E-ISSN: 2997-934X
American Journal of Business Practice
https://semantjournals.org/index.php/AJBP

| Research Article

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Analyzing the Relationship Between Automated Service Processes and Operational Performance Quality: A Field Study in the Electricity Distribution Sector in Al-Hawija District

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Abstract: The research aimed to analyze the relationship between automated service processes and operational performance quality in the electricity distribution sector in Al-Hawija district. A field study approach was adopted to collect data from a representative sample of workers in the sector, using a questionnaire as the main tool for data collection. Statistical tools (arithmetic mean, standard deviations, coefficients of variation, and response rates) were used to describe and diagnose respondents' answers. Correlation analysis was used to determine the nature, direction, and strength of relationships between research variables and dimensions. Simple regression analysis was used to determine the nature of influence relationships between research variables. The study's results showed strong and positive correlation and effect relationships between the main research variables, indicating that automated service processes have a direct and positive impact on operational performance quality. The study also verified the existence of significant correlation and influence relationships between the independent variable (automated service processes) and dimensions of operational performance quality, including efficiency, reliability, flexibility, and speed in implementing processes. The study recommends the need to enhance automation strategies to improve operational performance and achieve more effectiveness and efficiency in the electricity distribution sector.

Key words: Automated service processes, Operational performance quality, Efficiency, Reliability, Flexibility, Speed, Loss reduction.

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The First Section: Research Methodology

First: Introduction

The electricity distribution sector is a cornerstone of the infrastructure, responsible for delivering electricity with high quality and reliability to consumers. However, traditional distribution

systems face numerous challenges that undermine their efficiency, such as high loss rates, weak metering systems, and collection processes, as well as outdated infrastructure and low network reliability. These factors pose fundamental obstacles to developing this vital sector, necessitating the adoption of advanced technologies and comprehensive automation in distribution network operations (Cao, *et.al*, 2023). The demand for electricity and its quality is continuously increasing, which requires reducing energy losses in existing networks. To achieve this, networks and distribution stations need modifications to improve their performance. Old substations that operate manually suffer from multiple defects and problems that negatively affect network efficiency. In contrast, automated distribution systems have become essential to ensure more reliable and stable operations, especially under abnormal operating conditions. Energy system planners must adhere to electrical standards that ensure high performance and continuity of supply, even during maintenance, external disturbances, internal faults, and faults caused by lightning strikes. Furthermore, reliability standards enable informed decisions about the continuity of power supply under various operating conditions, while improvements and modifications to distribution systems contribute to enhancing the reliability of power transmission in general (Abdo, *et.al*, 2022). In recent years, the electricity distribution sector has faced increasing pressure to improve operational performance quality in the face of growing energy demand and challenges related to physical resources and human capital. With the development of modern technologies, automated service processes have emerged as one of the solutions that can contribute to increasing performance efficiency and achieving higher levels of reliability, flexibility, speed, and loss reduction. However, the extent to which automation contributes to improving operational performance in electricity distribution companies remains unclear, which necessitates an analytical study to measure the correlation and effect relationships between service process automation and operational performance quality dimensions. From here, the research problem can be formulated with the following questions:

1. What is the nature of the correlation between automated service processes and operational performance quality with its dimensions (efficiency, reliability, flexibility, speed, loss reduction) in the electricity distribution sector?

2. What is the nature of the influence relationship between automated service processes and operational performance quality with its dimensions (efficiency, reliability, flexibility, speed, loss reduction) in the electricity distribution sector?

Second: Research Objectives

1. Measuring the level of automation application in service processes in the electricity distribution sector
2. Evaluating the level of operational performance quality with its five dimensions in the sector.
3. Analyzing the correlation between service process automation and operational performance quality.
4. Measuring the impact of service process automation on each dimension of operational performance (efficiency, reliability, flexibility, speed, loss reduction).
5. Providing practical recommendations to improve operational performance quality by enhancing automation.

Third: Research Methodology

A descriptive analytical methodology was utilized, focusing on the phenomenon's real-world manifestation and aiming to accurately capture its essence through qualitative and quantitative descriptions. The qualitative component elucidates the phenomenon's features, while the

quantitative component quantifies its scope and correlations with other phenomena. **Fourth: Research Hypotheses**

1. **The first main hypothesis:** There is a statistically significant correlation between service process automation and operational performance quality in the electricity distribution sector, and the following sub-hypothesis branches out from it:

- There is a statistically significant correlation between service process automation and the ingredients of operational performance quality in the electricity distribution sector.

2. **The second main hypothesis:** There is a statistically significant impact relationship between service process automation and operational performance quality in the electricity distribution sector, and the following sub-hypothesis branches out from it:

- There is a statistically significant impact relationship between service process automation and the ingredients of operational performance quality in the electricity distribution sector.

Fifth: The Hypothetical Model of the Research:

In light of the research problem and its objectives, a comprehensive proposed model was designed to represent and diagnose the relationship between automated service processes on one hand and operational performance on the other hand, as illustrated in the following figure, which was derived from the reality of research and academic literature related to the research variables:

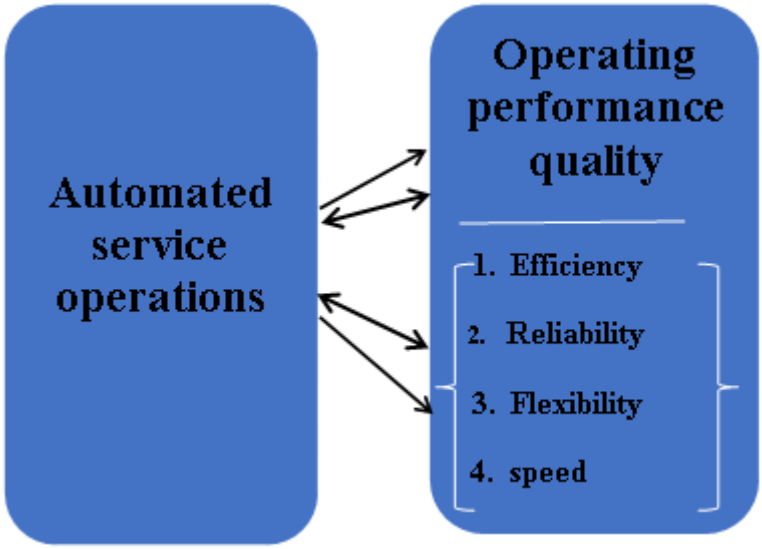

Figure (1) The Hypothetical Model of the Research

Source: Created by the Researchers

The Second section : Literature Review

First: The Concept of Automated Service Processes.

The concept of automated service processes is a modern concept that has emerged as a result of rapid technological advancements and the increasing reliance on computer applications. Automation has become a necessity that cannot be dispensed with in contemporary work environments. Automation in service processes is represented by the execution of tasks and exchange of information using electronic means based on modern technologies, such as computers, networks, email, and other tools that contribute to facilitating the performance of work and increasing its efficiency (Al-Ghamdi, 2022). Process technology refers to the equipment and machinery that help operations transform materials, information, and patrons, which is different from product technology establish in the product or service itself. The degree of automation in

technology, its volume, scalability, and connectivity should reflect the volume and variety. Generally, low-volume and high-diversity processes require relatively non-automated, multi-purpose, small-scale, and flexible technologies. In contrast, high-volume and low-variety processes require automated, specialized, large-scale, and sometimes relatively inflexible technologies (Slack, 2018). Automation can be defined as a system, process, or piece of equipment that operates autonomously and self-regulates, and the justification for technology is not limited to cost reduction but can sometimes enable greater task variety by providing a vast range of options for the customer (Krajewski, *et.al*, 2013).

Second: The Importance of Automating Distribution Processes.

The importance of automated services is increasing, and examples include ATMs and automated heating and air conditioning systems, including automated storage and retrieval systems, parcel sorting, mail processing, email, online banking, and electronic pass cards (Stevenson, 2015). Automating distribution networks is a pivotal factor in increasing the efficiency of energy distribution systems, improving their reliability and quality. Its importance is highlighted through the following aspects: (Cao, *et.al*, 2023)

1. Enhancing Reliability: Automation technologies contribute to quickly detecting faults, isolating them, and restoring service, which reduces the duration of outages and enhances the continuity of electricity supply to beneficiaries.
2. Improving Operational Efficiency: Automated systems and smart technologies enable improving the flow of electrical energy, reducing losses, and elevating the overall performance of the network.
3. Raising Customer Satisfaction: Distribution automation provides a more stable service, effective response to outage cases, which positively reflects on customer satisfaction.
4. Integrating Renewable Energy Sources: Automation facilitates the integration of distributed energy resources such as home solar systems by supporting bi-directional energy flow and promoting reliance on clean and sustainable sources. In addition to the above, technology enables service automation to achieve higher efficiency, leading to cost reduction and quality improvement. Employees can also be a source of a company's potential, and technology is considered a support mechanism for employees' work, increasing the company's value to the customer (Schroeder & Goldstein, 2018). Researchers believe that automation in service processes in the electricity distribution sector is necessary due to the similar customer requirements in this sector.

Third: Types of The Automations

In general, automation can be categorized into three types: fixed, programmable, and flexible. Fixed automation, which utilizes specialized equipment designed for a specific sequence of operations, offers the benefits of low unit costs and high production volumes. However, its rigidity results in limitations, including a lack of product variety and substantial costs associated with implementing significant changes to the product or process. (Slack, 2018). It is a manufacturing process that produces one type of part or product in a fixed sequence of simple operations (Krajewski, *et.al*, 2013). Programmable automation involves using high-cost general-purpose equipment controlled by a computer program that supply the sequence of operations and specific details for each operation. This type of automation is characterized by the ability to produce a relatively wide range of low-volume products in small batches, and at an economic cost. Numerically controlled (N/C) machines and some robots are applications of programmable automation. Flexible automation has evolved from programmable automation and uses more specialized equipment than programmable automation. The main difference between them is that flexible automation requires much less time to change, allowing equipment to operate and product

variety to be produced almost continuously without the need for batch production (Stevenson, 2015). Flexible automation, also known as programmable automation, offers the advantage of easy adaptability to accommodate various products, making it suitable for both low- and high-customization operations. This flexibility enables machines to be reprogrammed, allowing for efficient handling of diverse product requirements. (Krajewski, *et.al*, 2013). To a certain extent, all technologies necessitate human involvement, which can range from minimal intervention, such as routine maintenance in a petrochemical refinery, to highly skilled oversight, as seen in a surgeon utilizing advanced surgical technologies. Typically, processes characterized by high variety and low volume employ technologies with lower automation levels, whereas processes with higher volumes and lower variety tend to utilize more automated technologies. (Slack, 2018).

Fourth: The Concept of Operational Performance Quality

Quality of performance refers to customer necessity that generate satisfaction or dissatisfaction in ratio to the level of implementation and attractiveness (Stevenson, 2015). Operational performance is defined as the ability of an organization to effectively manage its operational resources to achieve specific goals. The quality of operational performance reflects the excellence in executing operational processes according to quality standards, achieving the lowest cost, highest productivity, and fastest response time. It is linked to measurement indicators such as productivity, defect rate, cycle time, and unit cost (Slack & Lewis, 2011).

Fifth: The Importance of Operational Performance Quality

The quality of operational performance plays a vital role in the success of organizations, contributing to (Smith, *et.al*, 2021):

1. **Reducing operational costs** by improving processes, which leads to reducing waste and excess effort.
2. **Enhancing customer satisfaction** by delivering high-quality products or services on time, which boosts customer loyalty and encourages word-of-mouth recommendations.
3. **Improving efficiency and productivity** by applying quality management practices (such as TQM) and continuous improvement techniques.
4. **Achieving competitive advantage and sustainability** in the market by adhering to high-quality standards and effective performance methodologies.
5. **Supporting management decisions based on real data and accurate performance indicators**, which enhances the ability to continuously evaluate and improve operational performance.

Sixth: Dimensions of Operational Performance Quality. Operational performance quality includes several key dimensions, most notably: (Johnston, 2005)

1. Efficiency: It means the optimal use of resources (human, material, time) to achieve maximum production at the lowest cost. It also means completing work to the highest standard with the least amount of resources and waste (Heizer, *et.al*, 2017).
2. Reliability: It means the ability of the operational system to continue working without frequent stops or breakdowns.
3. Flexibility: The ability of operations to adapt to changes in demand or surrounding circumstances. It also refers to the ease with which employees and equipment can handle a wide range of products, production levels, tasks, and functions (Krajewski, *et.al*, 2013).
4. Speed: The speed of response to customer requirements or operational changes.

5. Waste Reduction: Through continuous improvement, quality techniques, and methods such as Lean and Six Sigma.

The Third Section: The Field Side

In this section, a statistical analysis of the research variables is presented in accordance with the study's hypotheses and proposed model. The aim is to clarify the nature of the correlation and impact relationships between automated service processes and the quality of operational performance. This analysis employs a range of statistical tools, including arithmetic means, standard deviations, coefficients of variation, and response rates for each dimension. Additionally, simple correlation and regression coefficients are used to assess the strength and direction of the relationships among the research variables**.**

First: Description and Diagnosis of the Sample's Responses

The results of the statistical analysis presented in Table (1) indicate a strong consensus among the research sample regarding the sector management's focus on automated service processes. The arithmetic mean for this variable was 2.515, exceeding the hypothetical mean value of 2.0 based on the three-point Likert scale. This was accompanied by a standard deviation of 0.575 and a coefficient of variation of 0.228, reflecting a high level of homogeneity among the respondents. The response rate was 83.82%. Similarly, the findings reveal a strong agreement among the participants concerning the sector management's attention to operational performance quality. The arithmetic means for all dimensions of operational performance quality surpassed the hypothetical mean value of 2.0. The overall average was 2.584, with a standard deviation of 0.522 and a coefficient of variation of 0.202, again indicating consistency among the responses. The response rate in this case was 86.13%.Among the dimensions, **efficiency** emerged as the most prominent contributor, with an arithmetic mean of 2.634, a standard deviation of 0.548, a coefficient of variation of 0.208, and a response rate of 87.80%. Conversely, **reliability** was the least contributing dimension, recording an arithmetic mean of 2.529, a standard deviation of 0.629, a coefficient of variation of 0.248, and a response rate of 84.29%. The remaining dimensions fell within this range.

Table (1) Arithmetic Means, Standard Deviations, degree of Variation, and Response Rates for Research Variables

Research variables	Dimensions	arithmetic mean	standard deviation	coefficient of variation	Response rate %
Automated Service Operations		2.515	0.575	0.228	83.82%
Operational Performance Quality	**Efficiency**	2.634	0.548	0.208	87.80%
	Reliability	2.529	0.629	0.248	84.29%
	Flexibility	2.590	0.562	0.216	86.35%
	Speed	2.612	0.549	0.210	87.07%
	Waste Reduction	2.554	0.568	0.222	85.14%
General average		2.584	0.522	0.202	86.13

Source: Created by the researchers based on the outputs of SPSS V.25 program

Second / Testing the Research Hypotheses:

1. Testing the Correlation Relationships between Automated Service Processes and Operational Performance Quality: The conclusions of Table (2) and Figure (2) reverberate the values of the correlation degree between the independent variable (automated service processes)

at the total level and the dependent variable (operational performance quality) at the total level and at the level of dimensions. Through reviewing the results of the table, it is clear that there is a variation in the strength of the correlation coefficient between automated service processes and operational performance quality. The results of the correlation analysis indicate the presence of positive and statistically significant relationships between automated service processes and dimensions of operational performance quality. This reflects the pivotal role that automation plays in service processes in improving the quality of operational processes within the researched institution. The results showed that all dimensions of operational performance quality (efficiency, reliability, flexibility, speed, and waste reduction) are affected to varying degrees by automated processes. The results also showed a strong and positive correlation between automating service processes and operational performance quality at the overall level, with a correlation coefficient of (0.770). This indicates that improving the level of process automation is associated with a significant increase in operational performance quality. The probabilistic value (p-Value=0.000) was less than the importance level (0.05), confirming that the relationship is statistically importance and not random. The results also showed positive and strong correlation relationships between automating service processes and the five dimensions of operational performance quality, all of which have high statistical importance (p-value = 0.000 < 0.05). This means that these relationships are not coincidental but reflect a tangible field reality. The results display a direct relevance between automating service processes and efficiency (r = 0.838), representing the strongest correlation relationship in this study. This indicates that adopting automation significantly contributes to the optimal use of resources and achieving high productivity at the lowest costs. Flexibility came in second place in terms of relationship strength (r = 0.809), reflecting the ability of automation to quickly adapt processes to changing and diverse demands, which is crucial in the modern work environment. Speed came in third place in terms of relationship strength with a correlation degreeof (r = 0.764), indicating that automation shortens service delivery time and accelerates response to customer needs, which is a critical element in improving the operational experience. In fourth place, reliability came with a correlation degreeof (r = 0.741), indicating that automated systems enhance consistency and reliability in service delivery and reduce the likelihood of errors or disruptions. Finally, waste reduction came with a correlation degreeof (r = 0.700), which, although relatively lower than the other dimensions, still represents a strong relationship, indicating the role of automation in reducing waste in time, materials, and effort, although its impact in this aspect is slightly less than its impact in other aspects. Based on this, it can be said that investing in automating service processes does not only affect one dimension of quality, but rather achieves a comprehensive improvement in all dimensions, with its impact being more pronounced in efficiency and flexibility. This gives institutions a clear competitive advantage in an environment characterized by high competition and rapid change. Based on the overhead, the main hypotheses and its sub-hypotheses can be accepted, as it has been shown that there are direct and strong correlation relationships between automated service processes and operational performance quality at the total level and at the level of dimensions.

Table (2) Values of the correlation degree between automated service processes and operational performance quality.

debendent variable / undebendent variable	Operational Performance Quality					
	Efficiency	Reliability	Flexibility	Speed	Waste Reduction	Total Index
Automated Service Operations	0.838	0.741	0.809	0.764	0.700	0.770
Sig.	0.000	0.000	0.000	0.000	0.000	0.000

Source: Created by the researchers based on the outputs of SPSS V.25 program

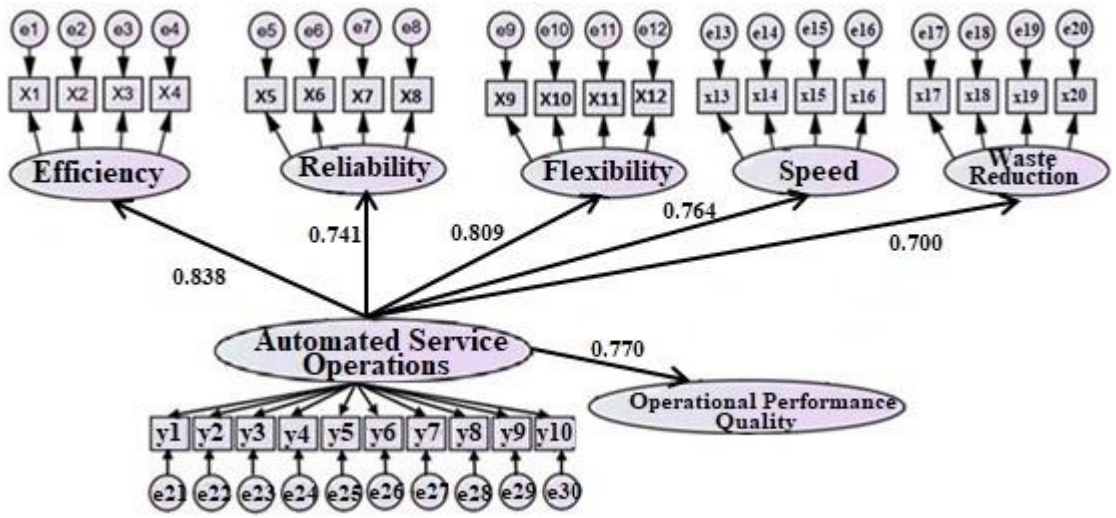

Figure (3) Values of the correlation coefficient between automated service processes and operational performance quality.

Source: Created by the researchers

2. Testing the Impact Relationships between Automated Service Processes and Operational Performance Quality:

In this aspect, the impact of automated service processes in general on the dimensions of operational performance quality (efficiency, reliability, flexibility, speed, and waste reduction) is measured. The researchers measured the impact of each dimension separately and then measured the total impact of the independent variable on the dependent variable as follows:

a. The Impact of Automated Service Processes on Efficiency:

The results of the statistical analysis shown in Table (3) indicate that automated service processes have a positive and significant impact on efficiency, with a correlation degreevalue of R = 0.838, reflecting the intensity of the relationship between the two variables. The determination (R^2) also showed that automation explains 70.1% of the changes in efficiency. The regression degree value (B = 0.838) indicated that an increase in the level of automation by one unit leads to an increase in the level of efficiency by 0.838 units. The probability value (Sig = 0.000) confirmed the significance of this impact at a significance level of 0.05.

Table (3) The Impact of Automated Service Processes on Efficiency

debendent variable / Undebendent Variable	Efficiency			
	R	R^2	B	Sig.
Automated Service Operations	0.838	0.701	0.838	0.000

Source: Created by the researchers based on the outputs of SPSS V.25 program.

b. The Impact of Automated Service Processes on Reliability: The results of the statistical analysis shown in Table (4) indicate that automated service processes have a positive and significant impact on reliability, with a correlation degreevalue of R = 0.741, reflecting the intensity of the relationship between the two variables. The determination degree (R^2) showed that

automation explains 55% of the changes in reliability, while the remaining percentage is attributed to other factors. The regression coefficient indicated that an increase in the level of automation by one unit leads to an increase in reliability by 0.741 units. The probability value (0.000) confirmed the significance of this impact at a significance level of 0.05.

Table (4) The Impact of Automated Service Processes on Reliability

debendent variable / Undebendent Variable	Reliability			
	R	R^2	β	Sig.
Automated Service Operations	0.741	0.550	0.741	0.000

Source: Created by the researchers based on the outputs of SPSS V.25 program

c. The Impact of Automated Service Processes on Flexibility: The results of the statistical analysis shown in Table (5) indicate a strong and positive relationship between automated service processes and flexibility in the electricity distribution sector in Al-Hawija district. The correlation degreevalue R = 0.809 reflects the strength of the relationship. The determination degreeR^2 = 0.654 shows that automation explains approximately 65.4% of the variation in the level of flexibility, which is a high indicator that suggests that introducing automation significantly contributes to the institution's ability to quickly adapt to changes and emergency conditions. The value of B = 0.809 point that for every one-unit increase in the level of automation of service processes, the level of flexibility improves by 0.809 units. The statistical test significance sig = 0.000 confirms that this result is statistically significant at a significance level of less than 0.05.

Table (5) The Impact of Automated Service Processes on Flexibility

debendent variable / Undebendent Variable	Flexibility			
	R	R^2	B	Sig.
Automated Service Operations	0.809	0.654	0.809	0.000

Source: Created by the researchers based on the outputs of SPSS V.25 program

d. The Impact of Automated Service Processes on Speed: The results indicate a strong and positive relationship between automated service processes and speed in the electricity distribution sector in Al-Huwaitha district. The correlation degreevalue R = 0.764 reflects the strength of the positive relationship between the two variables. The determination degree R^2 = 0.556 shows that automation explains 55.6% of the variation in the level of speed, which is a significant coefficient amount that reflects the role of automation in speeding up the performance of operations and services. The value of the unstandardized regression B = 0.764 indicates that for every one-unit increase in the level of automation of service processes, the level of speed increases by 0.764 units. The sig value = 0.000 confirms that this result is statistically significant at a significance level of less than 0.05.

Table (6) The Impact of Automated Service Processes on Speed

debendent variable / Undebendent Variable	Speed			
	R	R^2	β	Sig.
Automated Service Operations	0.764	0.556	0.764	0.000

Source: Created by the researchers based on the outputs of SPSS V.25 program

e. The Impact of Automated Service Processes on Loss Reduction:

The results of the simple regression analysis shown in Table (7) indicate a strong and positive correlation between automating service processes and reducing losses, with a correlation degree(R) of 0.700. This indicates that an increase in the level of automation is accompanied by a significant improvement in reducing losses. The determination degree(R^2) showed that 94.1% of the changes in the level of loss reduction can be explained by automating service processes, reflecting the ability of the statistical model to explain most of the variation in the dependent variable. The standardized regression degree(Beta) of 0.700 refer to that a one-standard-unit increase in automation corresponds to a 0.700 standard-unit increase in loss reduction. The probability value (Sig = 0.000) is less than the statistical significance level (0.05), confirming the significance of the relationship and its statistical importance, and indicating that automation plays a crucial role in improving operational efficiency by reducing losses.

Table (7) The Impact of Automated Service Processes on Loss Reduction.

debendent variable / Undebendent Variable	Waste Reduction			
	R	R^2	β	Sig.
Automated Service Operations	0.700	0.941	0.700	0.000

Source: Created by the researchers based on the outputs of SPSS V.25 program

f. The Impact of Automated Service Processes on Operational Performance Quality: The results of the statistical analysis showed a strong and positive correlation between automating service processes and the quality of operational performance, with a correlation degree(R) of 0.838. This refer to that an increase in the level of automation is associated with a significant improvement in the quality of operational performance. The determination degree(R^2) also showed that automating service processes explains 70.3% of the variation in the quality of operational performance, which is a high percentage that reflects the strength of the model in explaining the phenomenon under study. The standardized regression degree(Beta) of 0.838 confirms that a one-standard-unit increase in automation corresponds to a 0.838 standard-unit increase in the quality of operational performance. The probability value (Sig = 0.000) is less than the significance level (0.05), which proves the statistical significance of the relationship and its practical importance, and reinforces the importance of automation as a fundamental approach to improving efficiency and quality of performance.

Table (8) The Impact of Automated Service Processes on Operational Performance Quality

debendent variable / Undebendent Variable	Operational Performance Quality			
	R	R^2	β	Sig.
Automated Service Operations	0.838	0.703	0.838	0.000

Source: Created by the researchers based on the outputs of SPSS V.25 program

Through reviewing the regression analysis results, it is evident that there is a significant impact of automated service processes on the quality of operational performance at both the total level and the dimensional level, which leads us to accept the second main hypothesis and the sub-hypotheses derived from it.

Conclusions:

1. Automating service processes enhances operational efficiency in the electricity distribution sector by reducing waste, speeding up procedures, and improving resource utilization. Investing in automated systems is a fundamental strategy for achieving operational excellence and ensuring service sustainability.
2. Adopting automated systems enhances stability and continuity of service, reduces faults and outages, thereby increasing customer trust and ensuring long-term service quality.
3. Automating service processes enhances operational flexibility in the electricity distribution sector, enabling it to respond effectively to faults, changes in demand, and emergency crises.
4. Automating service processes is a key element in reducing loss rates, as it significantly contributes to improving operational efficiency and enhancing resource sustainability.
5. Automating service processes is a fundamental factor in improving the quality of operational performance, enhancing efficiency, reliability, and productivity, making it an effective tool for achieving institutional development and modernization goals.

Proposals:

1. Developing the technical infrastructure to support advanced automation systems, including smart grids and remote fault management systems.
2. Automating maintenance processes to ensure issues are addressed before they escalate into major faults.
3. Increasing investment in service process automation systems and linking them to emergency management plans and dynamic resource rescheduling, ensuring service continuity and reducing recovery time in the event of any disruption or sudden change in the work environment.
4. Enhancing the application of service process automation systems on a wider scale within the work environment, with investment in technical infrastructure and development of employee skills, to ensure optimal use of digital technologies and achieve maximum loss reduction.
5. Enhancing the application of service process automation on a wide scale in various operational areas, with a focus on developing technical infrastructure, adopting the latest digital solutions, and implementing specialized training programs for employees.

Resources

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