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'The Effect of Critical Factors on Product Quality': An Applied Research on Electrical Industry in Egypt

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ABSTRACT

The purpose of this study is to investigate the effect that critical factors on product quality. Which investigates the influence that five essential elements—markets, manpower, money capital, management, and raw materials—have on the product quality produced in the electrical sector. The study utilised a quantitative methodology, and it gathered information from 369 individuals that participated in the survey inside Elsewedy Electric. Structural Equation Modelling (SEM) was utilised for the purpose of data analysis, and the SmartPLS software was utilised for Confirmatory Factor Analysis (CFA) in order to test the hypothesised correlations between the essential elements and product quality. At Elsewedy Electric, the results of the SEM study suggest that all five essential factors—Markets, Manpower, Money Capital, Management, and Raw Materials—have a strong beneficial effect on product quality. This is the conclusion that can be drawn from the findings of the analysis. With a confidence level of 99%, these data were statistically significant at a level of $p < 0.05$, thereby verifying all five hypotheses that were being investigated in this study. A detailed evaluation of many essential aspects that influence product quality within the specific context of Egypt's electrical industry is provided in this study.

Keywords: Product Quality, Manufacturing Sector, Global Competitiveness, Critical Factors, Electrical Industry, El-Sewedy electric

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1. Introduction

Globalization extends its web across diversified markets, making the quality of products produced internally a significant concern not only in the domestic market but also in the global market (Pegoraro et al., 2020). This study aims to address the critical issue of product quality in Egypt, a country with great potential and a rich history in manufacturing. The importance of quality products has become a major focus for firms in the international business environment for several reasons. As organizations face the challenges of globalization and rapid technological advancements, there is an increasing need to adopt a customer-oriented market strategy as a crucial competitive advantage (Shi et al., 2018).

With economic globalization, the world is now viewed as a single market where national borders are blurred, and markets have merged into a larger marketplace. In this constantly evolving environment, providing consumers with what they want, amid a wide choice of products and brands regularly being offered, has become a challenging task. Amid this growing competition, the quality of products has emerged as a crucial strategic factor that helps firms handle conflicts, attract customers, and capture their targeted market share. Product quality is

a complex concept, focusing on features and characteristics that ensure a product meets certain performance standards in line with stated or inherent customer needs (Aharoni, 2024).

For Egypt, a country with a diverse industrial base capable of producing a wide range of goods, including textiles, food products, electronics, and automotive parts, it is essential to ensure and enhance product quality. Product quality reflects not only the productivity and efficiency of production processes but also serves as a defining characteristic of customer satisfaction, brand strength, and competitiveness (El-Haddad, 2018). Identifying the critical factors that affect product quality is vital for several reasons. First, it leads to efficiency in the production process by preventing deviations from recommended quality standards. Second, it helps identify areas of weakness, enabling manufacturers to control inefficiencies and reduce defects. Third, it provides valuable information on external factors such as government policies, consumer needs, and technological forces that influence product quality (Meesala & Paul, 2018).

This study aims to explore these critical factors in more detail within the context of Egypt's manufacturing sector. Among the internal factors considered are markets, manpower, capital, management, and raw materials. The study will provide useful information to assist manufacturers, policymakers, and other key stakeholders in improving the standards of goods produced in Egypt. Therefore, the research outcomes will not only contribute to theoretical knowledge about the impact of product quality but will also offer significant policy implications for enhancing industrial practices and economic performance in Egypt.

Despite the crucial role product quality plays in achieving competitive advantage and driving economic development, Egyptian manufacturers face numerous constraints in producing high-quality goods (Haseeb et al., 2019). Internal challenges such as outdated manufacturing technologies, weak quality assurance systems, and a scarcity of skilled labor hamper organizational learning and hinder production efficiency (Basten & Haamann, 2018). These issues often result in inconsistent product quality, higher defect rates, and increased waste. Furthermore, inadequacies in the supply of high-quality raw materials exacerbate these challenges, making it difficult for manufacturers to meet the standards required by both local and international markets. Thus, this research seeks to analyze these challenges, identify the factors affecting product quality, and provide recommendations for improving product quality within manufacturing firms in Egypt, focusing specifically on the Elsewedy Electric Company.

2. Literature Review

2.1. Critical Factors

A number of key factors have been identified in the thesis, which is closely related to the manufacturing companies and their effects on product quality. The raw materials, manpower, money capital, management and markets represents the factors involved in the business. Every one of them is unique and has an equal importance in the consideration of the worth of the products. Examples of such systems include markets which are unstructured places that can greatly change, from the consumer business relationships' preferences to the competitive pressures (Bhattacharya, 2021).

Another essential dimension in the study is manpower as already indicated in the thesis. The level of knowledge or skill, or how much the workers want or like their jobs also influence how much care is taken while handling the processes in the production line. The principal reasons as to why some companies should consider putting a lot of emphasis on the training and development of employees include the fact that the companies that recruit and develop skilled personnel are more capable of maintaining high quality. In the context of the thesis, it is stated

that the staff that has creative and qualified employees is the basis for the creation of flawless products (Nagy et al. 2018).

2.2. Markets

In the modern context of the growing significance and expansion of markets, markets may be described as growing instances of an identified economy, which is characterised by its inherent complexity, dynamics, and inter connectedness across several regions. This means global interconnectivity of the financial market and therefore the quality of products that is manufactured internally has great importance in home market as well as overseas market (Bjørnskov & Foss, 2016). In the process of economic globalization, the world is seen as a large electronic market where national boundaries often cease to exist in a number of ways. Other new market trends include the integration of different markets and countries into one single big market. I believe this transformation poses colossal challenges for manufacturers. In such a constantly developing environment, there is a problem of satisfying consumers' needs eventually. Organisations are operating in markets where stores are saturated with all sorts of goods and services and every product and brand competing for consumers' attention (McCann & Acs, 2015).

In the middle of this growing heaped competition the quality has also emerged as a key strategic weapon. Thereby the quality of products which the firms produce assists them in solving conflict, in driving in customers and in acquiring the required strategic stakeholders' market share. Having cut a competitive figure in the middle of this upward vying, the product quality becomes a must-have need. As has been seen above, experience is one of the most critical factors that determine the success or failure of a business venture in the market (Rahman et al. 2020).

Given the structural diversification of the Egyptian industry, able to produce virtually all sectors of industrial products including textiles, foodstuffs, electronics or auto parts, this clearly and emphatically underscores why quality enhancement and assurance is crucial. From the results of the study it is concluded that product quality for Egyptian manufacturers is not only the efficiency of the manufacturing process. More importantly, it has been stated that is the, defining characteristic that influences the customer satisfaction, strengthens the company's brand, and enables the company to become a competitive player in the domestic as well as international markets (Ali & Msadfa, 2016).

2.3. Manpower

Analyzing the complex world of international manufacturing systems, manpower stands out as a key element that has a tremendous impact on product quality. While the use of machineries in production line involves automation in a way that can be pre-set to a specific level of accuracy, human workers introduces skills, creativity and flexibility to work. This manpower component is not only the muscle power to drive machinery or manually perform work, but also the knowledge, passion, and adherence to social, cultural and religious practices that an employee contributes to work (Dillon, 2019).

Egypt in particular is a country with long tradition of several industries including textile, food products, electronics and auto parts etc and in such a backdrop the significance of manpower as a factor influencing and sustaining product quality is simply overwhelming. Egyptian manufacturers like manufacturers all over the world are discovering that while other aspects influenced by advances in technology make products at least on par with Egyptian counterparts in terms of the machinery and manufacturing process required, the people are the one that make

the difference in the quality of the product. This realization is especially important for the Egyptian context where craft-driven traditions and post-modern industrial realities meld into an organic entity (Elmogahzy, 2019).

Therefore, manpower in manufacturing is a complex not simply defined and it needs to be considered from all these perspectives. They include the refining of specific skills as well as expertise, acquisition of education and training, motivation and job satisfaction, leadership and team work and even the cultural as well as personal values. These facets also all bear immense importance in defining how efficiently an organisation can channel its human resources towards delivering quality goods throughout the organisation's clients' timers (Baltaci & Balcı, 2017).

Still, one crucial factor of manpower's influence on the product quality is the skill level and experience of the human capital. Manufacturing facilities in Egypt are vast and range through various types therefore the needs of each industry may not be the same. A worker in a textile factory, for instance, has to be able to identify defects in a fabric; the candidate he or she hires has to be tactful in handling delicate fabrics or embroidery; and knowledge of how fabrics behave. On the other hand, an employee in an electronics plant working directly with electronics needs to manipulate small parts, appreciate circuit diagrams and possess analytic skills to solve a problem. Thereby, habiliments like these, which are developed by repeated use and practice, immediately impact on the quality of the final output (Huo et al. 2016).

2.4. Money Capital

All these connections make it stunning to realize that money capital is one of the most influential variables determining product quality in the world of contemporary global manufacturing. Whereas the machinery used in a plant, the hands of people at the plant, the finance, money capital is more insidious and influential than all of them as it seeping into all cracks of the production process. In Egypt, manufacturing sector is quite diversified ranging from garments and textiles, electronics and electricals, automobile parts and accessories, and many more; it is therefore more vivid how money capital plays to consolidate and build up the required standards (Toffler, 2022).

It follows therefore that while money capital may be defined as the amount of cash which is available for use in productivity, it is beyond that in the manufacture environment. It includes all forms of capital a company can apply – own funds invested by shareholders, borrowed funds, earnings retained from the company's operations, and even the company's reputation, which might be an important asset for financing and gaining profit as well (Bhattacharya, 2021).

This organismic ingredient is an all-encompassing, circulating current coursing through every line of a manufacturing business development, powering its operations, supporting its choices, and defining the quality of its goods. Egypt can be considered diverse in manufacturing production, and this paper highlights the ways by which money capital affects product quality both explicitly and implicitly. Ideally, access to adequate capital opens the door to the procurement of quality raw materials since the company will be financially capable of procuring them from the market (Heinberg & Fridley, 2016).

Sustaining these R&D programs implies high levels of capital investment and often, it may take years before potential products are produced for the market. However, when such a breakthrough comes through—when it becomes possible, for instance, to invent a new generation of glass-ceramic composite that is twice as resilient as corresponding screens in rival gadgets—the quality edge can be invaluable. The phones get a reputation of being heavily

built to endure the rough Egyptian environment that secures the firm a loyal market. Just to be clear, money capital here isn't merely retaining high quality – it is elevating the status of entire industries (Söderholm, 2020).

2.5. Management

Management therefore elicits understanding of human organization which predates as far as ancient epochs. From the construction of the pyramids in Egypt, including the present day complex multinational, business management practices have greatly developed over centuries. Management, in the most simplistic sense is the coordination, direction and supervision of people and resources to accomplish pre-determined objectives in the best way possible. It is not a single entity but a broad framework that involves several activities, concepts, approaches, and propositions that collectively define organizational development (Chakrabarty, 2021).

The topic of management can be traced back through various early civilizations and societies. Many organized societies have been developed in the ancient Mesopotamia and Sumerians were among them and these ancient society their accounting and today can be viewed as a basis for accounting of resources. Likewise to the Roman aqueducts which is a representation of the project management advancement during that era; the Great Wall of China. Yet, based on historical references, it could not really be said that management was recognised separately as a subject of research until the Industrial Revolution in the 18th and the 19th century (Wren & Bedeian, 2023).

The Industrial Revolution era seen the major shift in producing processes where most products were hand made to those produced by machines. In its wake arose the need for new approaches to grouping activity and directing multiple people. Among the figures present during this period was Robert Owen, an industrialist from Wales who brought humane methods in managing his textile mill, the New Lanark. Owen flouted ideas that workers are just products of machines but a human who needs attention to be entrusted and feel noble to the job (Mohajan, 2019).

Sustainability and CSR are on the managerial agendas and have hence become part of common discourse. Consumers, employees, and shareholders are equally demanding ethical behavior from business organizations and beyond reasonable doubt, reducing their environmental impact. The absolute concept known as the Triple Bottom Line, which was conceptualized by John Elkington, describes that an organization should not only be measured based on the amount of profitability it generates but also on its effect on people and the environment. Sustainability reports have become common by corporate organizations today to with their financial statements, owing to this more expansive perspective of firm performance (Aslaksen et al. 2021).

2.6. Raw Materials

It is worth to underline those raw materials always remain the cornerstone of manufacturing and production processes in various fields of industry. These buy resources or raw materials that go through a process of fabrication before being converted into the finished products are central to the manufacturing process because they greatly influence the quality, productivity, and cost of production. It warrants elaboration in this extensive discussion where we consider different raw materials, their sources, challenges related to procurement and in turn look at the need to implement quality controls on the raw materials that are sourced (Savastano et al. 2019).

Raw materials can be divided into several categories based the origin, for instance, natural resources, agriculture produce and inputs used in industries. Minerals, metals and fossil fuels

are non-renewable resources which are obtained directly from the earth and are crucial for industries like construction, energy and manufacturing units. For instance, iron ore is used to make steel and Bauxite used to produce aluminum, Crude oil forms the basis for the petrochemical market (Wrigley, 2017).

Chemicals, plastics, and synthetic fibres, which are inputs used in industries, are produced from natural resources or even agricultural products via specific chemical processes. These materials are important to several industries such as the pharmaceuticals, electronics, and automotive industries. For instance, polypropylene which is a type of plastic used in the packaging materials, car components and other consumer products while silicon is a key component in production of semiconductor (Patti & Acierno, 2022).

The following key risks regarding procurement of raw materials are closely connected and interdependent: supply chain risks, fluctuations in the prices of materials, and geopolitical risks. Supply and procurement activities also refer to the acquisition of materials and necessary substances for use in production operations, in the right quantity, quality and at the right time, timeously. Another major challenge reflected in raw material procurement is the disruptions in the supply chain. Economic problems such as natural disasters, problems with transportation system, and labor strikes, for instance, may hinder the inflow of raw materials to the production lines thus disrupting production and increasing costs (Asgary et al. 2020).

2.7. Product Quality

Quality of products is a factor that is widely considered in businesses of all kinds across the world. In a world where everything has become more globalized and with lots of players in the market, giving the end-users those products the truth of the matter is they deserve is not only an advantage, but a basic need in order to survive and sustain business growth. In this way, product quality means primary consideration since it determines numerous overall aspects including customer satisfaction, brand image, profitability, and organizational success (Dziallas & Blind, 2019).

Thus, at the base of product quality, is always the valued understanding of the ability to deliver product quality to the customers as supposed or better. When it comes to customers they have been very selective when it comes to buying products that they need, the customers want products that are efficient in their use and also functional for an extended period. In this sense, a high-quality product is one that produces the intended results as envisaged; has all features that it was designed to possess and maintain their functionality over a certain period of usage; and does not include any defects that may hinder its ability to perform its intended function or negatively affect the user experience (Macdonald et al. 2016).

Sustaining and attaining quality in products is an extensive process that does not need just an isolated factor, but a holistic approach in dealing with the product quality issue of an organization. Key components of the drive include the following success factors: Identification, understanding, and implementation of a solid quality management system. By regularly following a well-planned QMS framework, the strategic method for including quality in the life of a product is established from design and development to manufacturing, testing, and after-sales services (Bastas & Liyanage, 2018).

It should identify quality standards and quality control frameworks and detail various procedures and systems, which should enable a company to achieve continuous improvement. This system includes a framework with clear orientation of the organizations that aim to achieve quality excellence and guarantee compliance with the normative references and standards that are mandatory in the corresponding industries. A strong connection between the

senior management and the organizations quality management initiative is also another aspect (Abbas, 2020).

2.8. The Relationship Between Critical Factors and Product Quality

2.8.1 The Relationship Between Market and Product Quality

The market influences quality standards in the sense that organisations are required to meet certain high standards in the production of their products which they source from the market. The quality management system over the course of the twenty-first century has its consumer tastes and expectations as the ultimate determinant. Lack of coordination between the quality initiatives of the business and the market requirements, therefore, leads to a compromise of the overall market share and stability. Indeed, market dynamics should not pose any challenge to adequate manufacture and quality since these must be constantly driven by market forces, as frequently observed in service provision (Hoe & Mansori, 2018).

Market competition is one of the leading causes of product quality since it creates forces that push organisations towards constant improvement of the quality of the products that they produce and sell. There is nothing unusual for consumers to find themselves with a number of choices, and that is why they inevitably go for better brands, quality and value for their money (Blanchard, 2018). This intense competition compels organisations to strive for higher quality; they spend their goodwill on quality management enhancement programmes as a way of outdoing their competitors. Businesses that continue to enhance/focus on the quality of the products they produce are likely to attain and maintain the loyalty of the consumers, hence improving their strategic position in the market (Maarof & Mahmud, 2016).

2.8.2 The Relationship Between Manpower and Product Quality

For any firm, human resources or manpower are very crucial, especially in the production process with regard to quality products. Starting from the initial stages of product design and development up to the actual production process, right up to the latter stages of receiving feedback from as far as the customer is concerned, all these personnel play a crucial role in the quality of the final product. These attributes include proficiency in certain tasks or interactions, expertise in some areas or knowledge, and commitment to quality (Piwowar-Sulej, 2021).

As for the manpower and product quality relationship, one of the most important factors that have been known to have a pivotal role is the skill of the workers. Qualified and experienced personnel bring technical expertise along with focus, which are valued for efficiently and effectively implementing production procedures in manufacturing industries. This capability helps them to decide in advance on the probable queues in the product quality, hence avoiding or minimising the existence of defects, rework or product recalls; hence, it enhances the quality of the products and their costs as well (Kazancoglu & Ozkan-Ozen, 2018).

2.8.3 The Relationship Between Money Market and Product Quality

The financial aspect is one of those fundamental components that define the degree of companies' success and their ability to provide high levels of product quality. This means that identification of a sufficient amount of capital in terms of capacity to nurture different facets of the quality management process, right from the synthesis of ideas and technology to the manufacturing and quality control and to the process of constant improvement of the quality of the manufactured product. Indeed, often, even quality plans and strategies may face a lack of support when a company lacks the necessary funding (França et al. 2017).

The most effective role of financial resources as a determinant of product quality has to do with the obtainment of quality inputs. Organisations with access to large volumes of capital can expend additional capital and purchase high-quality materials from reliable vendors, thus guaranteeing that fundamental elements for creating the end product are of high quality to begin with. On the other hand, companies that work under extreme financial limitations may perceive the benefits of implementing cost-cutting measures, thus choosing cheaper materials, standards, or technologies, which may lead to substandard products (Christensen et al. 2016).

2.8.4 The Relationship Between Management and Product Quality

Leadership is one of the critical success factors of any organisation; hence, management plays a role in ensuring that quality products are produced in the organisation. Clear and long-term goals of management teams, the provision of adequate resources and conditions for staff, improving their competencies and responsibility, continuous training in quality management technologies, and the promotion of a positive organisational culture associated with the pursuit of high-quality products and services are the key success factors in quality management. Organisational capacity can therefore be used to build managerial capacity by adopting sound managerial practices that enhance job performance with the intention of improving product quality to meet customers' needs in the market (Goetsch & Davis, 2016).

The aim of this paper is to identify some essential principles of the quality management system that rely on top management's commitment. Substantive commitment to quality Integrating a systematic commitment to quality within leadership encompasses high-level actions, decisions, and resources dedicated to the process so that it is credibly communicated and internalised in the organisation. This commitment cascades down now so that people right down from the managerial to the line themselves take pride in working on quality and feel ownership to ensure that the end result brings satisfactory, high-quality products. Thus, it is clear that strong leadership in the promotion of quality derives a level of shared responsibility and accountability whereby everyone will work under the same ideals in pushing for the best quality (Sharma & Sharma, 2014).

2.8.5 The Relationship Between Raw Materials and Product Quality

A host of manufactured products exist that exist as end products, and raw materials act as the cornerstone of these products and therefore play a central role in the quality of the manufactured products. Previous studies observed that the quality of what is used in the manufacturing processes cannot be overemphasised, as it influences the overall quality features such as the performance, durability, reliability, and appearance of the final product. Consequently, it becomes critical for one to ensure that the buying process sources only the best raw materials so as to meet or surpass the client's expectations (Li et al. 2019).

A major aspect of how raw materials determine the quality of a product is due to their inherent characteristics. There is always an expectation that when compounds with higher strength, purity or composition are used, there will be an outcome of sturdiness, durability, and reliability which can withstand various pressures and other factors in the environment. On the other hand, there are negative effects of using raw materials that do not meet the required standards, and these include poor-quality products, a high rate of spoilage, and early deterioration of the product (Fonteyne et al. 2014).

2.9. Literature Review Summary

From the literature review, it has been possible to capture vital information on critical factors and the extant essential linkages to the product quality. Several important issues and outcomes have been identified from the research carried out in the course of this work. First, the interrelationships between internal and external variables are critical when defining the impact on product quality outcomes. Culture, leadership, employees, and methods recognition are some of the factors that exist internally and that shape the capacity of an organisation to create and offer high-quality products in a consistent manner in the market. Factors from outside the organisation, such as markets, customers, competition and the economy, put a lot of pressure on and generate tough obstacles that need to be overcome in order to ensure that the quality and standard of the product are maintained.

Secondly, the literature explains the need for organisations and individuals to embrace system approaches in quality management. It means that an integral approach involving every aspect of the product life cycle, from development to design, manufacturing, testing and after-sales service, is critical to managing quality successfully. This leads to a cultural integration of TQM and fosters teamwork and information sharing, as well as encourages the application of quality principles wherever possible in the organisation.

Thirdly, analysis of strategy and leadership revealed how strategic management and leadership are the key drivers to product quality excellence. Support from the leading team of an organisation, understanding and communicating the quality goals and aims, commitment of resources and establishing a culture that encourages improvement of quality are key factors that underpin the attainment and sustainment of quality of products. This paper therefore concludes that leadership must design organisational structures in a manner that makes quality improvements visible and attainable and, in the process, ensure that all employees are motivated to contribute towards the quality improvement process.

Finally, it can be stated that the results derived from the literature review were found to be useful in gaining insight into the complex nature of the factors that impact product quality as well as their interactions. This paper's results also point to the necessity for a systematic and proactive approach to managing quality that takes into account both internal and external challenges within an organisation and provides for their resolution via strong leadership, adequate resource provision, and a customer-oriented perspective. Thus, the outlined facility of knowledge may be considered as useful input for subsequent empirical examinations and to create the effective patterns aimed at improving the product quality in the manufacturing contexts.

Therefore, the conceptual framework and hypotheses as follows:

2.10. Conceptual Framework

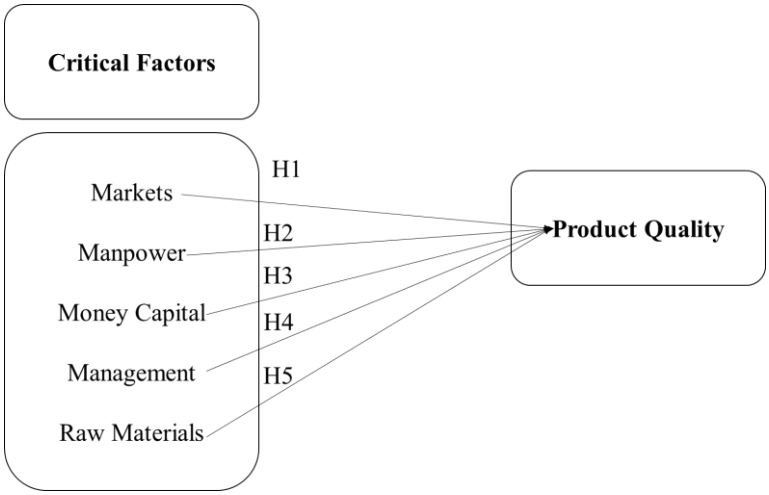

Figure 1. Conceptual Framework
Source: Developed by the researcher

Research Hypothesis

H1: Markets of critical factors have a significant effect on Product Quality

H2: Manpower of critical factors have a significant effect on Product Quality

H3: Money Capital of critical factors have a sinificant effect on Product Quality

H4: Management of critical factors have a significant effect on Product Quality

H5: Raw Materials of critical factors have a significant effect on Product Quality

3. Methodology Introduction

3.1. Research Philosophy

In the first layer of the onion that represents research, which is the outermost layer, research philosophies and their implications are included. Investigate According to Melnikovas (2018), philosophy is the system of beliefs, values, and ethics that contributes to the creation of knowledge. Philosophy is also responsible for creating the foundations. Positivism, critical realism, interpretivism, postmodernism, and pragmatism are the five primary philosophies that are utilised in the field of business and management. The research in question makes use of the traditional philosophical approach known as positivism, which is associated with the "philosophical stance of a natural scientist." According to Saunders et al. (2009), it uses universal criteria to differentiate between casual connections, which ultimately results in the formation of generalisations that are similar to laws. This method is considered appropriate because it was based on an existing theory of job satisfaction, which was used to construct hypotheses for the purpose of this investigation.

3.2. Research Approach

The three primary methods that are utilised in the process of theory development are included in the second layer of the research onion theory system. There are three types of reasoning: deductive, inductive, and abductive. The method of research that was utilised in this investigation was the inductive method. This is due to the fact that the hypotheses were not

previously established based on existing theory on critical factors and tested through a designed research strategy. As a result, the inductive approach is the most suitable method because it is always applied onto existing theory, and its reasoning moves from universal rules into law-like inference. Data collecting is the primary focus of the inductive technique, and it is typically utilised for quantitative data (Saunders et al., 2009). As a result, the inductive method is utilised in the process of theory creation or in particular topic areas that have not received adequate research.

3.3. Methodology Choice

Analysis of the critical factors that influences product quality in the electrict sector is the major objective of this study, since this study will be descriptive in nature, its ultimate goal will be to assess how well the product quality has worked thus far.

Quantitative analysis would be used to solve this problem. Administrative, Manufacturing, and quality assurance specialists in the electric sector were polled. Confirmatory factor analysis (CFA) and structural equation modelling (SEM) are two methods for analyzing data. The percentages of the variables were shown using pie charts, and the mean and standard deviation were calculated to characterize the study sample.

The first stage of the suggested analysis is CFA. It is used when an underlying model and latent variables are taken into account, according to Kyriazos and Poga-Kyriazou, (2023). The hidden variables and the dependability of the KPIs used to measure the variables are determined via path analysis. While the SEM is based on the CFA in Hair et al. (2020) study. It also covered how current advancements in statistical applications have made procedures simpler.

According to Rohrer (2018), a theoretical causal model's plausibility is assessed by contrasting it with the data that have been collected. It also considers the existence of latent variables, in addition to the path formation between variables. In terms of SEM, Korkmaz et al. (2017) makes the following assumptions:

1) The assumption of multivariate normality is satisfied
2) There should be no anomalies in the data.
3) A relatively large sample size.
4) Correct model requirements

According to Fan et al. (2016), the SEM was mentioned. They discussed the performance of PLS estimates. The SEM predictions are the most precise. It was mentioned that AMOS and SmartPls were among the statistical applications that utilized it.

This method was also favored by Joshi et al. (2015) for Likert-scaled and performance-related variables.

According to Abdi & Williams (2013), estimation is performed using the Partial Least Square (PLS) method. While Jolliffe and Cadima (2016) also discussed how it reduces the dimensionality of correlated variables in order to model dataset-provided information using variables within the scope of this research, it is important to note that this study does not reduce the dimensionality of variables. It is considered a preferable alternative to the Ordinary Least Square (OLS) method in modelling due to its lenient assumptions, which include: 1) Large sample size and independent variables.

2) The multivariate normality assumption is satisfied even though it is unnecessary if smart pls is utilized. While Wong (2016) discussed the application of PLS in a variety of statistical systems, this article will focus on the application of PLS. The development of this technology has facilitated multivariate statistical analysis, as discussed. Numerous journals have reviewed

and endorsed their PLS-based structural equation modelling. It is believed that the study's findings are valid and reliable for deriving conclusions. It ensures the reproducibility and scrutiny-readiness of findings.

Recently, Henseler et al. (2016) reviewed prior literature and discussed the PLS. Conclusion: PLS as a measuring instrument in statistical methods facilitates multiple regression analysis and principal component regression. This is due to its durability. Robustness denotes that the model's parameters do not substantially change when fresh samples are drawn from the entire population. Therefore, it provides an excellent alternative for those working on theory confirmation, especially for theories that are not supported by a substantial amount of literature. In addition, a review of the relevant literature revealed that PLS requires fewer assumptions and conditions than SEM.

3.4. Data Collection

In most cases, primary data sources are the sources of data. Research from a number of different studies, including those conducted by Chiang et al. (2015), was utilised in the development of the questionnaire. The findings are derived from surveys that were collected after interviews were conducted with 399 employees of the Elsewedy electric Company. The company is comprised of workers that are employed in the Quality production, Administrative, and Manufacturing departments and departments. These are the departments that need to be informed about the quality of the product and the crucial aspects that affect it. As a result of the in-person interviews that were carried out, the response rate was about, which is considered to be above average.

3.5. Research Design

Changing the focus of the research design to include data collecting and analysis is the primary idea behind the research onion paradigm. The manner in which the methods for data collection and analysis will be carried out in order to provide support for answering the research question is determined by the decisions that are made throughout the process of "peeling" the onion (Melnikovas, 2018). It was easier to maintain consistency across objectives, sources of data, and data analysis when the study technique was designed in an organised manner. This was accomplished while taking ethical considerations into account.

Explanatory, exploratory, and descriptive research designs are the three primary models that can be utilised in research. In the early stages of research, when there are no clear definitions of concepts, the exploratory design is typically utilised. It is likely to change depending on new data or insights, and its primary objective is to seek out new discoveries and evaluate phenomena. According to Rahi (2017), explanatory research is a type of research that is similar to studies that investigate the causal linkages between the variables (Saunders et al. 2009). It also assists in the testing of ideas. Alternatively, descriptive research is centred on the collection of data about a phenomenon that is currently occurring. When looking into the experiences of participants, it is useful to make use of it. Subsequently, the research design feasible for this study is the explanatory design as it enables for the casual relationships between the dependent and independent variables to be tested, and tests out theories such as the Resource-Based Theory (RBT) and Quality Function Deployment (QFD) (Utami and Alamanos, 2022; Gintinget al. 2020).

3.6. Research Strategy

In order to uncover research methodologies, the next fourth layer of the onion must be peeled away. This illustrates that there is a connection between the research philosophy that was selected and the methodologies that were selected. To put it another way, it is a strategy that the researcher will use to answer the question that they have posed in their research (Saunders et al., 2019). It should also be stressed that researchers are allowed to apply more than one strategy within their research design when they strategise their approach to answering their research question (Saunders & Tosey, 2013). This is something that should be taken into consideration. Due to the fact that this study utilised the quantitative research approach, there were two appropriate strategies that could have been utilised that might have been implemented. Both a survey and an experiment are included here.

Because it enabled "a collection of standardised data from a large number of respondents economically" (Melnikovas, 2018), the method of employing a survey was chosen as the one to implement. As a result, a questionnaire was developed in order to test the relationship between the independent variables of job happiness and the dependent variable of elements that make an internship more meaningful, the latter of which is referred to as internship satisfaction. The utilisation of a survey was advantageous since it made it possible to streamline the process of data collecting from a sizeable population sample in a more expedient manner. Furthermore, this method is related with the positivist research philosophy as well as the deductive approach, therefore making this strategy the supreme alternative for this research (Abdelhakim, 2021).

3.7. Time Horizon

The next layer of the study onion is the temporal horizon, which comes after the fifth layer. That is to say, this is the time scale that the research will be conducted on. Both longitudinal and cross-sectional approaches are recognised as types. The ability of a researcher to evaluate the change and development that occurs over a period of time in their study is made possible by a longitudinal study, which can be of great benefit to the researcher (Salthouse, 2014). The focus of a cross-sectional study is much more narrowly directed towards the investigation of a particular time period. Because of the time limits of this academic piece of research, a cross-sectional study was a more practical alternative than a longitudinal strategy, despite the fact that this study may benefit from the usage of a longitudinal approach because it would allow for internship satisfaction to be recorded for the entirety of an internship (Kim, 2022).

3.8. Sampling Frame and Sampling Method

Participants in this study were selected based on some key characteristics. To qualify, a participant must work at Elsewedy electric company in Egypt as part of this DBA thesis. This permitted for quite a sizeable target population due to the rising popularity of employees at the company (Prospects, 2018). Although age was not an important factor, all participants had to be over the age of eighteen. The method of sampling used is a cluster-based version of random sampling. To randomly choose a cluster from a sample frame is the definition of cluster random sampling. Disparate parts make up the cluster (Dilokthanakul et al., 2016). Everything should be checked again. For this thesis, a representative sample of Egyptian companies was selected at random. Members of the quality assurance, Manufacturing and Administrative teams were all interviewed in person. Some were wiped off because of a lack of understanding of the topic itselve. This allowed for purposive sampling to be utilised; it was the most suitable option.

Overall, there was a total of 369 responses. However, after an initial screening 30 of the responses had to be excluded, this is because they did not match the required criteria for a valid respondent as it have been shown to have a high response rate and give a great chance to prevent respondents from giving biased or dishonest answers due to language barriers or lack of familiarity with the topic at hand. Moreover, Cluster sampling will be used for this purpose. It calls for a representative sample drawn from a wide variety of demographic subsets. In this setting, businesses are represented by clusters of workers that have similar organizational structures and departmental makeup. The next step is to randomly choose a cluster from the data set. To generalize the generated findings to other firms without introducing bias, this is necessary (Kohlhas & Walther, 2021).

Sedgwick (2014) had discussed the cluster random sampling. The probabilistic sampling technique depend on separating the individuals into heterogenous groups. Each heterogenous group consists of different management level representing a firm. For this study, the heterogenous groups are individuals of auto bus industry. Each firm represent a cluster. The list of companies from which the clusters were randomly selected was obtained from Egypt Business Directory. According to their recent reports concerning manufacturing in electric industry. A number of 50 companies were listed to be in the field of electric industry. According to Egyptian Business directory only 4 companies were reported as national companies in the field of electric industry. The list contained

1. Elsewedy electric	2. Arab organization for industrialization	3.Rozetta LED	4.Venus LED

The size of the sample used in the DBA thesis is decided by

$$n = \frac{z^2 * p * (1-p)}{e^2} = \frac{(2.57)^2 * (0.5)(1-0.5)}{0.1^2} \approx 165.1 \approx 166 < 369$$

Therefore, the sample need to exceed 166 respondents to obtain a margin of error of 0.1. This require selecting 1 random clusters from the list. The chosen clusters was Elsewedy electric Over the course of its history, Elsewedy Electric has established itself as a significant participant in the Egyptian and regional electrical industry. The company places a significant emphasis on maximising visibility and sustainability. Elsewedy Electric has created a vast distribution network in order to strengthen its presence in the Egyptian market. This network includes a large number of dealerships and service centres located all across the nation. This extensive network guarantees that their products are easily available and well-supported, giving them the ability to meet a wide variety of customer requirements. Beyond the borders of Egypt, Elsewedy Electric has expanded its distribution network to include worldwide markets. The company now exports electrical items to a number of nations in Africa and the Middle East. Not only does this strategic growth strengthen the firm's footprint in the market, but it also places the company in a position to become the most prominent provider of electrical solutions in the region.

Significant progress has been made by Elsewedy Electric in the implementation of environmentally friendly supply chain procedures, which is in line with the current global sustainability trends. The utilisation of recycled materials in the manufacturing processes of the organisation is one of the most important efforts that it has undertaken. A reduction in the demand for new raw materials is achieved by Elsewedy Electric through the use of recycled materials. This results in the conservation of natural resources and the reduction of waste. By taking this strategy, not only is it possible to prevent garbage from being dumped in landfills,

but it also helps to greatly reduce the carbon footprint that is associated with the manufactured products.

During the year 2020, Elsewedy Electric presented a whole new collection of electrical items that were friendly to the environment. These items, which include transformers and cables that are efficient in terms of energy use, are designed to have a minimal impact on the environment. In addition, the company has incorporated cutting-edge technology like solar panels and LED lighting into its product lineup, which represents an additional contribution to the preservation of energy and the promotion of sustainable practices. In addition, Elsewedy Electric has introduced a number of energy efficiency initiatives throughout its operations. These include the implementation of technologies such as motion sensors, LED lights, and other technologies that reduce the amount of energy that is consumed.

Through the use of lean manufacturing techniques and the enhancement of recycling programs, the company has directed its attention towards the reduction of waste that occurs during the production processes. The goal of these efforts is to reduce the amount of trash that is produced and to maximise the utilisation of resources. This will not only lower the expenses of operations but will also help to create a supply chain that is more environmentally friendly. As a conclusion, Elsewedy Electric is a significant player in the electrical business, not only in Egypt but also in the Middle East and Africa region as a whole. The commitment of the company to sustainability, in conjunction with its extensive product portfolio, strategic relationships, and distribution network, has helped to solidify the company's position as a leading conglomerate in the region.

3.9. Pilot Study

A pilot study helps in testing the effectiveness of items within the research instrument, in this case the online survey. It is imperative for improvement of quality and efficiency of a study, and can help with ethical concerns, as it can asses the safety interventions, examine the sampling process, and provide sample size calculations.

3.10. Data Analysis and Measure

3.10.1 Measurement Development

The measurement items were adapted from literature and combined in order to create a questionnaire. Items for all constructs excluding demographic information, were evaluated on as a five point Likert scale ranging from “Strongly Agree” to “Strongly Disagree”. The questions obtained were slightly modified in order to fit the context and Likert scales of this study. Questionnaire can be seen in (Appendix A).

3.10.2 Data Analysis – Instruments

In this study SmartPLS 4 and SPSS 26 were used in order to analyse the collected data. SPSS is a very developed software with the ability to analyse a substantial variety of data (George and Mallery, 2016). It is very effective when establishing the relationships between variables. In this study, the Spearman’s Rho correlation analysis was used; this was an appropriate method as the variables were not normally distributed (George and Mallery, 2016). A SEM via SmartPLS 4 method had to be applied with the dependent variable being product quality. The independent variables were Markets, Manpower, Money market, Management and Raw material. These acted as the predictors on the dependant variable. To further support my

representation of results, Microsoft excel was utilised to be uploaded to SPSS 26 to produce descriptive statistics and to illustrate the correlations in a clear manner.

3.11. Validity and Reliability

In this study, Cronbach's alpha was utilised through the use of SmartPLS 4 SEM in order to test the scales and reliability for each item. Instead of testing constructs as a whole, the factors within each construct were tested in order to provide as much reliability as possible. When establishing internal consistency, it is imperative the Cronbach's alpha value is above 0.7 (Kamis et al. 2020). After completion of the reliability test, all constructs were deemed reliable as presented in the table below respectively.

3.12. Ethical Considerations

The process of data collection and research within this study were compliant with the requirements of Helwan University's Code of Ethics as ethical approval for this research was granted by the Helwan Ethics Committee in September 2024. It was mandatory for all participants to read the participant information sheet which included all the relevant information to their involvement in the study. Furthermore, a consent form had to be completed prior to starting the survey (Appendix A).

4. Statistical Results

4.1. Correlation

Table 1. Correlation

		Product Quality	Market	Manpower	Management	Raw Material
Product Quality	Correlation Coefficient	1.000				
	Sig. (2-tailed)	.				
Market	Correlation Coefficient	.967**	1.000			
	Sig. (2-tailed)	.000	.			
Manpower	Correlation Coefficient	.231**	.206**	1.000		
	Sig. (2-tailed)	.000	.000	.		
Management	Correlation Coefficient	.213**	.021	.652**	1.000	
	Sig. (2-tailed)	.000	.684	.000	.	
Raw Material	Correlation Coefficient	.207**	.207**	.894**	.581**	1.000
	Sig. (2-tailed)	.000	.000	.000	.000	.

** Correlation is significant at the 0.01 level (2-tailed).

According to table 3, it is observable that there is a strong positive significant relationship between product quality and market at 99% confidence level. In addition, a weak significant positive relationship between Product quality, Manpower, Management and Raw Material at 99% confidence. Therefore, the hypotheses are accepted which are H1, H2, H3, H4 and H5. This table does not indicate a final interpretation of the statistical results as more calculations is needed to prove the suggested hypotheses.

4.2. Confirmatory Factor Analysis

Table 2. Reliability and validity of 5 dimensions of phenomenon after applying confirmatory factor analysis

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Product Quality	0.807	0.868	0.574
Market	0.946	0.813	0.598
Manpower	0.844	0.907	0.766
Money Capital	0.950	0.735	0.581
Management	0.830	0.713	0.555
Raw Material	0.846	0.751	0.729

Source: Based on calculations using Smart PLS

For the purpose of determining the reliability and validity of the variables that were collected via the use of EFA, CFA is utilised. Cronbach's alpha was used to determine the level of reliability. Cronbach's alpha was greater than 0.7 for each and every one of the data points. As a result, each of the claims may be relied upon to accurately represent the factors that were investigated in the study. Both the composite reliability and the average variance extracted were computed in order to get a better understanding of the validity of the statements they included in terms of conveying the components. Each of the factors had an AVE that was greater than 0.5, and the CR was greater than 0.7. As a result, this demonstrates that the statements were appropriate for use in the factors.

4.3. Structural Equation Modelling

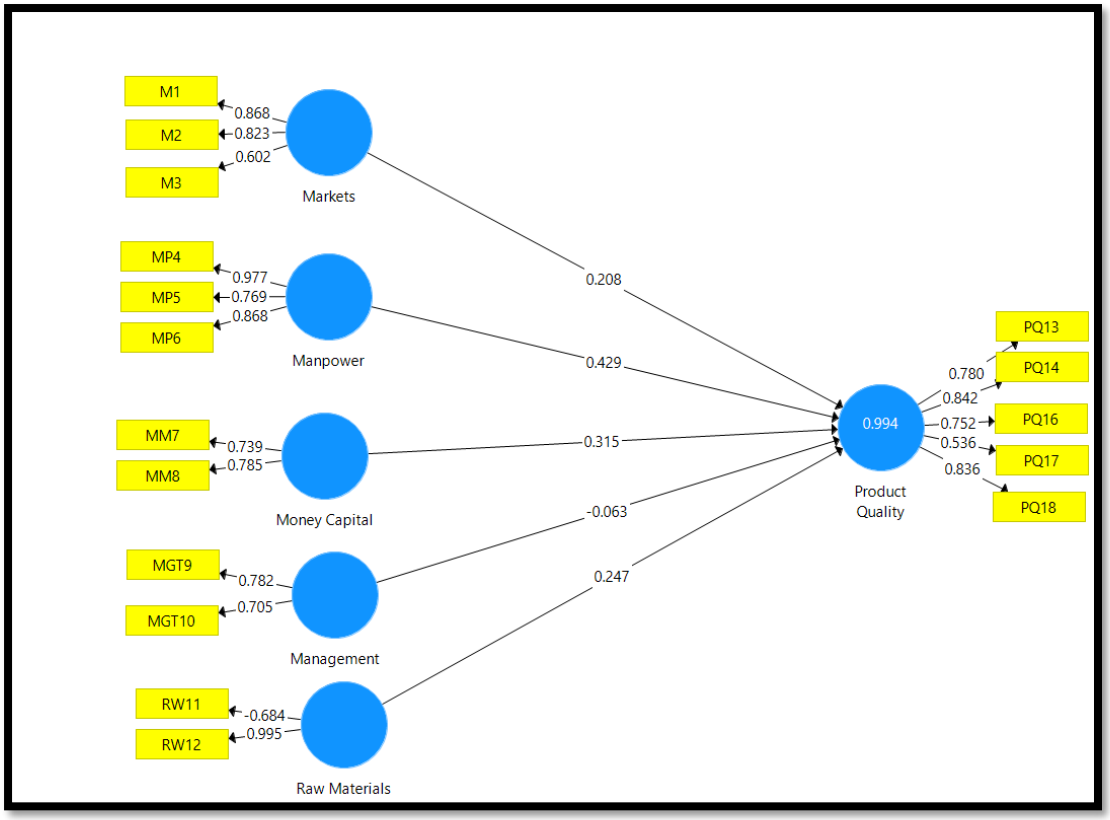

Figure 1. Structural equation model of the 4 factors provided by using SmartPls.

With regard to the structural equation model, the picture that came before it illustrates how the linkages are constructed. Every single one of the loadings is greater than 0.7, which indicates that none of the claims should be eliminated from the scientific investigation. It is possible to explore the influence that different variables have on one another by employing structural equation modelling. Understanding the phenomenon is provided as a result of this. Once the CFA has been applied, the SEM is able to represent the data accurately because its assumptions have been satisfied.

Table 3. Estimates of structural equation model of phenomenon

	Original Sample (O)	**Standard Deviation**
Markets -> Product Quality	0.287***	0.271
Manpower -> Product Quality	0.216***	0.240
Money Capital -> Product Quality	0.389***	0.236
Management -> Product Quality	0.348***	0.121
Raw Materials -> Product Quality	0.386***	0.129

**p-value<0.01, * p-value<0.05, “” p-value>0.05

Source: Based on calculations using Smart PLS

After applying SEM, the phenomenon was more understood. From the table above the results of the study indicate that All the independent variables which are Markets, Manpower, Money capital, Management and Raw materials have a positive significant effect on porudct quality at $p < 0.05$ where the confidence level is 99%. Thus, All hypotheses are accepted (H1, H2, H3, H4 and H5).

Note: "Positive significant impact" refers to a positive correlation between the independent and dependent variables that is statistically significant. "Insignificant impact" refers to no correlation between the independent and dependent variables that is statistically significant

4.4. Discussion

Within the context of the Egyptian electrical sector, this study investigated the impact that five essential elements—markets, manpower, money capital, management, and raw materials—have on the quality of the products that are manufactured. Therefore, our hypotheses have been validated by the findings, which show that each of the five elements has a considerable beneficial impact on the quality of the product. In a number of significant respects, our findings are consistent with and build upon the findings of earlier studies. According to Hoe and Mansori (2018) and Blanchard (2018), our research underscores the significance of market forces in determining the quality of a product.

This finding is in line with the findings of previous studies. The study, on the other hand, takes a more complete approach by taking into consideration economic conditions, globalisation, and regulatory settings as market elements that influence quality. Earlier research, on the other hand, frequently concentrated on competition and consumer needs. With this more comprehensive viewpoint, one can gain a more nuanced comprehension of the ways in which market dynamics influence product quality within the framework of a growing economy. The findings provide credence to the current body of research on the critical role that staff skills, training, and engagement play in quality management (Piwowar-Sulej, 2021; Kazancoglu and Ozkan-Ozen, 2018). In terms of manpower, our findings provide support for this literature. Our study contributes to this body of information by highlighting the significance of cross-functional teamwork and employee autonomy in quality improvement initiatives. These are

characteristics that have gotten less emphasis in earlier research that has concentrated on the electrical industry in developing nations.

Previous studies (Franca et al., 2017; Christensen et al., 2016) have shown that the significance of financial resources in quality management is consistent with the findings of these studies. Nevertheless, the significance of getting sufficient funds is not the only thing that our research demonstrates. We focus on the precise areas that require the most financial investment, such as the infrastructure for quality assurance, the personnel with the necessary skills, and research and development. This comprehensive breakdown offers managers useful information from a practical standpoint when it comes to the allocation of resources for quality improvement. Previous research have highlighted the importance of leadership commitment and strategic quality management (Goetsch and Davis, 2016; Sharma and Sharma, 2014).

The findings on the impact that management plays in product quality are consistent with these findings. This knowledge is expanded upon by the current study, which emphasises the significance of management in the process of cultivating a culture of continuous improvement and innovation, particularly in the context of Egypt's electrical industry. This cultural aspect of quality management has received less attention in earlier research that has been conducted in circumstances that are comparable.

As was mentioned in earlier studies (Li et al., 2019; Fonteyne et al., 2014), our findings provide further evidence that raw materials play an essential part in determining the quality of the final product. In contrast, our research places a higher emphasis on the entirety of the supply chain, which includes the relationships with suppliers as well as the procedures for material handling. A more comprehensive understanding of the ways in which raw materials influence product quality throughout the production process can be gained by adopting this more expansive perspective.

The integrated method that this study takes, which examines all five aspects simultaneously within the specific context of Egypt's electrical industry, is one of the most important contributions that this study makes. The comprehensive model offers a more comprehensive perspective on the elements that determine product quality, in contrast to the research that has been done in the past, which has frequently concentrated on specific factors or a selection of components. This method makes it possible to have a deeper comprehension of the relevance of various aspects in relation to one another and the ways in which they interact within an actual industrial environment. Furthermore, by utilising Structural Equation Modelling (SEM), our research offers solid statistical proof for the connections that exist between these essential aspects and the quality of the product. This quantitative technique builds upon and reinforces the findings of many previous research in this field, which were mostly qualitative or theoretical in nature since they were mostly qualitative. On the other hand, it is essential to point out that although our research investigates a wide variety of aspects, it does not investigate all of the possible factors that could have an effect on the quality of the product.

As an illustration, our model does not explicitly incorporate elements such as organisational culture, technological innovation, and external alliances, all of which have been brought to light in a number of earlier studies. It is possible that our findings could be expanded upon further in subsequent study by integrating these additional elements. As a conclusion, this study not only validates but also expands upon the findings of earlier research on the factors that determine product quality. The purpose of this study is to provide scholars and practitioners in the field of quality management with significant insights by offering a complete and quantitative examination of five critical aspects within the specific context of Egypt's electrical industry. The findings highlight the complex and multifaceted character of product quality, as

well as the necessity of taking a holistic approach to quality management in manufacturing environments.

5. Conclusion

The purpose of this study was to evaluate the impact that five essential elements—markets, manpower, money capital, management, and raw materials—have on the quality of products and services offered by the electrical sector in Egypt. Our initial ideas were supported by the findings of our Structural Equation Modelling (SEM) research, which demonstrated that each of the five elements has a considerable beneficial impact on the quality of the output. The complexity and multifaceted character of product quality management is highlighted by the conclusions that we have obtained. It is brought to light by them that the achievement of excellent product quality is not the result of a single aspect, but rather the conclusion of a number of different elements that are interconnected.

When it comes to deciding the final quality of products, the market environment, human resources, financial capital, managerial practices, and the quality of raw materials are all factors that play a significant influence. It is clear from the findings of the study that the electrical industry would benefit greatly from adopting a more comprehensive strategy for quality control. The findings show that concentrating on strengthening a single element may not be sufficient; rather, it is likely that a holistic strategy that addresses all five essential factors will give the best results in terms of improving product quality. Moreover, this research makes a contribution to the current body of knowledge by supplying empirical evidence from the setting of Egypt's electrical industry. It offers vital insights for both academics and practitioners in developing countries, which is a significant contribution.

The findings suggest several key recommendations for improving product quality in manufacturing organizations. First, regarding market orientation, companies should establish comprehensive systems for monitoring market trends, customer preferences, and competitive landscapes. This includes implementing robust market research practices and maintaining the flexibility to adapt swiftly to changing market demands.

In terms of human resource development, organizations should prioritize investment in comprehensive training programs aimed at enhancing employee skills. It is essential to foster a culture of quality consciousness while empowering employees through increased autonomy and cross-functional teamwork. This approach helps create a workforce that is both skilled and motivated to maintain high quality standards.

Financial resource allocation plays a crucial role in quality improvement. Organizations should ensure adequate financial resources are directed toward quality improvement initiatives, including investments in quality assurance infrastructure, research and development, and the acquisition of advanced technologies. This financial commitment is fundamental to sustaining long-term quality improvements. Leadership and management commitment is equally vital. Top management should demonstrate strong dedication to quality through active involvement and support. This includes developing and communicating clear quality objectives, along with implementing systems for regular monitoring and review of quality metrics. The leadership's commitment sets the tone for the entire organization's approach to quality.

Finally, an integrated approach is recommended that addresses all five critical factors simultaneously. This recognizes the interconnected nature of these factors in influencing product quality and ensures a comprehensive strategy for quality improvement. The study presents several notable limitations that should be considered when interpreting the results. The geographic scope is limited to the electrical industry in Egypt, which may restrict the

generalizability of findings to other industries or countries. Additionally, the cross-sectional design of the research provides only a snapshot at a single point in time, failing to capture potential changes in the relationships between variables over time. The industry-specific focus on the electrical sector may also overlook unique factors that could be relevant in other manufacturing contexts.

There is much more that could be done in this area and there are many ways the research can be expanded upon as outlined below. More research should be carried out in form of longitudinal investigations to establish the pattern of change in the interaction of the critical factors and Product quality. Industry comparison studies would be useful to examine the activity-nearby industry effects on product quality, though cross-country studies would be useful to determine outside variables' impact on the critical factors-product quality nexus.

The study's findings offer actionable insights for Egypt's electrical sector, but their practical implications could be further elaborated to enhance applied value. By integrating comprehensive market monitoring systems, companies can better align with customer needs and competitive trends, ensuring product relevance. Investing in employee training and fostering a quality-driven culture through autonomy and teamwork can elevate workforce performance, directly impacting output standards. Allocating financial resources to advanced technologies and quality assurance infrastructure supports sustained improvements, while strong leadership commitment—through clear quality objectives and consistent oversight—sets a robust foundation for success. Adopting an integrated strategy that simultaneously strengthens markets, manpower, money capital, management, and raw materials ensures a holistic approach, maximizing product quality. Further detailing specific implementation steps, such as tailored training modules, technology adoption frameworks, or cross-departmental collaboration models, would provide practitioners with clearer roadmaps to translate these insights into tangible outcomes.

It is also necessary to identify other potential antecedents related to improvement of products quality including organizational culture, technologic innovation, strategic partnerships. Perhaps carrying out parallel research on mediating and moderating effects might give better insights into the way these critical factors affect product quality. Such components and factors could be elucidated if mixed- methods approaches incorporating both quantitative analyses and qualitative methodologies would be implemented in the study.

Also, future research should follow customer-focused research for the investigation of the factors affecting product quality outcomes by incorporating the perceived customer factors and perceived customer satisfaction measures. However, there is a lack of empirical research on how sustainability practices and environmental factors affect or are related to identified critical factors regarding product quality, especially given the burgeoning focus on sustainable manufacturing in the current business climate.

Compliance with Ethical Standards

Authors: The author confirms compliance with ethical standards.

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Ethical conduct: The research was conducted adhering to ethical guidelines for human subject research.

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Appendix

Appendix A

Questionnaire

Thank you for taking your valuable time to complete this survey. This should take about 5-7 minutes to complete. Again, your involvement is entirely willing. Your answers will remain anonymous and no results will be shared at the individual level. The data will not be used to identify individuals but only compiled and analyzed for research purposes. Please, fill out the questions honestly and truthfully as much as possible. This is your chance to let us know your personal thoughts and views and there are no ‘right’ or ‘wrong’ answers. Once again I want to express my appreciation for your time and contribution to the study. Thank you for your generosity.

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Critical Factors		*5.*	*4.*	*3.*	*2.*	*1.*
Market	1. The fluctuations and changes in the market significantly impact our company.					
	2. Our Company faces intense competition.					
	3. Our company closely monitors market trends and consumer preferences.					
Manpower	4. Our company invests heavily in training and developing the skills of our workforce.					
	We have a rigorous recruitment process to attract and hire the most qualified and skilled personnel.					
	Employee motivation and job satisfaction levels directly influence the attention to detail and care taken in the company.					
Money Market	Our company invests in state-of-the-art machinery and equipment to facilitate high-precision manufacturing processes.					
	8. Our company allocates sufficient funds for research and development activities to drive innovation.					
Management	9. Our company's top management demonstrates a strong commitment to quality, setting clear goals and expectations for product excellence.					
	10. Management actively promotes a culture of continuous improvement, encouraging employees to identify and address quality issues proactively.					
Raw Materials	11. We maintain long-term relationships with reliable and reputable suppliers who consistently provide high-quality raw materials.					
	12. Our company conducts rigorous inspections and testing of raw materials upon receipt to identify and reject any substandard or defective materials.					
Product Quality						
	13. We have a robust quality management system in place that ensures consistent quality across all our product lines.					
	14. Our products undergo rigorous testing and quality assurance processes before being released to the market.					
	15. We actively seek customer feedback and incorporate their insights into our product development and quality improvement efforts.					
	16. Our company has a strong commitment to continuous quality improvement, regularly reviewing and updating our processes and standards.					
	17. Quality is a core value deeply embedded in our company culture, and everyone takes responsibility for ensuring the highest standards are met.					
	18. Our company prioritizes quality over cost considerations when making decisions.					