The Role of Automation in Improving the Efficiency of Organizational Knowledge Flow and its effect on the Quality of Information Services: An Empirical Study

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ABSTRACT: The study aims to measure the level of awareness of the study sample about: measuring the ability of the automation system to convert available resources into high-value information services with minimal effort and time, and analyzing the effect of automation in accelerating the knowledge lifecycle and reducing administrative bottlenecks in data exchange Evaluate the level of quality of information services (ease of access, updating, and reliability) after the implementation of automation and identify ways to maximize the use of automation to achieve excellence in information performance, However, the approach that adopted the descriptive-analytical method as a specialized method for implementation The study used questionnaires, observation, and structured interviews as data collection methods. SPSS version 23 was used to analyze the results. The study yielded several key findings, including: - The results of the regression showed that there is a positive, strong and statistically significant correlation and effect between the application of automation and the two main hypotheses of the research (the efficiency of knowledge flow and the quality of information services), where the statistical significance value (Sig.) came to be 0.000 for both. 2- The total proficiency index (mathematically measured) was 1.08. This value (greater than 1) indicates that the organization has achieved actual outputs that exceeded the proportion of inputs used (108%), reflecting an increase in completion capacity and elimination of backlogs.

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INTRODUCTION

Automation and the adoption of new technologies in academic environments are the primary digital transformation motivation; It is no longer just a tool for automating paperwork, rather, it has become a strategic means of reshaping the flow of organizational knowledge. In academic institutions, which are knowledge incubators, automation plays a pivotal role in ensuring the smooth and accurate transfer of information and expertise between administrative units and beneficiaries.

The integration of automation systems into administrative and information processes (e.g., student affairs, digital libraries) mainly aims to reduce information bottlenecks, which directly reflects on the quality of the information services provided. It provides faster and more reliable access to research and academic resources, thereby creating added value for the final beneficiary. In this context, performance measurement is no longer limited to traditional management concepts, but has become a precise focus on the efficiency of the flow of knowledge and the extent to which the organization is able to invest in these technologies to reduce time and material waste in information transmission pathways. Accordingly, this research seeks to study the interactive relationship between automation and improving the efficiency of organizational knowledge flow and its effect on improving the quality of information services in the academic environment, in an effort to provide a practical framework that highlights the feasibility of digital transformation in maximizing the knowledge return, which can be expressed through the following questions: 1- What is the role

of automation in improving the efficiency of the organizational knowledge flow (in terms of speed, accuracy, and cost of accessing information)? 2- How does the improvement of the efficiency of this flow reflect on the quality of information services provided to students and researchers? 3- What are the challenges facing the sustainability of automation success in the development of administrative and information processes? The research objectives were directed towards: measuring the ability of the automation system to convert available resources into high-value information services with minimal effort and time, and analyzing the effect of automation in accelerating the knowledge lifecycle and reducing administrative bottlenecks in data exchange

Evaluate the level of quality of information services (ease of access, updating, and reliability) after the implementation of automation and identify ways to maximize the use of automation to achieve excellence in information performance. The importance of this scientific research comes from measuring the real effect of automation in improving the flow of knowledge, and ensuring that information reaches the beneficiaries with the highest standards of quality and accuracy. The importance of this scientific research comes from knowing how to better exploit the available human and technical resources, which reduces waste and increases the productivity of academic work, and the research provides a clear vision for senior management to make informed decisions about the modernization of automation systems, in order to ensure the creation of an advanced and easy work environment, also contributes to achieving the goals of the academic institution towards full digital transformation, by providing distinguished information services that meet the needs of students and researchers. As for the research hypotheses, they were directed towards:

1. There are a statistically significant positive correlation and impact between the application of automation and the improvement of the efficiency of the organizational knowledge flow (in terms of resource utilization, time and cost reduction) in the academic institution.

2. There are a statistically significant positive correlation and effect between the application of automation and raising the level of quality of information services provided to beneficiaries.

3. Automation contributes to organizational excellence through its role in accelerating access to information and reducing waste in human and technical resources.

The following hypothetical diagram reflects the hypothetical causal relationship, where mass automation represents the independent variable that affects dependent variables:
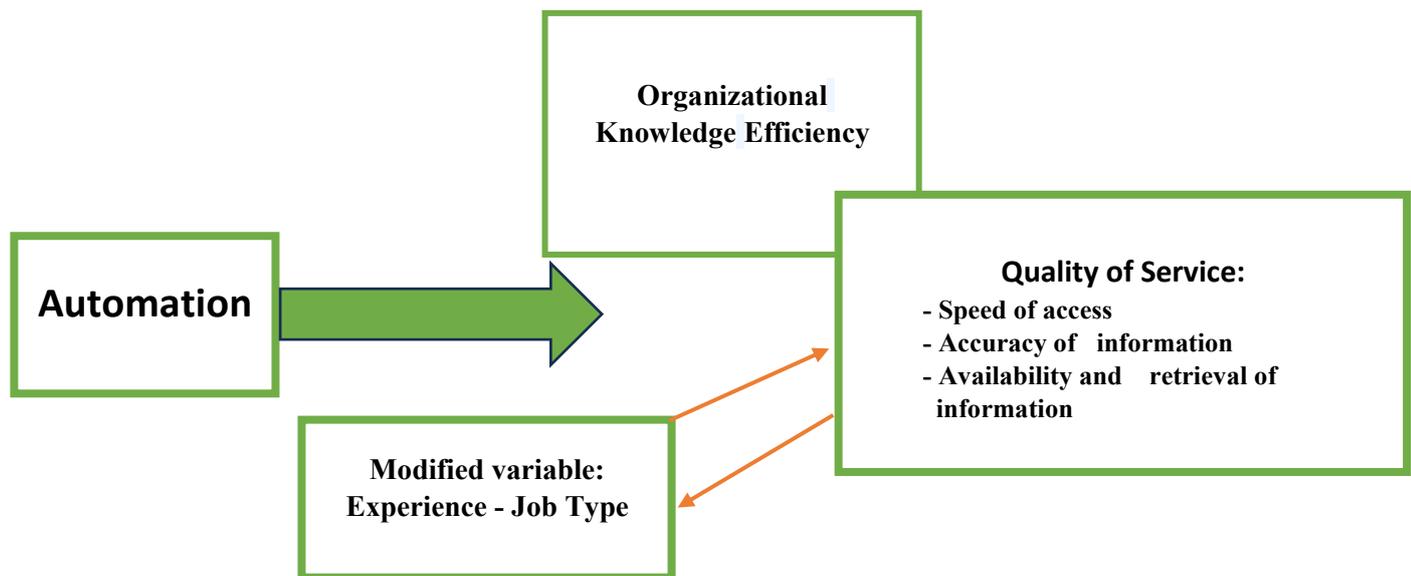
As for the study population and the sample, the study population consists of all the workers in the administrative departments and information service centers in the academic institution (field of study), which are (490) individuals, the intentional sample consisting of (150) individuals was selected based on the criterion of experience and knowledge of the automation system, where the study sample includes workers at the upper and middle administrative levels who make decisions related to automation, and executive workers responsible for operating and maintaining the automation system directly, in order to ensure obtaining on accurate data on the impact of automation within the organization (field of study)

Relevant Statistical Methods and Tools in Research

To analyze the collected data, test the hypotheses of the study, and draw conclusions accurately and objectively, the study relied on an integrated set of statistical and mathematical methods, and the data were statistically processed using statistical software (SPSS). These methods included the following:

1. **Descriptive Statistics:** Descriptive statistics measures were adopted to describe the characteristics of the study sample and analyze the answers to the questionnaire paragraphs, by determining the response level of the sample members for the arithmetic

averages, identifying the standard deviations that measure the extent of the dispersion of the sample members' answers, and determining the frequency distributions and percentages of the sample.

2. **Tool reliability analysis**

the internal consistency and measurability of the questionnaire paragraphs was verified using Cronbach's alpha coefficient, which is the primary criterion for estimating the stability of the study tool.

Table (1) Validity and Consistency of the Study Instrument

Main Dimensions	Cronbach's Alpha Value	Stability Level
Automation hub	0.89	Very high
Organizational Knowledge Efficiency Axis	0.85	High
Information Services Quality Axis	0.88	Very high
Overall Survey Score	0.91	Very high

Table Analysis:

The results showed that the value of Cronbach's alpha coefficient for all the main dimensions of the questionnaire was very high and ranged between (0.85 and 0.91), Since all dimensional values are greater than the accepted standard of 0.70, it means that the questionnaire has a high degree of reliability These figures indicate that there is a high internal consistency between the paragraphs of each dimension, which means that the paragraphs designed to measure organizational knowledge and the quality of information services are consistent and reliable in measuring research concepts, and that the data that will be analyzed in the subsequent sections are valid, reliable, and statistically inferential.

3. **Quantitative Mathematical Measurement**

To support internal honesty, the research relied on the following equation:

The Organizational efficiency index has been calculated in accordance with the following general law:

$$Faculty\ efficiency = \frac{Actual\ outputs}{Used\ Inputs}$$

The effectiveness and quality achievement index was measured using the goal achievement model to determine the success of the automation application in reaching the goals set for the quality of information services, according to the following law:

$$Effectiveness = 100 * \frac{Achieved\ goals}{Planned\ Goals}$$

4. Inferential Statistics: In order to test the hypotheses and determine the strength of the relationships between variables, the following methods were used:

1. The Pearson correlation coefficient was used to determine the strength and direction of the relationship between the automation variable and the performance variables (efficiency, organizational knowledge, quality of information services).
2. The simple linear regression coefficient was used to determine the effect of the automation-independent variable on each of the dependent variables, to determine the ratio of explained variance (R^2), and the statistical significance test (Sig.).

As for the approved research methodology, the descriptive method was chosen for the purpose of reaching the accurate knowledge of the elements of the problem and reaching a better and more accurate understanding in developing solutions, and as the research adopted the analytical method from the descriptive method to describe the reality of the application of the automation system and the evaluation of the variables of quality and efficiency, the research limits were framed to the following:

1. Spatial Boundaries: Imam Azam University College
2. Temporal Limits: 2024 to 2025.
3. Objective Limitations: Studying the effect of automation, the efficiency of organizational knowledge flow, and the quality of information services as dependent variables.

Procedural Definitions:

Automation is the process of directing the periodic administrative and information procedures and processes within the academic institution to a comprehensive automated system based on modern technologies and specialized software, and this variable has been measured by the availability and application of these systems in the main processes, the system's inclusion of various functions, and the level of interaction of employees with the automated system.

Efficiency Organizational Knowledge Flow: It is the ability of an academic institution to invest in the available automation systems and technologies in the best possible way, to ensure the transfer of information and expertise between administrative units and beneficiaries with the highest level of accuracy, by reducing waste of resources, reducing cost, and shortening the time required to complete information processes after digital transformation.

Quality of Information Services: It is defined as the extent to which the services and information provided technically meet the expectations and satisfaction of the beneficiaries within the academic institution. This variable was measured quantitatively through the goal achievement equation, and descriptively through the quality dimensions.

Theoretical aspect: This research dealt with multiple paragraphs, which we explain as follows:

First: Basic concepts that we present as follows:

1- Automation: It is a term expressed from English that means self-operation and is called the processes that work self-operate without human intervention using computers based on processors and software, as it is the art of making the procedures self-executable (Al-Srihi, 1999, p. 11)

Automation: A computerized system that collects, processes, stores, retrieves information, sends emails, documents, and other electronic forms, and office communications between employees and establishments to increase the productivity of office workers, as well as the quality of office work through networks, word processing, e-mail systems, electronic schedules, and electronic interview systems.

2- Efficiency: Performing things correctly and focusing on the relationship between inputs and outputs, with the aim of reaching the maximum possible output using the least amount of input (Abu Al-Nasr & Mohammed, 2023)

3- Organizational Knowledge: These dimensions relate to the organization of information and knowledge within an organization. These dimensions include the design and development of the information and knowledge structure, including hierarchy, classification, assignment of responsibilities, and the allocation of roles and tasks, and this dimension is what the study adopted to achieve the goals that were identified. (Mansoor, F. A & Abdalrazzaq, Z. M., 2023)

4- Service quality is defined as meeting the needs of the beneficiaries of services from the first time, and it is the continuous improvement process based on the provision of correct services and their development over time while ensuring the quality levels in them (Fatiha, 2015, p. 285), as well as the provision of services on the basis of adding to the final benefits achieved by the beneficiaries of that service (Battoush, 2006, p. 37).

Second: Basic Requirements (Critical Success Factors) for Automation in the University Environment

(Al-Subaie, 2023), (AlShamsi, A, AlBlooshi, Z, & AlTaheri, M, 2025) and (Hitzger, J & Al-Debei, M, 2023) that the successful automation process in higher education institutions requires technical, administrative, and human factors that can be explained as follows:

1- Commitment and continuous support from the university's senior management to provide adequate budget, allocate resources, and guide appropriate plans to adopt automation and digital transformation.

2- Clearly link automation endeavors with the University's full strategic objectives (vision and mission) to ensure that automation serves the quality of information services and operations management.

3- Providing a reliable and reliable IT system, the ability to integrate with existing systems, develop digitization models, and provide data protection and privacy.

4- Human resources and skills through the presence of technical and administrative cadres of workers capable of managing, maintaining and operating the automation system and providing continuous training for faculty members, workers and students to use the new systems efficiently.

5- Engage and empower employees to accept change and create a corporate culture that encourages innovation, collaboration, continuous learning, and acceptance of new technologies.

6- Establish clear key performance indicators (KPIs) to track the success of automation and its impact on the quality of information services and administrative processes.

Third: The Main Challenges of Applying Automation in the University Environment

Universities are institutions that mix the academic and the administrative, which creates a set of challenges when applying automation systems, these challenges can be categorized into main axes: (AlShamsi, AlBlooshi, & AlTaheri, 2025) (Hitzger, Al-Debei, & El Khatib, 2023) and (Al-Subaie, 2023)

- Resistance to change: Resistance of workers can hinder the adoption of a fully automation system

- Lack of competencies and training: Academic institutions often lack technical personnel specialized in managing, maintaining, and developing automation solutions, and the lack of adequate training to the end users reduces the efficiency of the system.

- There may be unrealistic possibilities on the part of management or patrons about how quickly automation will achieve the expected results, leading to frustration if the expected return is not realized immediately.

1- Technical and data challenges include

- Outdated Infrastructure: Many universities are still based on outdated information systems that are difficult to integrate with modern automation technologies, which leads to significant investments to modernize them.

- Data quality and inconsistencies: Automation requires accurate and standardized data. Data dispersion between departments (admissions, finance, library, colleges) can lead to inaccurate data, which impairs the effectiveness of automation.
- Security and Privacy Academic institutions handle highly accurate data (student records, employee information) Automation application raises risks about data security, protecting its privacy, and adhering to local and international regulations.
1-Financial and administrative challenges include:

 - High cost of implementation: Automation requires significant initial employment in hardware software, guidance, and training. Budget controls are often a major barrier for public universities.

- Weakness in building strategies that may be applied in the form of fragmented initiatives that are not tied to the goals and vision of the academic institution, resulting in a reduction in return on investment and creating a conflict of priorities.

- There are difficulties in measuring the financial or academic return of some automation projects (e.g., improving the student experience), making it difficult to explain continued investment.

Second Topic: **Organizational Knowledge**
Firstly: **Organizational Knowledge Dimensions**
There are several classifications of organizational knowledge according to the basis on which it is classified and the direction from which it is perceived, which can be explained as follows (Al-Salami, 2003, page 204), (Abdel Aleem, 2012, page 109), and (Al-Harthi, 2022, page 488)

First: According to the source of its formation, it is divided into:
1- **Internal Organizational Knowledge**: It is the knowledge that the members of the organization form by their own effort based on their intellectual ability, mental energies, various experiences and expertise, interactions between them, and their interaction with the elements of the external environment.
2- **External Organizational Knowledge**: It is the knowledge that reaches the organization and is derived by individuals from external sources, and it is represented in the flow of knowledge that communication and information technologies have contributed to facilitating access, and part of this knowledge is achieved through the processes of social interaction between people.
Secondly: According to their clarity and circulation, it is divided into:
1- **Implicit organizational knowledge**, which is related to the technical knowledge, perceptual knowledge, and behavioral knowledge that lies within the individual's soul, and it is also the knowledge that the members of the organization store in their minds and do not declare it, and this latent knowledge was formed and developed in individuals as a result of study or personal experience, intuition, personal judgment, and the experiences they have experienced.
2- Virtual (explicit) organizational knowledge: It means knowledge that can be shared with other individuals within organizations and thus transferred to others in the form of documents, interviews, or other methods, and this knowledge relates to virtual data and information that can be obtained and stored in the organization's files and records related to the organization's policies.
Second: The Importance of Service Quality:
(Al-Jubouri, 2013, p. 167) and (Al-Dararka, 2006, p. 194) stated that the importance of the quality of services lies in the following:
1- Continuous growth in the field of service, as the organization providing the service is constantly increasing as a result of the growing interest in this sector and the need of individuals for various types of services.
2- Increasing Competition: The increase in service organizations leads to increased competition and reliance on service quality can give them more competitive advantages.
3- Economic benefit through the quality services that institutions can provide to the beneficiary has started to focus on expanding the possibilities of obtaining economic gains and benefits in the market.
4- Understanding the requirements of the beneficiaries Most of the beneficiaries are not aware of their needs, it is not enough to provide the service to the beneficiary only, as it is necessary to understand the requirements and needs of the beneficiary before starting to provide the service to him.
Third: Dimensions of Service Quality
(Al-Ezzi, 2019, p. 73) mentioned several dimensions of the quality of services that can be clarified according to the following table:

Table (2) Quality of Service Dimensions

S	Dimensions	Dimension Description
1	Satisfaction	The degree of satisfaction reached by the service provided to the beneficiaries by the employees of the institutions
2	The beneficiaries	The quality of the service provided is the product of the performance of the institution and is in itself related to the recipient of the service (the beneficiaries), as only he has the ability to judge whether the service has met his wishes and needs or not.

3	Service Performance Factors	The quality-of-service performance factors refers to the achievement of the quality of each factor that goes into the performance of the service and as independent of other factors (factors related to employees, factors related to material resources, factors of participation during the provision of the service).
4	Service Performance	Quality of service performance relates to the quality of interactions between service performance factors (e.g., ease and flexibility).
5	Communications	Ability to listen and understand all the requirements and needs of the beneficiary.
6	Understanding and perception	The extent to which service providers use to give enough time to the beneficiary to express his point of view without boredom.
7	Timing	Fulfilling the wishes on time for the beneficiary
8	Confidence	The reputation of service providers in the organization
9	Self-guarantee of service	The skill of the staff in providing services in terms of presentation style and Tools the level of persuasion provided
10	Continuity	Efficiency and effectiveness for non-stop time solutions
11	Matching	The level of homogeneity achieved between the beneficiary and the service seekers
12	Tools	The beneficiary's expectations of the availability of the accompanying tools for the provision of the service and a high degree of efficiency

Fourth: The Role of Automation in Improving the Quality of Information Services

Automation plays a pivotal role in raising the quality of information services by addressing challenges related to speed, accuracy, consistency, and service availability, and (Al-Ameen & Al-Ameri, 2021), (Shanker & Sarada, 2020), and (Parasuraman, 2022) mentioned a set of points that affect the quality of information services that can be explained as follows:

1- Increasing speed and efficiency: Automated systems perform routine and repetitive tasks (such as data entry, information retrieval, and report generation) much faster than a human can do. This reduces the service wait time for patrons.

2- Improve accuracy and reduce errors: Automation reduces the likelihood of human errors caused by fatigue or lack of concentration. This ensures that the information provided to beneficiaries is accurate and reliable, enhancing data quality.

3- Ensure consistency: Automation provides a unified way to execute processes, regardless of who is monitoring the system or the time of execution. This consistency in service delivery and data processing is an essential component of the user's perceived quality of service.

4- Improved availability and accessibility: Automated systems can operate around the clock (24/7) without the need for direct human intervention. This ensures the availability of information services anytime and anywhere, increasing user satisfaction.

5-Service Customization: Automation can use advanced algorithms and analytics to track the preferences and behaviors of beneficiaries, and then provide personalized and accurately targeted information recommendations, which increases the added value of the service.

Practical Aspect:

Applied aspect: Measurement and analysis methodology

This aspect of the research deals with measuring the effect of automation on the dependent variables (efficiency of organizational knowledge flow, and the quality of information services) through two main dimensions:

T**he first dimension: Statistical measurement of the impact of automation (quantitative analysis)**

This dimension focuses on measuring the relationships and effects between variables using advanced statistical measures, where the statistical impact of automation (as an independent variable) is measured on: -

- **Organizational Knowledge Flow Efficiency Scale**: It is measured through indicators (speed of information flow, accuracy of transfer of experiences, and reduction of waste of knowledge and time resources).

-**Information Services Quality Scale:** It is measured through indicators (reliability, freshness of information, and ease of access to digital resources).

- **Correlation analysis**: Using the correlation coefficient and multiple regression to determine the strength and direction of the automation effect in the improvement of dependent variables.

The second dimension: **measuring the reality of the situation (tool and field)**

The indicators were measured in the field through the application of the questionnaire as a key tool, with the aim of identifying the strengths and weaknesses of the automation environment and their impact on flow efficiency and quality. This can be explained as follows:

First: Measuring the indicators of the efficiency of knowledge flow and the quality of services using mathematical methods to achieve the research objectives related **to measuring the efficiency of the knowledge flow** achieved after automation, the quantitative mathematical approach was adopted according to the following:

Mathematical Equation for Measuring the Efficiency of the Knowledge Flow The flow efficiency here is measured by the outputs of the information system compared to the time inputs and human effort, to ensure that the highest level of service is reached at the lowest cost and time. To achieve the research objectives related to the measurement of efficiency and the flow of knowledge achieved after the application of automation systems in the academic institution, mathematical methods were adopted according to the following steps:

1- Mathematical Equation for Measuring Proficiency[1]

$$Ovarall\ Efficiency = \frac{Effective\ outputs}{Used\ Inputs}$$

2-Efficiency Index Analysis

A table has been designed showing the inputs and outputs of the institution (field of study) and the status of the Proficiency Index defined by the months of the year as follows:

Table No. (3) Defined Efficiency Index for the Year 2025

S	Month	Inputs (Number of request)	Outputs (Number of completed)	Efficiency (Outputs)	Indicator Status
1	January	2888	3200	1.11	High Efficiency
2	February	2597	2700	1.04	High Efficiency
3	March	2934	3150	1.07	High Efficiency
4	April	2873	3100	1.08	High Efficiency
5	May	3335	3450	1.03	High Efficiency
6	June	3254	3380	1.04	High Efficiency
7	July	2884	3050	1.06	High Efficiency
8	August	4125	4200	1.02	High Efficiency
9	September	2845	3000	1.05	High Efficiency
10	October	3505	3700	1.06	High Efficiency
11	November	3260	3350	1.03	High Efficiency
12	December	2680	2800	1.04	High Efficiency
13	Total	37180	40080	1.08	High Efficiency

Table Analysis: -

After analyzing the table data, we note that the overall proficiency index ratio was 1.08. This value is greater than 1, which indicates that the efficiency of the knowledge flow is high This result supports the hypothesis of the positive effect of automation and the value that exceeds the correct one (1.08) indicates that the automated system has enabled the organization to exceed the completion of incoming requests in the current period, which reflects the ability of automation to accelerate the documentary cycle and work to liquidate the backlog of previous work with high efficiency.

Second: Measuring the Knowledge Flow Efficiency Index at the Real-Life Level Using the Questionnaire Tool

This section is concerned with presenting and analyzing the responses of the research sample on the axis of **organizational knowledge flow efficiency** (as an indicator resulting from the automation process), in order to identify the strengths and weaknesses at the level of the academic institution's current situation (field of study).

The Knowledge Flow Efficiency Axis includes (5) standards and (5) applications that measure the effect of automation on the flow of knowledge work, the speed of information transfer, and the reduction of human and time effort waste within the organization. The sample answers came to confirm the significant improvement in flow efficiency as shown in the following table:

Table (4): Sample Responses to the "Organizational Knowledge Flow Efficiency" Axis

Standard	Application	Average	Standard deviation	Degree of Accreditation
Knowledge Flow Speed	Automation systems have accelerated the flow of academic information and data compared to traditional methods	4.32	0.65	Strongly Agree

Accuracy and reliability of Knowledge	Automation has reduced human errors in entering and processing administrative data.	4.05	0.70	Agree
Efficient Knowledge Resource Investment	Automation has helped to achieve tangible savings in the use of physical resources (papers and prints).	4.21	0.68	Strongly Agree
Investing time in cognitive work	Automation has enabled workers to use official working hours more effectively to focus on strategic tasks	3.88	0.82	Agree
Efficiency and volume of work done	The volume of work done automatically is commensurate with the increasing demands of the services of the academic institution.	3.95	0.75	Agree
Overall Axis Paragraphs		4.08	0.72	Agree

Table Analysis:

After analyzing the data of Table (6) of the Organizational Knowledge Flow Efficiency Axis, we note that the total arithmetic average of this axis was (4.08), which falls within the fourth category (3.40 – 4.19), which indicates that there is a general consensus among the sample members that the application of automation has raised the efficiency of the knowledge flow at a "high" level. This statistical finding supports previously achieved mathematical results, confirming the success of digital systems in transforming available resources into effective knowledge flows.

First: Conclusion Strengths:

Based on the results, the most prominent strengths in the efficiency of the knowledge flow can be identified as follows:

1- **Knowledge Flow Speed**: This benchmark achieved the highest average (**4.32**) in the "Strongly Agree" category, proving that automation is the critical factor in accelerating the transfer of information between organizational units and overcoming temporal and spatial barriers.

2. **Efficiency of Knowledge Resources Investment**: This standard has an average score of (**4.21**), which indicates the organization's success in applying the principle of efficiency by transforming traditional resources into digital assets that are easy to trade and use.

3. **Accuracy and reliability of knowledge**: With an average of (**4.05**), the ability of automation to improve the quality of the data flowing and reduce the rates of human error has been confirmed, thereby enhancing confidence in information outputs.

Despite the general positive indicators, the criterion related to (time investment in knowledge work) obtained an arithmetic average of (3.88), which is the lowest within this axis. This suggests that part of the human effort is still being drained in routine procedures, hindering the "maximum efficiency" of the flow of knowledge. This relative decline in this criterion can be explained according to the following factors:

1- The training gap in digital content management: The challenge in using time is the need for advanced training programs that are not only limited to operating the system, but extend to how to employ intelligent features in automation to streamline complex knowledge paths and reduce manual intervention.

2-Disparity in information literacy levels: Disparity in technical abilities among employees creates "choke points" in the flow of knowledge, with some seeing the system as an aid and others as an additional burden, reducing the overall flow of information within the organization.

3- The need for continuous technical alignment: An automation system may require periodic updates to keep pace with the rapid changes in information sources and academic regulations, as any gap between "system update" and "procedural reality" necessarily slows down the knowledge flow cycle.

Despite the overall success, the criterion (the need to enhance the utilization of work time) received an average of (3.88), which is the lowest average in the axis, which indicates that part of the workers' time is still consumed in other routine tasks or that the training on the automated system has not yet reached the level of full mastery, the reason for the existence of the lowest averages can be explained as follows:

1- Lack of Continuous Training: The challenge of utilizing the working time is due to the lack of advanced training programs on the new features in the automated system and how to use them to simplify complex tasks.

2- Differential skill ratios among employees: Differential levels of technical literacy among employees make the automated system a burden for some, making it less effective to fully exploit it.

3- Need for continuous system updates: An automated system may need periodic updates to keep pace with rapid changes in academic regulations and procedures, which sometimes reduces its efficiency.

Third: Measuring the Effectiveness Index (Quality of Information Services)

To achieve the research objectives related to the impact of automation on the quality of information services, the objective approach (the extent to which the drawn quality goal has been achieved) was used to measure the effectiveness index in the academic institution in the field of study.

1- Mathematical Equation for Measuring Effectiveness

The following equation was used to measure effectiveness (from the perspective of achieving quality goals):

$$Effectiveness = 100 * \frac{Achieved\ Goals}{Drawn\ Goals}$$

Second: Determining the Goals Drawn and Achieved

The goals set represent the maximum declared organizational ambition, after dividing the composite goals into individual goals, which amounted to (14) measurable sub-goals.

The goals achieved are the percentage of goals that have actually been achieved, after automation has been implemented. In order to measure this percentage, a list of these objectives was designed and distributed to the study sample to indicate the extent of their achievement, according to the following weights:

Fully Achieved (Weight 3): To represent the full verification of the goal -

- Partially achieved (Weight 2): To represent the verification in a reasonable proportion of the target.

- Unachieved (weight 1): To represent the failure to achieve the goal.

Table (5) shows the results of the sample responses on the achievement of the objectives of the

Table (5): Answers on (Objectives Achieved)

S	The Goals	Weights			The weight	Cumulative Total
		Fully achieved	Partially achieved	Unachieved		
1	Achieve a clear speed up in the process of handling official documents and correspondence compared to the traditional system.	√	×	×	3	3
2	Reduce the time it takes to complete administrative transactions via automation	√	×	×	3	6
3	Providing an automated and accurate tracking system for the document's timeline (from creation to completion)	×	√	×	2	8
4	Reduce the effort and burden exerted by employees in manual entry, signing, and registration	√	×	×	3	11
5	Reduce direct operational costs related to paper, printing, and physical storage archives.	×	√	×	2	13
6	Ensure the unification of administrative procedures across departments through unified electronic workflows	×	√	×	2	15
7	Achieve a high level of responsiveness and speed in providing documents upon immediate request	×	√	×	2	17
8	Eliminate the risk of loss or damage to official documents and administrative files	√	×	×	3	20
9	Providing an effective electronic archiving system that facilitates the process of searching and retrieving documents instantly	√	×	×	3	23
10	Ensuring the accuracy and reliability of information in electronic documents and minimizing human input errors	√	×	×	3	26
11	Enhance transparency and accountability in the circulation of documents through audit trails	×	√	×	2	28
12	Supporting decision-makers with reliable and up-to-date electronic documents to enhance decision quality	×	×	√	1	29
13	Provide remote access (if needed) to authorized staff	×	×	√	1	30

14	Achieving employee and beneficiary satisfaction with new and automated administrative and information procedures	×	√	×	2	32
	Total number of goals achieved	7	6	2	32	-

Third: Calculating the Effectiveness Index (Quality)

Based on the results of Table (7) and the levels of achievement approved by the sample, the value of the actual achieved goals is calculated:

1- Goals Achieved Holistically (Weight 3):
 - Number 7: Goals.
 - Estimated Value (7goals * 3dgrees) = 21 degrees
 - Percentage of total drawn (42): $\frac{21}{42} * 100\% = 50\%$

2- Partially achieved Goals (weight 2)
 - Number 6: Goals
 - Estimated Value (5 goals * 2 degrees) = 10 degrees.
 - Percentage of total drawn (42): $\frac{12}{42} * 100\% = 23.81\%$

3- Unachieved Goals (Weight 1):
 - Number 2: Goal
 - Estimated Value (2 goals * 1 degree) = 2 degrees
 - Percentage of total drawn (42): $\frac{2}{42} * 100\% = 4.76\%$

- Total Objectives Achieved:
  Total objectives Achieved (Actual Value) 35 degrees. (21+10+2)
  Applying the Efficiency Equation:

The following equation was used to measure the effectiveness index:

$$\frac{Goals}{Drawn\ goals} * 100 = effectiveness$$

$$\frac{35}{42} * 100 = 78.57\ achieved\ effectiveness$$

Measuring the Information Services Quality Index (Effectiveness) at the Real- Level Using the Questionnaire Tool

After completing the mathematical quantification of efficiency and effectiveness (which proved the success of automation), we move on to field measurement (descriptive-analytical) to determine the reasons for this success and the strengths in the quality of information services that resulted from automation.

The information services quality axis included (5) standards and (5) applications on the quality of automated services provided in the academic institution. The sample answers confirmed the significant increase in quality, which supports the positive hypotheses of the research.

Table (6)

Standard	Application	Scale	Strongly Agree	Agree	Somewhat agree	Disagree	Strongly Disagree	Average	Standard deviation	Degree of Accreditation
Access quality	Easy and fast access to academic information and resources through the automated system.	Frequency N=150	48	51	35	10	6	4.08	0.86	agree
Percentage (%)			32	34	23	7	4			
Quality Reliability	The automated information system works with high stability and no sudden breakdowns	Frequency N=150	39	55	40	11	5	4.01	0.79	agree
Percentage (%)			26	37	27	7	3			
Quality Accuracy	The information extracted from the automated system is accurate, reliable and error-free.	Frequency N=150	52	45	32	15	6	4.04	0.89	agree

			35	30	21	10	4				
Percentage (%)			35	30	21	10	4				
Response Quality	The automated system responds quickly and effectively to the inquiries and requests of the beneficiaries.	Frequency N=150	55	50	25	13	7		4.17	0.94	agree
Percentage (%)			37	33	17	9	4				
Security Quality	The automated system provides high protection of the personal and academic data of the beneficiaries.	Frequency N=150	60	40	30	12	8		4.21	0.98	Strongly agree
Percentage (%)			40	27	20	8	5				
Overall Axis Paragraphs									4.10	0.85	agree

Analysis of the sample answers

After analyzing the data of Table (6), we note that the overall arithmetic average of the information services quality axis was 4.10, which falls under the "Agree" category and is close to the "Strongly Agree" category, which confirms that automation has achieved a high quality of services in the academic institution. This result corresponds to the high mathematical score of potency (83.33%).

Strengths:

Since the overall average of the axis is 4.10, this shows the automation success in quality, specifically:

1- Strength in security quality: The standard received the highest average (4.21) and is in the "Strongly Agree" category, confirming that automation has succeeded in enhancing the protection of academic and personal data.

2- Strength in Response Quality: The standard received an average of 4.17, which confirms that automated systems respond very quickly to the requirements of the beneficiaries.

3- Strength in access quality: The standard received an average of 4.08, which shows that the process of accessing information has become easy and fast thanks to automation.

Despite the overall increase in quality, the lowest averages appear at Reliability Quality (4.01) and Accuracy Quality (4.04), which need to be strengthened to avoid becoming restrictions:

- Need to enhance reliability quality: Although the average is high, a percentage of the sample (12%) between "disagree" and "strongly disagree" indicates that the system may occasionally experience sudden failures or stoppages that need to be addressed to ensure round-the-clock service stability.

Despite the success of achieving quality, the reasons for the existence of minor challenges can be explained as follows:

1- Network infrastructure: An academic institution's network infrastructure may need to be continuously upgraded to keep up with the increasing pressure on the automated system, sometimes causing a decrease in reliability.

2- Systems integration: There may be a challenge in the full integration of all automated subsystems (such as the student affairs system and the library system), resulting in a slight discrepancy in data accuracy at certain points.

3- Lack of periodic updates and licensing: This may be due to a lack of budget for periodic software updates or insufficient licenses, which prevents the long-term reliability of the required reliability.

Fifth: The results of regression analysis and the correlation between automation and study variables

To prove the research hypotheses that there is a positive and statistically significant correlation and effect relationship between the application of automation and both the efficiency of knowledge flow and the quality of information services, simple linear regression and correlation analysis was used to determine the strength and direction of the relationship.

Table (7) shows the results of linear regression analysis

Dependent variable	Correlation coefficient (R)	Determination Coefficient (R2)	Value (F)	Significance Level (Sig.)	Conclusion
Efficient Knowledge Flow	0.79	0.624	247.5	*0.000	Strong relationship and positive effect
Quality of Information Services	0.82	0.672	297.8	*0.000	Strong relationship and positive effect

Table 7 Analysis:

1- Relationship strength (correlation coefficient - R):

- A correlation coefficient (R) of 0.79 between automation and knowledge flow efficiency indicates a strong and positive correlation between the two variables, which means that an increase in the level of automation application leads to an increase in the level of knowledge flow efficiency.

- The correlation coefficient of 0.82 between automation and the quality of information services indicates that there is a very strong and positive correlation between them, which supports the hypothesis related to improving quality through automation.

2- Interpretation Strength (Determining Coefficient - R2):

- The R2 value of management efficiency is 0.624, which means that 62.4% of the variation in knowledge flow efficiency is directly explained by the implementation of an automation system.

- The value of the determination coefficient (R2) for the quality of information services is 0.672, which means that 67.2% of the variation in the quality of services is attributable to automation. These high values indicate that automation is a key factor in achieving improvement.

3- Statistical significance (Sig.):

- The significance level (Sig.) value was 0.000 for both relationships, which is lower than the standard significance level of 0.05. This confirms that the relationship and the effect are not the result of chance, but rather are of strong statistical significance.

These statistical results conclusively prove the validity of the research hypotheses:

- The first hypothesis was accepted: there is a positive and statistically significant correlation and effect between the application of automation and raising the level of knowledge flow efficiency in the academic institution.

- The second hypothesis was accepted: there is a positive and statistically significant correlation and effect between the application of automation and the improvement of the quality of information services provided in the academic institution.

RESULTS AND RECOMMENDATION

Results

1- The results of the regression showed that there is a positive, strong and statistically significant correlation and effect between the application of automation and the two main hypotheses of the research (the efficiency of knowledge flow and the quality of information services), where the statistical significance value (Sig.) came to be 0.000 for both.

2- The total proficiency index (mathematically measured) was 1.08. This value (greater than 1) indicates that the organization has achieved actual outputs that exceeded the proportion of inputs used (108%), reflecting an increase in completion capacity and elimination of backlogs.

3- Automation mainly contributes to the explanation of the improvement in the performance of the dependent variables, as the application of the automated system explains 67.2% of the variation in the quality of information services and 62.4% of the variation in the efficiency of knowledge flow (R2 value is high for both variables).

4- The study showed that the effectiveness of the performance of information services (quality of services) when measured from the perspective of achieving the goals amounted to 83.33%, and the amount of the unachieved percentage of performance of the standards is 16.67%..

5- The (**speed of automation**) and (**material resource provision**) criterion are pivotal strengths in the efficiency of knowledge flow, as these paragraphs obtained the highest weighted arithmetic averages **of 4.32 and 4.21**, respectively, which are very high level functioning values.

6- The highest quality standards achieved within the information services were recorded in the (Security Quality) and (Response Quality) criteria, with their weighted arithmetic averages of 4.21 and 4.17, confirming the success of automation in enhancing data protection and providing rapid response.

7- The lowest average (**utilization of work time**) in the proficiency axis was recorded with an arithmetic average **of 3.88** (compared to the overall average of 4.08), indicating that there is a **variation in the application of automation** to this criterion and the need for intensive training in automated skills.

8- Variation in the extent to which the quality of information services has been achieved within the lower standards, with the (**reliability quality**) and (accuracy quality) criteria recording the lowest arithmetic averages of **4.01 and 4.04** respectively, indicating that there are technical challenges related to the **level of full integration between subsystems** or the need for continuous infrastructure development.

Recommendations

1- The challenge of utilizing working time should be addressed by developing advanced, ongoing training programs that focus on new features in the automated system and how they can be used to **streamline complex tasks**, ensure that the level of proficiency reaches everyone and minimizes skill disparities among employees[11].

2- Adequate budget should be allocated for periodic software and licensing updates13, continuous development of networks, and ensuring **full integration** of all automated subsystems (e.g., student affairs and library) to avoid data collisions.

3- Senior management should identify and document the administrative procedures in which automation has achieved the highest levels of efficiency (e.g., **speed of completion** and resource provision) and disseminate them as best practices across departments to maximize efficiency and quality.

4- An ongoing assessment approach should be adopted that goes beyond just the speed of completion, by establishing clear performance metrics[18] to measure the academic and financial effect of automation outcomes (e.g., reducing student complaints related to information services, or return on actual investment to reduce paper waste).

5- Activate the role of audit trails: To enhance transparency and accountability, it is important to ensure that the audit records provided by the automation system are used in periodic audits and performance appraisals. This supports decision-makers with reliable and up-to-date electronic documents.

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