highest mean score from the independent variable is 4.29 for relationship management. Therefore, the company had better long-term relationships, trustworthy small number of high-quality suppliers, systematic supplier rating system and evaluates suppliers based on parameters related to quality, delivery and price. The result also indicated that, the lowest mean score from the independent variable is 3.36 for Integrated System. Hence the company needs to strive to measure Integrated System.

"Customer Focus, Relationship Management, Leadership, Employee Engagement, Process Approach, Continuous Improvement, Fact-Based Decision Making, Integrated System, and Knowledge Management" are among the independent factors, according to the correlation matrix. Were found to have an interval & at 0.01 p-value 2taild, a positive and strong correlation with the dependent variable

of total production efficiency, and an R-value (Pearson Correlation Coefficient) of.759**,.599**,.787**,.842**,.718**,.921**,.875**,.642**, and.687**. Compared to the other eight independent variables, Fact-Based Decision making in this instance had a stronger and higher correlation with overall production efficiency ($r = 0.921$, $N = 155$, $p < 0.00$).

Interpretation of Two Different R^2 Values is the final significant finding of the regression analysis result. The first is the integration of TQM principles and knowledge management, and the second is the eight independent variables that make up the TQM principles (Customer Focus, Leadership, Engagement of People, Process Approach, Continuous Improvement, Fact-Based Decision Making, Relationship Management, and Integrated System). Eight TQM principles contribute to statistically significant level at (p-value = 0.001). The score of the coefficient correlation determination (R^2) is 0.887 which indicate, that 88.7% of the variance in the dependent variable is explained by the independent variables. While this is still a substantial percentage, it implies that there is 11.3% of the variance that remains unexplained by the model. This could suggest that while the model is relatively effective, there may be other factors or variables not included in. Customer focus, leadership, employee engagement, process approach, continuous improvement, fact-based decision making, relationship management, integrated systems, and knowledge management are all aspects of TQM that when combined with KM lead to a statistically significant level at (p-value = 0.001). The nine independent variables accounted for 95.6% of the variability in production efficiency, as indicated by the coefficient correlation determination (R^2) score. About 4.4% of the variability in the overall customer satisfaction level is attributed to the other variables that were not taken into account in this study. P-values for Customer Focus, Leadership, Engagement of People, Fact-Based Decision Making, Relationship Management, Integrated System, and Knowledge Management are all less than 0.05,This indicates a very strong relationship and implies that the model is likely performing very well in capturing the underlying trends in the data. It suggests minimal unexplained variance, indicating that the predictor variables are highly effective in predicting the outcome. Both R^2 values suggest effective models, but the R^2 of integrated TQM and KM (0.956) represents a more closely fitting model compared to the R^2 of TQM by itself (0.887).

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The main purpose of the study was to Modeling the Integrated Impact of Total Quality Management and Knowledge Management on Production Efficiency. The study was conducted on Aquaddis spring water in ASKU PLC. Every one of the selected independent variables or dimensions significantly affects the efficiency of production.

In terms of the respondents' demographics, most of them (66.5%) were men, and the remaining 33.5% were women. Additionally, based on their educational background, the majority of responders had degrees. In order to examine the links between the variables, correlation analysis was performed. The correlation matrix showed that all independent variables had positive coefficients of correlation and significantly correlated with the dependent variable. Further regression analysis was also conducted and results revealed that all the independent variables contribute to statistically significant level at (p-value = 0.001). The score of the coefficient correlation determination (R^2) Interpretation of Two Different R^2 Values: that is $R^2 = 0.887$ and $R^2 = 0.956$ is which indicate, 88.7% and 95.6% of the variability of production efficiency was explained by the nine independent variables. While both R^2 results point to acceptable models, the first one (0.956) explains the data better than the second (0.887). In conclusion, the integrated impact of Total Quality Management (TQM) and Knowledge Management (KM) on production efficiency is substantial and multifaceted. TQM places a strong emphasis on Fact-Based Decision Making, Relationship Management, Leadership, Customer Focus, Engagement of People, Process Approach, Continuous Improvement, and Integrated System; in addition, Knowledge Management (KM) concentrates on knowledge acquisition, knowledge storage, and knowledge transfer and knowledge application within an organization. When effectively combined, these two management practices create a powerful synergy that enhances production efficiency.

The researcher can accept the hypothesis on all KM and TQMS dimensions because, according to hypothesis testing, the p-value for Customer Focus, Leadership, Engagement of People, Process Approach, Continuous Improvement, Fact-Based Decision Making, Relationship Management, Integration System, and Knowledge Management is less than 0.05.

Now that the company is in a better situation than it was a year ago, it can carry out its production processes more effectively, which will improve production efficiency in terms of both business and operational performance.

5.2. Recommendation

Integrated TQMS principles and knowledge management are significantly positively correlated with Production efficiency. Many researchers have examined the use of total quality management systems as a means of boosting production efficiency; this research has verified the beneficial effects of integrating knowledge management and total quality management systems on production efficiency, as confirmed by the case company. The descriptive study found that most respondents believed that the principles of total quality management and knowledge management boost production efficiency. The researcher makes the following recommendations in light of the study's findings and the conclusions drawn in the previous sections.

The majority of the dependent and independent variables' mean scores have accumulated above the midpoint and are oriented toward agreement. The company should use integrated total quality management principles and knowledge management to improve productivity, input material utilization, cycle time, ability to produce variety of products, access to new domestic and international markets, sales of the company's product, process variability, market share, measure social impact, and work knowledge in order to achieve a progressive level of production efficiency.

Even though the research's conclusions show that the example company's production efficiency gains from the adoption of knowledge management and total quality management concepts, there is always room for improvement. The interview data was used to provide the following recommendations to improve the case company's existing implementation of these ideas. Companies should provide their staff with sufficient training regarding the implementation process in order for them to gain the requisite knowledge and expertise before putting total quality management principles and knowledge management into reality.

- Invest in training programs to raise staff members' KM ability. Training on knowledge sharing, documentation, and access is part of this. Motivate staff members to accept responsibility for their knowledge contributions.
- Make sure that documents are easily searchable and accessible to all employees. Effective KM documentation requires a structured strategy that emphasizes clarity, collaboration, and continuous improvement

- Establish key performance indicators (KPIs) to measure the impact of the integrated TQM and KM approach on production efficiency. Regularly review these metrics and adjust strategies as necessary to ensure continuous improvement
- The combined TQMS and KM implementation process should continue to be continuously assessed, revised, and updated in order to maintain this operational and production effectiveness.

5.3. Future Research Directions

These future research directions can contribute to advancing knowledge, informing policy, and ultimately fostering societal well-being. The dynamic nature of global challenges and technological advancements necessitates ongoing inquiry and adaptation to meet the evolving needs of society. The integrated impact of Total Quality Management (TQM) and Knowledge Management (KM) is a promising area for future research, particularly as organizations continually seek to enhance their production efficiency through improved quality and effective knowledge utilization.

Future studies should aim to include larger and more diverse populations to enhance the generalizability of the findings. Undertaking research in diverse cultural contexts may shed light on the ways in which contextual factors impact outcomes and result in more sophisticated knowledge. Future studies could explore the underlying mechanisms that drive the relationships observed in this study, providing a clearer picture of causality. In order to ascertain the effectiveness of treatments or programs in actual contexts, research may also concentrate on the practical application of findings. Explore the role of digital tools and technologies (e.g., AI, big data analytics, and collaboration platforms) in enhancing the integration of TQM and KM. By addressing these research directions, scholars and practitioners can better understand how these two paradigms complement each other in driving production efficiency, fostering innovation, and enhancing overall performance.

CHAPTER SIX

6. REFERENCES

Abbas, J., Zhang, Q., Hussain, I., Akram, S., Afaq, A., & Shad, M. A. (2020). Sustainable innovation in small medium enterprises: The impact of knowledge management on organizational innovation through a mediation analysis by using SEM approach. *Sustainability (Switzerland)*, *12*(6). https://doi.org/10.3390/su12062407

Al-Busaidi, K. A., Olfman, L., Ryan, T., & Leroy, G. (2010). Sharing Knowledge to A Knowledge Management System: Examining the motivators and the benefits in an Omani organization. *Journal of Organizational Knowledge Management*, *2010*(1), 928–935.

Al-Maamari, Q. A., Alkadash, T., Al-Absy, M. S., Nagi, M., & Abdullah, M. A. (2021). THE MEDIATION IMPACT OF ORGANIZATIONAL COMMITMENT ON THE TOTAL QUALITY MANAGEMENT PRACTICES AND INDIVIDUAL READINESS FOR TQM IMPLEMENTATION WITHIN YEMENI OIL UNITS. *International Journal for Quality Research*, *15*(2).

Alavi, M., & Leidner, D. E. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, 107–136.

Alawag, A. M., Salah Alaloul, W., Liew, M. S., Al-Aidrous, A. H. M. H., Saad, S., & Ammad, S. (2020). Total Quality Management Practices and Adoption in Construction Industry Organizations: A Review. *2020 2nd International Sustainability and Resilience Conference: Technology and Innovation in Building Designs*. https://doi.org/10.1109/IEEECONF51154.2020.9319992

Ali Ashraf, A. (2016). Total Quality Management, Knowledge Management and Corporate Culture: How do they synchronized for performance excellence. *Soc Sci Pakistan Journal of Commerce and Social Sciences*, *10*(1), 200–211.

Alzoubi, H. M., Ahmed, G., & Alshurideh, M. (2022). An empirical investigation into the impact of product quality dimensions on improving the order-winners and customer satisfaction. *International Journal of Productivity and Quality Management*, *36*(2), 169–186.

Ashraf, Z., Jaffri, A., & Sharif, M. (2012). Increasing Employee Organizational Commitment by Correlating Goal Setting, Employee Engagement and Optimism at Workplace. *European Journal of Business*, *4*(2), 71–77. http://iiste.org/Journals/index.php/EJBM/article/view/1036

Aziz, R. Z. A., & Morita, H. (2016). National culture, organisational culture, total quality management implementation, and performance: an empirical investigation. *International Journal of Productivity and Quality Management*, *19*(2), 139–159.

Azizi, R., Maleki, M., Moradi-Moghadam, M., & Cruz-Machado, V. (2016). The impact of knowledge management practices on supply chain quality management and competitive advantages. *Management and Production Engineering Review*, *1*.

Azmi, I. M. A. G., Ashraf, Q. M., Zulhuda, S., & Daud, M. Bin. (2016). Critical data leak analysis in educational environment. *Proceedings of 2016 4th International Conference on Cyber and IT Service Management, CITSM 2016*. https://doi.org/10.1109/CITSM.2016.7577523

Beckett, A. J., Wainwright, C. E. R., & Bance, D. (2000). Implementing an industrial continuous improvement system: A knowledge management case study. *Industrial Management and Data Systems*, *100*(7), 330–338. https://doi.org/10.1108/02635570010349113

Bidewell, P., & Sapsford, L. (2015). *The (re) evolution of the lean startup methodology*. *May*, 67. https://lup.lub.lu.se/student-papers/search/publication/8569110

Brata, J. S. H., & Soediantono, D. (2022). Total Quality Manufacturing (TQM) and Recommendations for Its Application in the Defense Industry: A Literature Review. *International Journal of Social and Management Studies (Ijosmas)*, *3*(3), 50–62.

Cheung, C. M. K., Lee, M. K. O., & Lee, Z. W. Y. (2013). Understanding the continuance intention of knowledge sharing in online communities of practice through the post-knowledge-sharing evaluation processes. *Journal of the American Society for Information Science and Technology*, *64*(7), 1357–1374.

Cselényi, J., & Illés, B. (2006). Planning and controlling of material flow systems. *Textbook, Miskolci Egyetemi Kiadó*.

Cummings, J. L. (2002). *Knowledge transfer across R&D units: an empirical investigation of the factors affecting successful knowledge transfer across intra-and inter-organizational units*. The George Washington University.

Davenport, T. H. (1998). Working knowledge: How organizations manage what they know. *NewYork Harvard Business School*.

de Bem Machado, A., Secinaro, S., Calandra, D., & Lanzalonga, F. (2022). Knowledge management and digital transformation for Industry 4.0: a structured literature review. *Knowledge Management Research and Practice*, *20*(2), 320–338. https://doi.org/10.1080/14778238.2021.2015261

Debowski, S. (2006). Critical times: An exploration of recent evaluations of researcher development needs. *Critical Visions: Thinking, Learning and Researching in Higher Education. Perth, Western Australia*, *29*, 81–86.

Desouza, K., & Paquette, S. (2011). *Knowledge management: An introduction*. Neal-Schuman Publishers, Inc.

Dogan, E., & Fausten, D. K. (2003). Productivity and technical change in Malaysian banking: 1989–1998. *Asia-Pacific Financial Markets*, *10*, 205–237.

Field, A. (2005). Exploring data. *Discovering Statistics Using SPSS*, *2*, 63–106.

Ford, D. P., & Staples, S. (2010). Are full and partial knowledge sharing the same? *Journal of Knowledge Management*, *14*(3), 394–409.

Førsund, F. R., Hjalmarsson, L., & Forsund, F. R. (1974). On the Measurement of Productive Efficiency. *The Swedish Journal of Economics*, *76*(2), 141. https://doi.org/10.2307/3439197

Frey, R. S. (2002). Small business knowledge management success story—this stuff really works! *Knowledge and Process Management*, *9*(3), 172–177.

Frey, S. (2016). *Sharing knowledge and expertise across departments: Creating a database to address KM (knowledge management) issues and concerns.*

Galarneau, D., & Dumas, C. (1993). About productivity. *Perspectives on Labour and Income*, *5*(1).

García-Bernal, J., & Ramírez-Alesón, M. (2015). Why and how TQM leads to performance improvements. *Quality Management Journal*, *22*(3), 23–37. https://doi.org/10.1080/10686967.2015.11918439

Garg, S., Pandey, D. K., & Vashisht, A. (2018). Importance of Knowledge Management for Organizational Management. *Deliberative Research*, *37*(1), 41–45. https://search.proquest.com/scholarly-journals/importance-knowledge-management-organizational/docview/2086689358/se-2?accountid=17242

Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. *Journal of Management Information Systems*, *18*(1), 185–214.

Gupta, A. K., & Govindarajan, V. (2000). Knowledge flows within multinational corporations. *Strategic Management Journal*, *21*(4), 473–496.

Gupta, B. (2008). Role of personality in knowledge sharing and knowledge acquisition behavior. *Journal of the Indian Academy of Applied Psychology*, *34*(1), 143–149.

Haux, T. (2018). What is 'impact'? *Social Policy Review 30, February*, 181–202. https://doi.org/10.2307/j.ctv3hh50d.15

Hislop, D., Bosua, R., & Helms, R. (2018). *Knowledge management in organizations: A critical introduction*. Oxford university press.

Hossain, R., Rasel, K., & Talapatra, S. (2014). Increasing Productivity through Facility Layout Improvement using Systematic Layout Planning Pattern Theory. *Global Journal of Researches in Engineering: J General Engineering*, *14*(7), 71–76. https://engineeringresearch.org/index.php/GJRE/article/view/1269

Jaafreh, A. B., & Al-abedallat, A. Z. (2012). The Effect of Quality Management Practices on Organizational Performance in Jordan: An Empirical Study. *International Journal of Financial Research*, *4*(1), 93–109. https://doi.org/10.5430/ijfr.v4n1p93

Jote, G. E. (2020). *June, 2020 Addis Ababa, Ethiopia*.

Kanawaty, G. (1992). *Introduction to work study*. International Labour Organization.

Karami, A., Shirouyehzad, H., & Asadpour, M. (2021). A DEA-Based Decision Support Framework for Organizations' Performance Evaluation considering TQM and Knowledge Management. *Journal of Healthcare Engineering*, *2021*(1), 6654600.

Koc, T. (2011). The relationship between TQM and performance in small manufacturing enterprises: The mediation effect of failure. *International Journal of Industrial Engineering : Theory Applications and Practice*, *18*(4), 203–218.

Kovács, G., & Kot, S. (2017). Facility layout redesign for efficiency improvement and cost reduction. *Journal of Applied Mathematics and Computational Mechanics*, *16*(1).

Li, H., Wigmosta, M. S., Wu, H., Huang, M., Ke, Y., Coleman, A. M., & Leung, L. R. (2013). A physically based runoff routing model for land surface and earth system models. *Journal of Hydrometeorology*, *14*(3), 808–828.

Limpiada, R. L. (2016). Selected Papers from the Asia Conference on Economics & Business Research 2015. *Selected Papers from the Asia Conference on Economics & Business Research 2015*, 139–145. https://doi.org/10.1007/978-981-10-0986-0

Lin, B., Wu, W., & Song, M. (2023). Industry 4.0: driving factors and impacts on firm's performance: an empirical study on China's manufacturing industry. *Annals of Operations Research*, *329*(1–2), 47–67. https://doi.org/10.1007/s10479-019-03433-6

Losee, R. (2014). Information and Knowledge: Combining Justification, Truth, and Belief. *Informing Science: The International Journal of an Emerging Transdiscipline*, *17*, 075–093. https://doi.org/10.28945/1950

Luthra, S., Garg, D., Agarwal, A., & Mangla, S. K. (2020). *Total quality management (TQM): Principles, methods, and applications*. CRC press.

Masa'deh, R., Obeidat, B. Y., & Tarhini, A. (2016a). A Jordanian empirical study of the associations among transformational leadership, transactional leadership, knowledge sharing, job performance, and firm performance: A structural equation modelling approach. *Journal of Management Development*, *35*(5), 681–705. https://doi.org/10.1108/JMD-09-2015-0134

Masa'deh, R., Obeidat, B. Y., & Tarhini, A. (2016b). A Jordanian empirical study of the associations among transformational leadership, transactional leadership, knowledge sharing, job performance, and firm performance: A structural equation modelling approach. *Journal of Management Development*, *35*(5), 681–705.

Mele, C., & Colurcio, M. (2006). The evolving path of TQM: towards business excellence and stakeholder value. *International Journal of Quality & Reliability Management*, *23*(5), 464–489.

Mittal, V., & Frennea, C. (2010). Customer satisfaction: a strategic review and guidelines for managers. *MSI Fast Forward Series, Marketing Science Institute, Cambridge, MA*.

Mustapha, M. R., Muda, M. S., & Hasan, F. A. (2011). A survey of total quality management in the Malaysian small and medium sized manufacturing companies. *International Journal of Humanities and Social Science*, *1*(2), 118–122.

Ngwenya, B., Sibanda, V., Matunzeni, T., Ngwenya, B., Sibanda, V., & Matunzeni, T. (2016). Challenges and benefits of total quality management (TQM) implementation in manufacturing companies: A case study of delta beverages. *Zimbabwe The Impact of Multi-Currency System on the Viability of the Zimbabwean Hospitality System View Project. Int. J. Orig. Res*, *2*(6), 296–307.

Novotná, M., Volek, T., Rost, M., & Vrchota, J. (2021). Impact of technology investment on firm's production efficiency factor in manufacturing. *Journal of Business Economics and Management*, *22*(1), 135–155. https://doi.org/10.3846/jbem.2020.13635

Nur, F., Hossain, N. U. I., & Ullah, M. (2016). Determining of critical success factors for TQM execution in ship building industry of Bangladesh. *Presidency*, *3*(2), 47–53.

Obeidat, B. Y., Al-Suradi, M. M., Masa'deh, R., & Tarhini, A. (2016). The impact of knowledge management on innovation: An empirical study on Jordanian consultancy firms. *Management Research Review*, *39*(10), 1214–1238.

Olubunmi, F. (2015). Knowledge Management As an Important Tool in Organisational Management : a Review of. *Library Philosophy and Practice*, *4*(10), 1–23. http://digitalcommons.unl.edu/libphilprachttp://digitalcommons.unl.edu/libphilprac/1238

Pedhazur, E. J., & Kerlinger, F. N. (1982). *Multiple regression in behavioral research*.

Permana, A., Purba, H. H., & Rizkiyah, N. D. (2021). A systematic literature review of total quality management (TQM) implementation in the organization. *International Journal of Production Management and Engineering*, *9*(1), 25–36. https://doi.org/10.4995/IJPME.2021.13765

R. Anvari, a., Sorooshian, S., & Moghimi, R. (2012). The Strategic Approach to Exploration Review on TQM and Lean Production. *International Journal of Lean Thinking*, *3*(2), 13–26.

Roos, G. (2005). Epistemological cultures and knowledge transfer within and between organizations. *Knowledge Management and Intellectual Capital: Establishing a Field of Practice, Palgrave Macmillan, Basingstoke*, 149–172.

Russell, C. J., & Bobko, P. (1992). Moderated Regression Analysis and Likert Scales: Too Coarse for Comfort. *Journal of Applied Psychology*, *77*(3), 336–342. https://doi.org/10.1037/0021-9010.77.3.336

Ruževičius, J. (2006). Integration or total quality management and knowledge management. *Informacijos Mokslai*, *37*, 30–38.

Sadikoglu, E., & Zehir, C. (2010). Investigating the effects of innovation and employee performance on the relationship between total quality management practices and firm performance: An empirical study of Turkish firms. *International Journal of Production Economics*, *127*(1), 13–26. https://doi.org/10.1016/j.ijpe.2010.02.013

Sahibzada, U. F., Jianfeng, C., Latif, K. F., Shafait, Z., & Sahibzada, H. F. (2022). Interpreting the impact of knowledge management processes on organizational performance in Chinese higher education: mediating role of knowledge worker productivity. *Studies in Higher Education*, *47*(4), 713–730.

Sallis, E. (2014). *Total quality management in education*. Routledge.

Samson, K. (2017). Effects of total quality management (TQM) on firm's operational performance (South Korea). *Available at SSRN 2922208*.

Selmer, J. (2013). The TQM Journal. *The TQM Journal*, *25*(5), 61–72. https://doi.org/10.1108/tqm.2013.10625eaa.001

Shah, R., & Ward, P. T. (2007). Defining and developing measures of lean production. *Journal of Operations Management*, *25*(4), 785–805. https://doi.org/10.1016/j.jom.2007.01.019

Shannak, R., Masa'deh, R., Al-Zu'bi, Z., Obeidat, B., Alshurideh, M., & Altamony, H. (2012). A theoretical perspective on the relationship between knowledge management systems, customer knowledge management, and firm competitive advantage. *European Journal of Social Sciences*, *32*(4), 520–532.

Sinha, N., Garg, A. K., & Dhall, N. (2016). Effect of TQM principles on performance of Indian SMEs: the case of automotive supply chain. *The TQM Journal*, *28*(3).

Taherdoost, H. (2018). Validity and Reliability of the Research Instrument; How to Test the Validation of a Questionnaire/Survey in a Research. *SSRN Electronic Journal*, *5*(3), 28–36. https://doi.org/10.2139/ssrn.3205040

Telek, P. (2013). Equipment Preselection for Integrated Design of Materials Handling Systems. *Advanced Logistic Systems*, *7*(2), 57–66.

Thakur, G. R. (2013). Indoctrinating Knowledge Management Culture in Educational Institutions. *International Peer Reviewed Scholarly Research Journal 2278-8808, PISSN 2319-4766. Impact Factor-1.38.*, *2*(8), 353–359.

Tiwana, A. (2010). Systems development ambidexterity: Explaining the complementary and substitutive roles of formal and informal controls. *Journal of Management Information Systems*, *27*(2), 87–126.

Tompkins, J. A., White, J. A., Bozer, Y. A., & Tanchoco, J. M. A. (2010). *Facilities planning*. John Wiley & Sons.

Trojanowska, J., Kolinski, A., Galusik, D., Varela, M. L. R., & Machado, J. (2018). A methodology of improvement of manufacturing productivity through increasing operational efficiency of the production process. *Advances in Manufacturing*, 23–32.

Tsai, Y. C., & Wu, C. S. (2011). The effects of interpartner resource alignment and absorptive capacity on knowledge transfer performance. *African Journal of Business Management*, *5*(26), 10434–10445.

Yas, H., Alsaud, A. B., Almaghrabi, H. A., Almaghrabi, A. A., & Othman, B. (2021). The effects of TQM practices on performance of organizations: A case of selected manufacturing industries in Saudi Arabia. *Management Science Letters*, *11*, 503–510. https://doi.org/10.5267/j.msl.2020.9.017

Yusr, M. M., Mokhtar, S. S. M., Perumal, S., & Salimon, M. G. (2022). The impact of customer knowledge management, TQM and marketing capabilities on product innovation performance of Malaysian SMEs: an empirical study. *International Journal of Innovation Science*, *14*(2), 316–338.

Zaidi, Z. M., & Ahmad, N. (2020). Total Quality Management (TQM) Practices and Operational Performance in Manufacturing Company. *Research In Management Of Technology And Business*, *1*(1), 13–27. http://publisher.uthm.edu.my/periodicals/index.php/rmtb

Zhang, M., Batta, R., & Nagi, R. (2011). Designing manufacturing facility layouts to mitigate congestion. *IIE Transactions (Institute of Industrial Engineers)*, *43*(10), 689–702. https://doi.org/10.1080/0740817X.2010.546386

APPENDIX

Appendix - A

Addis Ababa University

Addis Ababa Institute of Technology (AAiT)

School of Mechanical and Industrial Engineering (SMIE)

Dear Respondents

The goal of this questionnaire is to collect data for a future study on Total Quality Management. Which is known as: - Improvement of production efficiency through total quality management a case of Aquaddis spring water in ASKU plc. The thesis is as a partial fulfillment of the requirements for the Masters of in Science in Industrial Engineering Degree.

The collected data will be used for academic purpose only and will be kept confidential.
Thank you in advance for agreeing to participate in the study and for giving up your time.

- Please place a check mark (✓) in the box where you want to select.

A. Demographic Characteristics
Highest Qualification: Diploma ☐ A/BSC ☐ Masters & above ☐
Work experience [year] 1-2 ☐ 3-4 ☐ 5-7 ☐ 26-40 ☐
Sex: Male ☐ Female ☐

B. Management and Employees Opinion Measurement

The following items which are related to your organizations performance as measured from the contribution of TQM implementation. It is based on your degree of agreement as rated from 1 to 5 from strong disagreement to strong agreement using (✓). Accordingly, please rate on the scale 1 to 5, with 1= strongly disagree; 2= disagree; 3= neither agree nor disagree; 4= agree; 5= strongly agree, and please tick "" sign in the corresponding cell provided.

Code	**Items**	***Measurement scale***				
		1	2	3	4	5
I	***Customer Focus***					
CF1	Your customers provide feedback on quality and delivery performance					
CF2	Your organization measures customer satisfaction of external customer					
CF3	Customer requirements are used as the basis for quality in your organization					
CF4	Your employees are aware about your customers					
CF5	Your customers visit your plant					
II	***Leadership***					
LP1	The top management of your organization (i.e. Top executives and major department heads) assumes responsibility for quality performance					
LP2	In your organization, major department heads participate in the production improvement process					
LP3	In your organization, "organization improved" are reviewed in top management meetings					
LP4	Senior leadership demonstrates and communicates to the entire organization its dedication to quality ideals.					
LP5	In your organization, quality policy is developed by top management					

III	***Engagement of people***					
EP1	Your organization form teams to solve problems					
EP2	Your organization provides feedback to employees on their quality performance					
EP3	Employees are also involved in quality decisions in your organization					
EP4	Supervisors encourage teamwork in your organization					
EP5	Make training available for employees who need to learn new processes and who want to explore opportunities for advancement					
IV	***Process approach***					
PA1	Processes in your organization are designed to minimize the chances of errors					
PA2	Your organization meets daily production schedule					
PA3	In your organization, production is stopped immediately for quality problems					
PA4	Your organization provides clear process instructions					
PA5	Your organization has adopted statistical process control					
V	***Continuous Improvement***					
CI1	Your organization plan and conduct internal audits					
CI2	Your organization has control of non-conforming products.					
CI3	Continual improvement practiced in your organization is based on the PDCA cycle.					
CI4	Top management is committed to continual improvement.					
CI5	There is emphasis of continual improvement of all operations and at all levels					

VI	***Integrated System***					
IS1	How would you rate the ease of use of the current integration system					
IS2	The integration system helps your day-to-day activities					
IS3	Has anyone received training on the integration system from your organization					
IS4	Your organization have a clear understanding of how various processes within the organization are interconnected					
IS5	Your organization measure its integration system					
VII	***Fact-based decision-making***					
DM1	Your organization compiles and record useful data pertaining to quality					
DM2	In your organization, data are accessible to managers, supervisors, and engineers					
DM3	Your organization manages data timely					
DM4	Your organization use data for managing quality					
DM5	Your organization use data for evaluating supervisory as well as managerial performance					
VIII	***Relationship management***					
RM1	Your organization believes in long-term relationships with suppliers and takes effort for the same					
RM2	Your organization trusts on a small number of high-quality suppliers					
RM3	Your organization evaluates suppliers based on parameters related to quality, delivery and price					
RM4	Your organization has a systematic supplier rating system					
RM5	Your organization is working with suppliers to ensure that expectations met					

IX	***Knowledge Management***					
KM1	Organization has knowledge management department					
KM2	There is free flow of relevant information in the organization.					
KM3	Employees can influence the management decisions related to work.					
KM4	Organization provides better environment for improving work knowledge of the employees					
KM5	Management of the organization encourages people to reflect on information and data, and reframe them at the strategic level.					

If you have any other suggestions or recommendations regarding how the downstream supply chain distribution performance might be assessed and improved, please write them here:

Thanks a lot!

Appendix –B

Interview Questions

1. How would you define Total Quality Management, and what do you consider its core values to be?
2. Can you describe how TQM principles are integrated into the daily operations and long-term strategies of your manufacturing processes?
3. How does upper management demonstrate its commitment to quality principles, and how is that communicated throughout the organization?
4. What role do employees play in the TQM process, and how is their continuous involvement ensured?
5. Can you give an example of how key production processes have been optimized through TQM practices?
6. What approach does the organization take to foster an environment of continuous improvement?
7. How have TQM initiatives affected the efficiency and quality of production in measurable terms?
8. Can you explain the concept of knowledge management and its importance in organizations?
9. How do you measure the effectiveness of a knowledge management system?
10. Can you provide examples of methods or practices that encourage knowledge sharing among employees?
11. Why is the integration of KM and TQM important for organizations?
12. What strategies would you recommend for integrating KM practices into a TQM framework?