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The Role of Knowledge Technology in Improving the Quality of Outputs in Higher Education Institutions: A Case Study of a Sample of Faculties at the University of 8 May 1945 Guelma

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Abstract:

This investigation aims to explore the impact of knowledge technology on enhancing output quality within higher education institutions. A detailed case study was carried out at the University of 8 May 1945 Guelma, encompassing four distinct faculties: Economic, Commercial and Management Sciences; Science and Technology; Law and Political Science, and Humanities and Social Sciences. A total of 103 questionnaires were disseminated and subsequently analyzed using descriptive analytical methods. Contrary to expectations, the findings reveal that knowledge technology does not significantly enhance the output quality at the specified university.

Keywords: Information Technology; Knowledge Management; Knowledge Technology; Quality; Higher Education Institutions.

JEL Classification: M15; O32; D83.

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Introduction

Contemporary organizations in Algeria encounter numerous challenges, particularly in the realm of integrating Information and Communication Technology (ICT) within various administrative frameworks. There exists a pressing need to revamp and modernize administrative procedures by shifting from conventional to electronic operations, leveraging ICT tools such as the Internet, intranet, extranet, and information systems. These tools are pivotal in enhancing decision-making processes by facilitating access to reports, statistics, and financial as well as accounting data.

Knowledge is now recognized as a strategic asset and a vital component of an organization's intangible assets, necessitating its acquisition through experience, exchange, and information. This recognition has sparked a new administrative revolution, known as Knowledge Management (KM). Information technology has empowered KM with a broad range of capabilities, including expansive internal and external information networks and data warehouses. Consequently, KM and information technology have emerged as crucial undertakings for any organization striving for sustainability and success.

Given the deluge of information and knowledge that flows into organizations, it is imperative to manage these resources effectively to ensure peak performance, high-quality outputs, and, ultimately, organizational growth and sustainability in a competitive and leadership-centric era. Despite the well-established notion of technology supporting KM and its extensive applications across business and economic sectors, its exploration and implementation in non-profit sectors such as universities and civil society organizations are still deemed limited and insufficient.

This study seeks to address the following pivotal question:

What role does knowledge technology play in improving the quality of outputs in higher education institutions?

This inquiry is guided by the following hypotheses:

- The university institution under study does not widely use the technology that supports knowledge management.
- Knowledge technology does not positively impact the quality of outputs in the university institution under study.

1- Knowledge Technology

1-1- Knowledge Discovery Technology

Knowledge discovery technology is instrumental for organizations aiming to secure a competitive edge. Traditionally known as knowledge discovery in databases, this process is now more commonly referred to as data

mining. Data mining is closely associated with another contemporary concept, data warehousing.

A data warehouse is a substantial repository of data collected from various heterogeneous sources. This data is extracted, transformed, cleaned, and stored to facilitate knowledge discovery, enabling temporal analysis, decision-making, and effective presentation.

1-2- Second Subtitle

This category of technology pertains to systems that foster the creation and innovation of new knowledge. For example, knowledge workers might develop a new product or devise improved methods for enhancing existing products. The authors (London et London) note that some of the more sophisticated systems designed specifically for knowledge generation include (Al-Khanak, 2005, p. 259):

- **Computer-Aided Design Systems**: These systems demand considerable computational power to swiftly execute complex calculations and render detailed graphical representations, assisting knowledge workers significantly.
- **Virtual Reality Systems**: These systems offer a distinct human-computer interaction experience by using advanced computing technology to immerse users in a virtual environment. Such environments are leveraged in remote design and innovation, thereby expanding the frontiers of human knowledge.

1-3- Knowledge Storage Technology

1-3-1 Knowledge Base Systems

These systems manage knowledge representation in a knowledge base, which begins with acquiring expertise from various sources and translating it into structured formats like rules or images. A knowledge base is essentially a repository encompassing a vast array of knowledge and expertise pertaining to a specific domain, aiming to encapsulate extensive information from that field (Al-Hamidi, 2004, p. 163).

The role of information technology in enhancing the efficacy of knowledge storage processes, particularly for explicit knowledge, is critically important. Various storage mechanisms are employed, including:

1-3-2 Data Warehouses: These facilities enable organizations to aggregate and store large amounts of data in comprehensive databases, facilitating rapid access.

1-3-3 Knowledge Maps: These tools delineate the location of knowledge and provide pathways to access it, guiding members of the organization to various knowledge sources.

1-3-4 Electronic Libraries: These are specialized databases that cater to the needs of specific user groups, offering an additional avenue for the straightforward storage and dissemination of knowledge within the organization (Ajam, 2007, p. 95).

1-4- Knowledge Distribution Technology

This category is epitomized by collaborative work networks which are essential for knowledge dissemination within organizations:

1-4-1 Intranet

This technology is among the most prevalent and effectively utilized for knowledge sharing within organizations, employing internet and web technology principles. It facilitates interaction with a variety of computer systems internally, utilizing the same structural framework as the internet.
This enables employees within an organization to connect and exchange information electronically, providing internet-like services but confined to a local network setting (Al-Hanawi et al., 2004, p. 303). The deployment of intranets is driven by several organizational needs:

- **Cost Reduction**: By hosting on a central server, intranets reduce the need for multiple software installations, such as databases.
- **Time Saving**: The use of intranets significantly diminishes the time spent on communication between different components of an organization, enhancing communication precision and preventing redundant exchanges.

1-4-2 Extranet

This system is a synthesis of internet and intranet technologies. It extends an intranet to include access by specified external entities, enabling them to engage in organizational activities electronically (Al-Hannawi, 2004, p. 303). Key applications of extranets include:

- Database Sharing Systems among research centers affiliated with governmental or specific administrative bodies.
- Networks for Financial and Banking Service Institutions.
- Facilitating communication with various organizational stakeholders, aiding in the planning of work and inventory management.

Groupware supports collective participation (Al-Khanak, 2005, p. 226), which is crucial for teamwork, employing essential technological tools and processes. Its primary advantage is in addressing geographic distance challenges and enabling synchronous operations using tools such as email, electronic meetings, discussion forums, or news groups (Prax, 2003, p. 133).

1-5- Knowledge Application Technology

This area primarily involves Artificial Intelligence (AI) systems, which stand at the forefront of modern scientific endeavors emerging from the intersection of technological advancements in systems science, computing, logic, and mathematics.

AI strives to decode the nature of human intelligence by developing computer programs that can emulate human thought processes marked by cognitive abilities (Faleh, 2007, p. 59). This concept has found its expression in the field of knowledge management through various innovative applications:

1-5-1 Expert Systems

These systems encapsulate accumulated knowledge and experience, including cognitive processes such as thought, perception, and behavior, to support decision-making and problem-solving. They utilize knowledge derived from extensive and stored experiences, which is then retrieved and analyzed to deduce associated truths (Faleh, 2007, pp. 60-61).

1-5-2 Neural Networks

Modeled after the biological brain, these computer programming systems process information by mimicking human interactions in scenarios that involve tacit knowledge of a specific domain, necessitating reliance on past experiences. This approach, which bridges the knowledge gap, is commonly referred to as neural networks (Al-Khanak, 2005, p. 259).

1-5-3 Fuzzy Logic Systems

These systems employ a range of techniques for expressing or reasoning with uncertain or ambiguous knowledge. Developed to transcend the binary logic that computers typically use, which categorizes phenomena strictly as true or false, fuzzy logic systems accommodate the relativity of truth, enabling more nuanced representations of knowledge that may be somewhat true or somewhat false, thus facilitating more effective knowledge application.

2- Quality and Higher Education

2-1- Concept of Quality

The notion of quality has been articulated through various definitions that capture its essence from different perspectives. Juran defines quality as suitability for use, emphasizing the utility aspect. Other definitions focus on quality as conformity to certain features and characteristics, a reduction in customer complaints, or a decrease in defect rates. Furthermore, quality is

often associated with enhanced efficiency and effectiveness in performance or cost reduction (Khudeir, 2010, p. 164).

The International Organization for Standardization (ISO) delineates quality in ISO standard 8402 as: "A set of inherent or fundamental features and characteristics of a product or service that fulfills declared or implied needs" (André & Autres, 1997, p. 117). This definition elaborates on the user's needs as both declared and latent, the known desires before purchase and those that emerge post-purchase, which help in forecasting future needs.

Similarly, the French Standardization Association describes quality as: "The ability of a product to satisfy user desires" (Eiglier, 2004, p. 73). This emphasizes the critical role of recognizing and understanding customer desires, subsequently translating them into a set of characteristics that inform and guide the design and production processes.

2-2- Quality in Higher Education Institutions

In the context of higher education, quality is regarded as an overarching strategy for continual enhancement. It is a collective responsibility involving every component of the university system, books, libraries, students, and faculty, and necessitates the engagement of all stakeholders, from administrative leaders to professors, in driving organizational success and fulfilling the university's objectives. Any dysfunction within this system can undermine development opportunities and competitive edge (Al-Tutory, 2006, pp. 76-77).

Quality in higher education is fundamentally an administrative process that is underpinned by a set of values and driven by information. This enables the utilization of the intellectual capacities and talents of employees towards continuous improvement (Al-Bakiri, 2015, p. 83).

Quality within higher education is concentrated on three primary dimensions (Alimat, 2004, pp. 93-94):

- **Design Quality**: This involves specifying the characteristics and specifications that are considered during the planning of work.
- **Performance Quality**: This pertains to executing tasks in accordance with established standards.
- **Output Quality**: This focuses on producing educational products and services that meet expected characteristics and specifications.

The implementation of a quality system in universities can lead to numerous benefits, including (Al-Bakiri, 2015, p. 84):

- Enhanced efficiency of university management.
- Development of curricula and methods for measurement and evaluation.
- Improved focus on utilizing educational technology.
- Elevated performance levels of academic and administrative staff.

- Fostering a spirit of teamwork.
- Development of administrative capabilities.
- Improvement in the outputs of the educational process.
- Increase in the production of scientific research within the university.

2-3- Pillars for Improving Quality of Outputs in Higher Education Institutions

The enhancement of quality within higher education institutions rests on several foundational pillars (Al-Bakiri, 2015, p. 85):

2-3-1 Faculty Members

The quality and dedication of faculty members are as crucial as the work they perform. An effective faculty member is deeply invested in the well-being and academic progress of their students, committed to the subject matter, and actively contributes to scientific research and community service.

2-3-2 The Student

It is imperative for higher education institutions to ensure the health and safety of students by:

- Providing necessary healthcare, whether for chronic or temporary conditions.
- Addressing and accommodating chronic or temporary disabilities.
- Promoting health awareness among the student body.
- Maintaining detailed and organized records for each student to monitor the care and services provided.

2-3-3 Management

The management approach in higher education institutions often leans towards traditional methods when interacting with students. To enhance quality, there is a need for leadership that is more persuasive and collaborative rather than authoritative. Effective management should lead, direct, and foster an environment of trust and enthusiasm among students and staff alike.

2-3-4 Infrastructure

The expansion and maintenance of facilities are vital. This includes constructing and upgrading buildings and health facilities equipped with adequate water and sanitation services. Regular maintenance is crucial to ensure these facilities remain conducive to educational activities.

3- Field Study

To ascertain the impact of knowledge technology on improving the quality of outputs in higher education institutions, a comprehensive field study was conducted at the University of 8 May 1945 Guelma. This study employed a range of tools and statistical analysis to test the hypotheses and

generate results that could guide officials and stakeholders in leveraging such technologies to enhance quality outputs effectively.

3-1- Field Study Methodology

This study adopted a descriptive analytical method combined with a case study approach to thoroughly explore the research question.

3-1-1 Study Sample

The research sample included individuals from four faculties at the University of 8 May 1945 Guelma, selected based on their significant student and user populations. A total of 120 questionnaires were distributed, with 103 returned and deemed valid for analysis. The data from these questionnaires provided valuable insights, as summarized in the table below:

Table 1: Targeted Faculties for the Study and Number of Distributed Questionnaires

Number	Faculty	Count
01	Faculty of Economic Sciences	45
02	Faculty of Law and Political Sciences	18
03	Faculty of Humanities and Social Sciences	25
04	Faculty of Science and Technology	15
Total		103

Source: Prepared by the researchers

3-1-2 Main Tool of the Study

The questionnaire served as the primary instrument for achieving the objectives of this study, targeting employees, administrators, and faculty members of the selected colleges. The questionnaire consisted of closed-ended questions, employing a five-point Likert scale to optimize the response rate and facilitate the ease of analysis.

The questionnaire was organized into three distinct axes to systematically analyze the gathered data:

- **First Axis**: This section collected personal and job-related data of the respondents.
- **Second Axis**: This segment focused on the independent variable of knowledge technology. It comprised 18 items spread across its four dimensions: knowledge generation technology, knowledge storage technology, knowledge distribution technology, and knowledge application technology.

- **Third Axis**: This part addressed the dependent variable, which is the quality of higher education outputs, and included 10 items.

The reliability and validity of the questionnaire were assessed using Cronbach's alpha coefficient. A 60% threshold is generally accepted as statistically valid, however, the reliability coefficient of the questionnaire items in this study was significantly higher, recorded at 78.4%, which indicates a high level of reliability for the questionnaire items.

Table 2: Results of the Reliability and Validity Test of the Study Tool (Cronbach's Alpha Coefficient)

Sample Size	Number of Items	Cronbach's Alpha
103	28	0.784

Source: Prepared by the researchers based on outputs from the SPSS program

3-1-3 Statistical Analysis Methods

A variety of statistical analysis methods were utilized to interpret the responses and discern patterns among the respondents, thereby aiding in answering the research questions. The analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 25, which included:

- Calculation of Cronbach's alpha to verify the reliability and validity of the study tool.
- Analysis of percentages and frequencies.
- Calculation of arithmetic means and standard deviations to assess the presence of study dimensions and the variability in respondents' answers.
- Execution of a One-Sample T Test for the sample.
- Application of linear regression to explore the impact of knowledge technology on enhancing the quality of outputs at the University of 8 May 1945 Guelma.

3-2- Analysis of Study Sample Responses

The results pertaining to the second and third axes, which focus on the independent and dependent variables respectively, were summarized according to their dimensions in the following manner:

Table 3: Respondents' Views on Study Axes

Number	Axis	Dimension	Mean Axis	Standard Deviation	Attitude
01	Second Axis: Knowledge Technology	Knowledge Generation Technology	2.7791	0.73227	Neutral
02		Knowledge Storage Technology	3.2107	0.67370	Neutral
03		Knowledge Distribution Technology	3.1120	0.67071	Neutral
04		Knowledge Application Technology	2.6989	0.61580	Disagree
Average for Second Axis			2.8614	0.44150	Neutral
Third Axis: Quality of Outputs in Higher Education			3.3456	0.81342	Neutral

Source: Prepared by the researchers based on outputs from SPSS version 25

From the analysis presented in the table, it is clear that the arithmetic means associated with the study axes demonstrate little variation in overall sentiment. The arithmetic mean for the second axis, focusing on Knowledge Technology, is 2.54, placing it in the neutral category.

This suggests that the respondents neither strongly agreed nor disagreed with the assertions related to this axis, indicating a general lack of conviction that the university under study effectively utilizes technology in managing knowledge processes. Notably, the dimension of Knowledge Application Technology showed a slight disagreement among respondents, evidenced by an average score of 2.69 and a low dispersion in responses, suggesting a uniformity in their perceptions.

The other dimensions within the Knowledge Technology axis, Knowledge Generation Technology, Knowledge Storage Technology, and Knowledge Distribution Technology, mostly reflected neutrality or a limited awareness among respondents regarding the statements presented.

Notably, Knowledge Storage Technology received the highest mean score of 3.21 among these, hinting at a recognition that technology is indeed being employed for the storage of knowledge, particularly within the university's libraries and archives. Knowledge Distribution Technology followed with a mean of 3.11, indicating occasional use of technological avenues for disseminating knowledge, possibly through the university’s website, social media platforms, or its YouTube channel.

Conversely, the third axis, which addresses the Quality of Outputs in Higher Education, recorded an arithmetic mean of 3.34. This score also falls within the neutral range, with a standard deviation of less than 1, pointing to a general consensus and a slight tendency towards agreement among the respondents on the statements within this axis.

3-3- Analysis and Testing of Study Hypotheses

Prior to the hypothesis testing, it was imperative to confirm the normality of the data distribution using the Kolmogorov-Smirnov test. The results of this test are summarized in the following table:

Table 4: Normal Distribution Test (Kolmogorov-Smirnov Test)

Number	Axis	Z value	Significance Level (sig)
1	Knowledge Technology	0.729	0.662
2	Quality of Outputs	1.215	0.104

Source: Prepared by the researchers based on statistical program SPSS version 25 results.

The significance levels, 0.662 and 0.104 respectively, are both above the conventionally accepted threshold in the study (0.05). This indicates that the hypothesis asserting the normal distribution of the data is accepted. Consequently, parametric tests, specifically Simple Regression and One-Sample T Test, are appropriate for application to this study's data, enabling a more precise interpretation of the impact of knowledge technology on the quality of outputs in higher education.

3-3-1 Testing the First Hypothesis

The hypothesis was formulated as follows:

- H0: The 8 May 1945 University do not rely on supportive technology for knowledge management.
- H1: The 8 May 1945 University rely on supportive technology for knowledge management.

Table 5: T-Test Results for the First Hypothesis

Test Value= 3							
	Sample Size	**Degrees of Freedom**	**Mean**	**Standard Deviation**	**Computed T Value**	**Significance Level Sig**	**Decision**
First Hypothesis	103	102	2.8614	0.44150	-3.186	0.002	Accept Alternative Hypothesis H1

Source: Prepared by the researchers based on SPSS version 25 outputs.

The significance level (Sig) equals 0.002, which is less than 0.05, leading to the rejection of the null hypothesis (H0) and acceptance of the alternative hypothesis (H1). It confirms that the university faculties under study rely on supportive technology for knowledge management operations, utilizing external and internal electronic networks in routine operations, the university's website for disseminating information to students, faculty, and external parties, as well as owning a YouTube channel and leveraging social media sites.

3-3-2 Testing the Second Hypothesis

The second hypothesis was formulated as follows:

- H0: There is no positive effect of knowledge technology on improving the quality of outputs in the un8 May 1945 University.
- H1: There is a positive effect of knowledge technology on improving the quality of outputs in the 8 May 1945 University.

Table 6: Simple Regression Test for the Second Hypothesis

	Regression Coefficients		**Beta Value**	**t Value**	**Significance Level (Sig)**
	B	Std. Error			
B (Constant)	3,502	,505		6,940	,000
knowledge technology	-,056	,174	-,032	-,323	,748
Correlation Coefficient R: 0.032 **Standard Error of Estimate:** 0.77719			**Coefficient of Determination R^2:** 0.001 **Adjusted Coefficient of Determination:** -0.009		

Source: Prepared by the researchers based on outputs from SPSS version 25.

Table 6 clarifies that the coefficient of determination (R^2) explains only 0.1% of the variations in the dependent variable (quality of outputs in higher education institutions), which is attributable to the relationship with the independent variable (knowledge technology). This percentage is nearly negligible, reflecting the weak exploitation of the available technology in the studied faculties.

Furthermore, the beta value ($\beta = -0.032$) indicates a negative correlation between the variables, which is weak. The significance level of less than 0.748 implies that the test is not statistically significant. Based on the above, we accept the null hypothesis (H0) stating that there is no positive effect of knowledge technology on improving the quality of outputs in the university institutions under study.

This suggests that, despite the availability of supportive technology for knowledge management at the university institutions under study, it does not influence the quality of higher education outputs.

Conclusion

Technology has become an indispensable facet of modern administrative processes, particularly evident in its integral role in knowledge management within organizations. This technology underpins all facets of knowledge management, from identifying essential knowledge and competencies, generating and innovating new knowledge, fostering environments conducive to knowledge creation among individuals, to the processes of storing, distributing, and applying knowledge. Collectively, these processes are critical in the production of high-quality outputs.

This theoretical framework was practically applied to the context of university institutions, specifically examining four prominent faculties at the University of 8 May 1945 Guelma. Data collected from 103 respondents, representing a diverse cross-section of these organizations, yielded the following insights:

- The university possesses a Medium technological infrastructure that Helps to some extent the knowledge management processes. This is evident from the utilization of the university's website, which hosts a multitude of pages offering various services and announcements. Furthermore, the active presence of the university on social media platforms such as Facebook, Twitter, and YouTube enhances its engagement and information dissemination capabilities, thus supporting the validity of the first hypothesis.

- Contrarily, the second hypothesis revealed a more complex scenario where the mere availability of technology supporting knowledge management processes does not automatically translate into high-quality outputs. The statistical tests conducted demonstrated no significant positive relationship between the use of knowledge technology and the improvement of outputs at the university institution under study, 8 May 1945 University.

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