Exploring the Role of Technology in E-Learning Adoption: Institutional Assistance as a Moderating Factor at faculty of Engineering,AL-Raqibah, Fezzan University in Libya

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Abstract

The implementation of E-learning systems in higher education has become a critical strategic objective for universities in developing countries, particularly in Libya. However, despite numerous initiatives, the successful adoption of these systems remains inconsistent. This study investigates the impact of the Technology Factor specifically the quality of technical products and the efficiency of Information Technology (IT) on the successful implementation of E-learning at the faculty of Engineering ALRaqibah, Fezzan University. Furthermore, it examines the moderating role of institutional assistance in strengthening the relationship between technological capabilities and implementation success. Adopting a quantitative research methodology, a survey was conducted among 47 faculty members including full-time faculty, part-time faculty, and lab technicians at the faculty of Engineering,AL-Raqibah,Fezzan University. Data were analysed using SPSS, employing reliability testing, factor analysis, and multiple linear regression. The findings reveal that the Technology Factor has a significant, positive direct effect on the successful implementation of E-learning ($\beta = 0.640$). Moreover, the study confirms that Institutional Support significantly moderates this relationship ($R^2 = 0.451$), suggesting that technological infrastructure alone is insufficient without the administrative, financial, and strategic backing of the university. These results provide a theoretical model for E-learning adoption in the Libyan context and offer practical recommendations for policy-makers to enhance IT infrastructure and support mechanisms.

Keywords: E-learning systems, Technology Factor, institutional assistance, faculty of Engineering,AL-Raqibah,Fezzan University

1. Introduction

1.1 Background of the Study

Adrugi, S. M. (2023) E-learning systems have revolutionized the method of teaching, learning, and knowledge dissemination through modern technology and internet connectivity. Alshref, H. M., Al-Sanjary, O. I., & Johar, M. G. (2024) In developed nations, E-learning has become the backbone of higher education systems, offering efficient and easily accessible educational resources. Recognizing this potential, the Libyan government has initiated steps to introduce E-learning into its higher education system to modernize academic performance and research capabilities

However, UNESCO. (2023) the transition from traditional face-to-face learning to E-learning in developing countries faces unique challenges. While there are success stories, there is also a significant number of failures where institutions fail to achieve their implementation goals. In the Arab region, specifically, there is a "digital divide" in the sector of ICT applications compared to the developed world. Libya, being a vast country with a dispersed population, faces difficulties in educational delivery due to distances between educational centers. E-learning presents a vital solution to these demographic and geographic challenges, yet its implementation is often hindered by infrastructure and support issues.

1.2 Research Problem

Despite the popularity of E-learning globally, its spread in Arab countries like Libya is slow due to a lack of technological advancement. There is a lack of empirical studies that identify and analyze the factors hindering E-learning implementation in Libyan higher education. Specifically, previous studies often focus heavily on the technological aspects while neglecting the critical role of institutional assistance as a moderator that bridges the gap between technology and practical implementation.

The absence of institutional assistance often manifests as a lack of clear vision, insufficient ICT infrastructure, and inadequate technical assistance, which directly impacts the utility of technology. Therefore, this research addresses the gap by investigating not just the direct impact of technology, but how institutional assistance moderates this relationship at the faculty of Engineering ALRaqibah..

1.3 Research Objectives

The specific objectives of this paper are:

1. To investigate the relationship between the Technology Factor (Quality of Technical Product and Efficiency of IT) and the successful implementation of E-learning at the faculty of Engineering ALRaqibah.
2. To assess the institutional assistance as a moderation effect that can emphasize the relationship between the Technology Factor and the successful implementation of E-learning.

1.4 Significance of the Study

This study is significant as it provides a conceptual model for faculty of Engineering ALRaqibah and other Engineering Faculties in Libyan universities. It identifies Critical Success Factors (CSFs) relative to the Libyan context, moving beyond models designed solely for developed countries. It highlights that without technologically developed equipment and strong institutional backing, successful implementation is impossible.

2. E-Learning in the Libyan Context

Alshref, H. M., Al-Sanjary, O. I., & Johar, M. G. (2024) & Masoud, A. A., Abdullah, F. A., & Mohammad, H. S. (2024) Libya has recently held high positions in literacy rates within the Middle East and Africa. However, the higher education system faces challenges regarding communication infrastructure and shortages of equipment required for smooth E-learning. The faculty of Engineering ALRaqibah, located in the southern city of ALRaqibah, is a prime example of an institution attempting to transition from traditional methods to technology-based learning. Currently, The faculty of Engineering ALRaqibah use a large number of computers for teaching and student records, but the integration into a cohesive E-learning system remains at an early stage.

2. The Technology Factor as a Critical Success Factor (CSF)

Technology is the essence enabler of E-learning. In the context of this study, the "Technology Factor" is defined by two sub-factors:

2.2.1 Quality of Technical Product: This refers to the reliability, ease of use, and functionality of the hardware and software used. Research indicates that system functionality and perceived ease of use have the strongest impact on E-learning adoption Lahwa, F., Alsulimani, T., & Amaimin, M. (2023). Reliable technology is a prerequisite for quality E-learning systems.

2.2.2 Efficiency of IT: Al-Fraihat, D., Joy, M., & Sinclair, J. (2020) this refers to the effective use of IT in delivering courses, including infrastructure stability and maintenance policies. Previous research confirms that system interactivity and functionality are critical for student and faculty acceptance.

Scholars such as Selim (2007) and Sun et al. (2008) have identified technology as a primary CSF, noting that technological proficiency increases the effectiveness of implementation.

2.3 : Institutional Assistance as a Moderator

Institutional Assistance refers to the material, moral, and technical support provided by university administration. It includes the establishment of clear visions, strategies, and the provision of adequate ICT infrastructure Al-Adwan, A., Albelbisi, N. A., & Al-Adwan, A. S. (2023). Literature suggests that E-learning success relies heavily on an institution's readiness to overcome challenges and its commitment to supporting academic staff.

Alenezi, A. (2023) the absence of institutional support leads to a gap between policy and practice. Conversely, strong management commitment ensures that disruptive influences, such as lack of time or technical difficulties, are resolved. In this study, : Institutional Assistance is posited not just as an independent variable, but as a moderator that influences the strength of the relationship between technology and implementation success.

2.4 Hypotheses Development

Based on the literature, the following hypotheses are proposed:

H1 (*Technology):* *There is a significant relationship between the Technology Factor (Quality of Technical Product and Efficiency of IT) and the successful implementation of E-learning.*

H1a: There is a significant relationship between quality of technical product and successful implementation.

H1b: There is a significant relationship between efficiency of IT and successful implementation.

H2 (Moderation): Institutional Assistance will moderate the significant relationship of the Technology Factor on the successful implementation of E-learning.

H2a: Institutional Assistance will moderate the relationship of quality of technical product on implementation.

H2b: Institutional Assistance will moderate the relationship of efficiency of IT on implementation.

3. Research Methodology

3.1 Research Design

The study employs a quantitative research approach using a survey method Creswell, J. W., & Creswell, J. D. (2023). This method was chosen to describe relationships between variables and to seek statistical significance in a context-independent manner. The design is descriptive, utilizing a structured questionnaire to collect data Kurzhals, K. (2021) .

3.2 Population and Sampling

Alcott, B., Bhattacharjee, S., Sabates, R., et al. (2024) , Taherdoost, H. (2022), Lakens, D. (2022), Montgomery, R. (2025) the population for this study consists of faculty members at The faculty of Engineering ALRaqibah,Fezzan University, Libya. The total population was approximately 47 faculty members, they are distributed across 3 scientific departments in the cities of Al-Raqiba and Wadi Athba. area.faculties. Using a simple random sampling strategy, a sample size of 47 participants was targeted. After distribution and collection, 40 valid questionnaires were available for analysis, meeting the minimum requirement for multivariate analysis.

3.3 Instrumentation

A questionnaire was developed using a 5-point Likert scale ranging from (1) strongly disagree to (5) strongly agree Kusmaryono, I., Wijayanti, D., & Maharani, H. R. (2022), Al-Fraihat, D., Joy, M., & Sinclair, J. (2020). The instrument was divided into sections measuring the specific variables:

- **Technology Factor:** 10 items total. 5 items measured "Quality of Technical Product" and 5 items measured "Efficiency of IT" .
- **Successful Implementation:** 6 items measuring the perception of E-learning potential and implementation success.
- **Institutional Assistance:** 9 items measuring the perception of university funding, policy, and technical backing.

3.4 Validity and Reliability

A pilot study was conducted with 30 participants to ensure clarity. Reliability was tested using **Cronbach's Alpha**. The results showed high internal consistency:

- Technology Factor: **0.815**.
- Successful Implementation: **0.829**.
- Institutional Assistance: **0.91152.**

These values exceed the recommended threshold of 0.7, indicating high reliability.

3.5 Data Analysis Methods

Data were analyzed using SPSS version 21.0. The analysis included:

1. **Descriptive Statistics:** Frequencies, percentages, and weighted means.
2. **Factor Analysis:** Exploratory Factor Analysis (EFA) to test construct validity.
3. **Multiple Linear Regression:** To test the direct relationship (H1).
4. **Moderation Analysis:** To test the moderating effect of Institutional Support (H2) following the steps suggested by Baron and Kenny (1986).

4. Data Analysis and Results

4.1 Normality and Factor Analysis

Normality tests (Skewness and Kurtosis tests) were conducted for all items. For the "Technology" factor, Skewness values ranged **between -0.224 and -0.853,** and Kurtosis values were between **-0.292 and 1.747**, indicating a normal distribution suitable for parametric testing.

Factor analysis for the **Technology** variable yielded a KMO value of **0.854** (labeled as great) and a significant Bartlett's Test ($p < .000$). The analysis extracted two components (Quality of Technical Product and Efficiency of IT) explaining **67.047%** of the total variance.

Factor analysis for **Institutional Assistance** yielded a KMO of **0.867** and explained **61.046%** of the variance.

4.2 Descriptive Analysis (Sample Trending)

The weighted means for the Technology factor items indicated strong agreement among faculty members regarding the importance of technology.

- **Quality of Technical Product:** The general weighted mean was **3.80**. The item "E-learning environment provides me with the opportunity of participating in E-Classes" scored the highest (3.94).
- **Efficiency of IT:** The general weighted mean was **3.84**. Faculty strongly agreed that "E-learning technology must be effective and efficient" (3.98).
- **Institutional Assistance:** This factor scored the highest general weighted mean of **4.14**, indicating that faculty members strongly believe institutional backing is crucial.

4.3 Testing Hypothesis H1: Direct Effect of Technology

A multiple linear regression analysis was conducted to test the direct relationship between the Technology Factor (Independent Variable) and Successful Implementation of E-learning (Dependent Variable).

- **Model Summary:** The R Square value was **0.410**. This indicates that **41%** of the variance in the successful implementation of E-learning can be explained by the Technology Factor.
- **ANOVA:** The F-value was **45.626** ($p < .000$), indicating the model is statistically significant.
- **Coefficients:**
    - **Quality of Technical Product:** Had the highest significant beta weight ($\beta = 0.482$, $t = 7.190$, $p = .000$).
    - **Efficiency of IT:** Had a significant beta weight ($\beta = 0.304$, $t = 4.141$, $p = .000$).

Result: Hypothesis H1 is **supported**. There is a significant positive relationship between technology and the successful implementation of E-learning.

4.4 Testing Hypothesis H2: Moderating Effect of Institutional Assistance

To test H2, a regression analysis was performed including the interaction terms to gauge the moderating effect of Institutional Assistance on the relationship between Technology and Implementation.

Model Summary: The R Square value increased to **0.451**. This indicates that **45.1%** of the variance is explained when the moderating effect of Institutional Support is included.

ANOVA: The F-value increased to **68.345** ($p < .000$), confirming the linear effect relationship is significant.

Coefficients (with Moderator):

Quality of Technical Product: Remained highly significant ($\beta = 0.484$, $p = .000$).

Efficiency of IT: Remained significant ($\beta = 0.304$, $p = .000$).

Moderating Effect: The analysis confirmed that Institutional Assistance has a moderating effect on these relationships.

Result: Hypothesis H2 is supported. Institutional Assistance significantly moderates the relationship between the Technology Factor and E-learning implementation. The regression equation for this relationship is:

$Y = 0.468 + 0.484(X1) + 0.304(X2)$
Where X1 is Quality of Technical Product and X2 is Efficiency of IT.

5. Discussion

5.1 Discussion of Technology Factors

The results confirm that the **Technology Factor** is a decisive predictor of E-learning success at the faculty of Engineering,AL-Raqibah . This aligns with previous studies by Al-Fraihat, D., Joy, M., & Sinclair, J. (2020) and Ahmed, A., Geepalla, E., & Masoud, R. (2025)) and Ellozi, S. (2025) which emphasized that system functionality and infrastructure efficiency are prerequisites for acceptance

The high weighted means for "Quality of Technical Product" (3.80) suggest that faculty members prioritize the availability of online materials 24/7 and the ability to participate in classes remotely. The "Efficiency of IT" results (Mean 3.84) highlight that faculty members are aware that simply having computers is not enough; the infrastructure must be qualified to support networks, services, and internet connectivity. The study found that faculty members viewed the "effectiveness and efficiency" of IT as critical, scoring it 3.98 out of 5. This implies that without a reliable technological base, the implementation of E-learning cannot proceed successfully in the Libyan context.

5.2 Discussion of Institutional Assistance as a Moderator

The most significant contribution of this study is the empirical validation of Institutional Assistance as a moderator. The analysis showed that when Institutional Assistance is accounted for, the explanatory power of the model (R^2) increases from 41% to 45.1%

This finding suggests that while technology is the engine of E-learning, institutional support is the fuel. Faculty members at the faculty of Engineering,AL-Raqibah believe that the institution must be technically capable of receiving and operating E-learning systems in terms of modernization and maintenance. Support encompasses not just purchasing equipment, but also providing training, help desk solutions, and a strategic vision .

The results support the view that the *intention* to adopt technology depends heavily on university support. If equipment quality is standard but maintenance support is lacking, implementation may fail. Conversely, strong institutional support can encourage teachers to adopt proper skills from experts, thereby increasing the efficiency of the E-learning system. The extremely high mean for Institutional Support items (4.14) confirms that faculty view this as the most critical gap or enabler in the current system.

5.3 Comparison with Previous Models

The findings validate the "Higher Education Critical Success Factor Innovation Model" (Dennison, 2014), which lists Technical Support, Infrastructure, and Financial Support as key distinct factors. It also aligns with the "Eight Component Model" (Khan, 2001), which lists Institutional and Technological as separate but vital components.

By proving the *interaction* between these two (moderation), this study advances the understanding of how these factors work together in a developing country context like Libya.

6. Conclusion and Recommendations

6.1 Conclusion

This research successfully achieved its objectives by determining the significant factors affecting E-learning implementation at the faculty of Engineering,AL-Raqibah. It concluded that the Technology Factor (comprising Quality of Technical Product and Efficiency of IT) has a strong direct impact on implementation success. Faculty members identified high-speed internet, reliable hardware, and system availability as essential requirements.

Furthermore, the study confirmed that Institutional Assistance plays a vital moderating role. The relationship between technology and success is significantly stronger when the institution provides adequate funding, clear policies, technical maintenance, and training. This indicates that purchasing technology alone is insufficient; the faculty of engineering, AL-Raqi the faculty of Engineering,AL-Raqibah bah administration must actively nurture the E-learning environment.

6.2 Recommendations

Based on the findings, the following recommendations are made for faculty of Engineering,AL-Raqibah and Libyan policy-makers:

1. **Enhance IT Infrastructure:** The government and university must invest in high-speed internet connections and bandwidth to support audio/video downloads, which were identified as critical for adoption.
2. **Establish Technical Support Units:** A help desk solution and constant supervision must be provided to handle urgent technical problems, as maintenance support is as critical as the equipment itself.
3. **Institutional Funding and Strategy:** The government should create a special fund to finance E-learning adoption projects and reduce barriers.
4. **Training Programs:** The faculty of Engineering,AL-Raqibah administration must offer training in the pedagogical and technical aspects of E-learning to improve faculty efficiency .
5. **Policy Development:** Measures need to be taken to develop regulations and administrative procedures that facilitate the use of the internet in higher education.

6.3 Limitations and Future Research

This study was limited to faculty members faculty of Engineering,AL-Raqibah , Fezzan university in Southern Libya. Future research should extend to other Libyan universities and include student perspectives to gain a more comprehensive view. Additionally, future studies could examine other factors such as cultural influence, student motivation, and environmental factors which were not the focus of this specific paper.

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