

# Challenges and Constraints of E-Government in Sudan from the Perspective of Higher Education Sector Employees

Osman Abdalla Mohamed Elhadi

Management Information Systems Department, College of Business and Economics, Qassim University,  
Buraydah, 51452, Kingdom of Saudi Arabia.

E-mail: [o.elhadi@qu.edu.sa](mailto:o.elhadi@qu.edu.sa)

ORCID ID: <https://orcid.org/0000-0002-6642-627X>

## Abstract

Digital transformation has reshaped public service delivery worldwide; up to now, many developing countries are still fighting to gain the benefits of e-government. Recently, the Sudanese government has been striving to advance digital transformation despite numerous challenges and constraints. The objective of this study is to investigate the managerial; organizational; financial, technological, and social challenges and constraints that impede e-government development and implementation in Sudan from the perspective of higher education sector employees. The study employed a quantitative approach; a questionnaire was designed to gather data from 195 employees across Sudanese higher education institutions. Reliability was strong across scales (Cronbach's  $\alpha$ : 0.798, 0.847, 0.857; overall 0.913). Statistical analyses (descriptive, chi-square) were conducted using SPSS to test the hypotheses. Results: Respondents reported high agreement that managerial; organizational; financial challenges and constraints hinder the adoption and implementation of e-government. Most notable items in the first dimension included changes of government; lack of awareness, lack of sustainable methodology, limited skills, resistance to change, and persistent budget insufficiencies (all  $p < .001$ ). The general first-dimension mean was approximately 4.29, which provides evidence to support H1. Technological challenges and barriers focused on poor telecommunication network coverage (especially in rural areas), inadequate electricity grids, high connectivity costs, weak data security practices, and incompatible systems. The general mean for the second dimension was 3.97, which provides evidence that supports H2. Social challenges and constraints included limited awareness of e-government concepts, technical illiteracy, talent emigration, weak recognition of creativity, absence of competency-based HR practices, and low trust among users. The general mean for the third dimension was approximately 3.99, which provides evidence to support H3. The significance level for the three dimensions was  $p < .001$ . The study concludes that the adoption and development of effective e-government projects in Sudan requires integrated strategies that combine institutional restructure, technological investment, human capacity development, and social awareness. For future research, the study recommends employing both quantitative and qualitative approaches to gain a better understanding of e-government challenges and constraints. Despite the limitations, this study contributes to the e-government research literature by informing policymakers and stakeholders about key areas for improvement in Sudan's e-government initiatives, particularly within the higher education sector.

**Keywords:** E-Government, Higher Education, Implementation, Challenges & Constraints, Sudan

**DOI:** 10.7176/IKM/16-1-03

**Publication date:** March 31<sup>st</sup> 2026

## 1. Introduction

In this modern era, technological advancement and digital transformation revolutionized every field of life. Due to which information technology plays an important role in facilitating the change (Fenech et al., 2019). These technologies are used by individuals, organizations, governments and even multi-governments for simple tasks such as communication to complex tasks such as maintaining national databases and controlling worldwide air traffic (Kraus et al., 2021). Therefore, government has a huge responsibility to adopt the latest technology while making decisions about to uplift the economics condition of a country (Jere & Ngidi, 2020). Developing countries also face many significant challenges when it comes to government decision-making (Bawack & Kamdjoug, 2018). Issues such as planning, mismanagement, ineffective decisions, complex interactions of

ideologies, and public expectations for good governance were part of the problems that developing countries have yet to resolve (Masuku & Jili, 2019). The main goal of e-government is to develop a digital transformation in order to deliver public services and information to citizens electronically to increase the transparency and saves the huge cost (Hujran et al., 2023). Digital transformation is an inevitable step for any institution that wishes to adapt to technological developments (Saarikko et al., 2020). Due to the rapid rise of the internet and digitization, governments all over the world are initiating steps to involve ICT in all governmental processes (Hujran et al., 2023). With the technological advances, the government sectors have gradually adopted digital transformation focused on serving the citizens', also to ensure that the government administration process becomes faster and more transparent (Sarker et al., 2018). In addition, the wide spread of e-government adoption is significantly influenced by the public sector reform (Sabani, 2021). Thus, e-government Implementation leads to achieves many benefits such as increasing confidentiality also ease of use, and ease of accessibility (Alcaraz-Quiles et al., 2018). This study mainly focuses on answering the question that how government institutions achieve progress through the utilization of information technology in performing their tasks, known as e-government. The study specifically targets the Sudanese citizen to understand the concept and the importance of e-government. The challenges and the constraints that hinder the implementation of e-government in Sudan and the level of the awareness among Sudanese citizens regarding the prospects of implementing e-government. Given the similarity in the goals of business organizations and the goals of government of developing countries represented in the necessity of survival considering economics conflict and the general challenges facing the two (Alcaraz-Quiles et al., 2018). Therefore, it is necessary to find the process of integrating the concepts and characteristics of e-government with the higher education sector employees that leads to the creation of a better reality for developing countries. The widespread use of digital media for public services has spawned a new breed of e-government systems that rely on IT-enabled web interfaces as the primary point of interaction between government agencies and stakeholder (Adrees, 2022). Therefore, the aim of this study is to introduce the concept and the importance of e-government, and to raise the awareness of e-government among citizens. This study also identifies the requirements and capabilities for implementing e-government, as well as the constraints and challenges it faces in Sudan. The significance of implementing e-government and the extent to which citizens are aware of was also examined in this to provide valuable information to develop new policies and strategies to enhance the effectiveness of e-government in Sudan. This study contributes in return to the tremendous technological developments in recent era, which has been called the era of information and communications or the era of digital transformation. So, this digital development has a huge role in the development of the concept of e-government. The findings of this study will reveal what the advantageous e-government implementations would be gained to society and to the personals. Therefore, the study also focusses on the economics benefits gains through implementing e-government. In addition, the study summarizes the advantages achieved by some countries and their experiences through implementation of e-Government such as facilitating and accelerate the procedures and transactions, reduce the procedures and transactions costs, complete all transactions and procedures through one window and work the whole day and all the days of the week (24/7).

## 2. Literature Review

The concept of e-government refers to the delivers of services in electronic way through adopting computers and networks (Wairiuko et al., 2018). E-government has become an essential channel for delivering government services in effective, efficient, credible, reliable, and transparent way (Suliaman et al., 2022). E-government means the uses and investments of ICT infrastructures in efficient way to enhance the services provided to the public (Wairiuko et al., 2018). According to Ashaye & Irani, (2019), the term e-government refers to the development and use of information and communication technologies (ICTs) with the aim of streamlining the delivery of public services to citizens, businesses, and public agencies (Ashaye & Irani, 2019). The World bank defines e-government as "the use of ICT to improve the efficiency, effectiveness, transparency and accountability of government" (Riany et al., 2018). According to Sulistiawaty et al., (2021), the term e-government refers to the use of ICT to achieve the administrative process (Sulistiawaty et al., 2021). Viana, (2021), defines e-government as a virtual system that enables government agencies to perform their obligations through applying advanced electronic technologies to deliver services to the public (Viana, 2021). E-government classified in the following ways such as, G2C which provide services online through electronic media to deliver information to the citizens (Špaček et al., 2020). G2B encourages e-transactions initiatives such as e-procurement and create an electronic marketplace for government purchases; and implement government procurement tenders electronically (Meiyanti et al., 2018). G2E were the initiatives which accommodate the management of the civil service and

internal communication with governmental employees in order to make e-career applications and paperless system in E-office (Meiyanti et al., 2018). G2G which provides cooperation and online communication to the government departments to increase efficiency and effectiveness, including internal exchange of information and commodities. Transfer of information and communication between government and nonprofit organizations such as political parties, social organizations, Legislature, etc (Meiyanti et al., 2018).

### *2.1 Evolution of E-Government in Sudan*

The evolution of e-government in Sudan has been a gradual process influenced by various factors such as technological advancements, government policies, and socio-economics conditions (Mogale, 2021). Initially, e-government initiatives in Sudan focused on basic online services, such as information dissemination and communication channels between government agencies and citizens (Adrees et al., 2019). However, in recent years, there has been a noticeable shift towards more comprehensive e-government strategies aimed at improving service delivery, transparency, and citizen participation (Khan & Krishnan, 2021, Li & Abdalla 2014). According to Bakunzibake (2019), a significant milestone in Sudan's e-government evolution was the establishment of the National Information Centre (NIC) in 2005, which aimed to coordinate and implement e-government projects across different government ministries and departments (Bakunzibake, 2019). Subsequently, the government launched several initiatives to digitize administrative processes, enhance online service delivery, and promote ICT infrastructure development across the country (Sharma et al., 2021). Despite these efforts, Sudan still faces challenges in fully realizing the potential of e-government (Adrees et al., 2019). According to Malodia et al. (2021), the factors such as limited internet penetration, digital literacy gaps, and bureaucratic hurdles have hindered the widespread adoption and effectiveness of e-government services (Malodia et al., 2021). Additionally, political instability and economics constraints have impacted the pace of e-government development in the country Faraj,(2019).

### *2.2 E-Government Challenges*

According to Wright (2019), in all projects, it was necessary to ensure political support, especially where innovating public administration has been involved. Unfortunately, that was one of the major obstacles to the success of e-government in less developing countries. Since citizens demand digital technology in their everyday lives, politicians always show a general desire to support digitalization projects (Wulandari & Adawiyah, 2025, Sheik et al., 2026). However, in reality, there was a serious lack of confidence and trust from the authorities, for instance, when it comes to projects led by local engineers many members of government at the time were reluctant to use technologies to exchange messages because they feared that their messages might be leaked before it reaches the destination offices (Zeebaree & Aqel, 2021). Therefore, authorities worried that system administrators must be able to read the contents of their conversation via the e-government messaging platform. Resistance to change was also one of the main factors impeding digitalization projects because people like to stick to their habits (Zeebaree & Aqel, 2021). In this case, state workers need to acquire a certain habit in the management of their files and digitization was perceived as a disruptive factor, even though it brings certain advantages or reveals shortcomings in standard procedures. This led workers to enter a form of resistance. Another obstacle was the difficulty of mobilizing the ones who benefit from governmental dematerialization projects, the end users working in public administration (Kenis & Lievens, 2016). Indeed, the public administration has authorized certain motivational elements for workers, which ultimately prove to be an obstacle for any activity that does not integrate these motivational aspects. For instance, the state authorizes the organization of workshops and activities in other cities and the payment of per diems to participants per day of participation. As a result, the achievements and benefits of digitalization efforts are repeatedly questioned. This has a great impact on the success of such projects because naturally they require a strong involvement of beneficiaries (Mumford, 2006).

(Sulieman et al.,2022) synthesis the barriers and challenges which may restrict the full and effective implementation of e-government in the following:

- Economic factors: Investing in ICT assets such as both hardware and software systems are considered vital for its sustainability (Savoldelli et al., 2014).
- Technical factors: many technical challenges may be faced during the implementation process and adoption of e-government. Those obstacles include the lack of compatibility on infrastructure among departments, or concerns on information security and privacy or accessibility (Meijer, 2015).
- Social and cultural factors: The social divides within a country are shaped by the level of education of citizens and government employees, income, age, geographical location, gender, and family type, those shall be considered to build a comprehensive model that satisfy and consider their needs and characteristics (Al-Hujran et al., 2015).

- Organizational factors: Lack of qualifications and training, resistance to change, limited stakeholder capabilities are major challenges in the project success (Meijer, 2015).
- Legal and political strategies: Without a legal base, the adaptation and implementation of e-government is impaired. If there were no legal basis, the decision-making process of e-government should be formalized to assure transparency, credibility, and reliability (Hanna, 2010).
- Environmental Factors: They refer to government policy towards pollution, utilization of eco-friendly technology, energy efficiency, climate change (Abdoh et al., 2020).

### 2.3 Sudan's EGDI Performance (2003–2024)

According to the United Nations E-Government Survey reports, Sudan's E-Government Development Index (EGDI) shows a continuously low and unstable progression over the period 2003–2024. The table 1 demonstrate the index increased slightly from 0.20618 in 2003 to 0.26095 in 2012, followed by slowdown and decline between 2014 and 2018, where Sudan reached its lowest ranking position (180th globally in 2018). A temporary improvement was witnessed in 2020 (0.31540), which representing the highest recorded value in the table 1 data. However, this improvement was not sustained, as the value declined to 0.27594 in the year 2024. This trend aligns with findings reported in the United Nations Department of Economic and Social Affairs (2022, 2024), which emphasize that least developed and politically fragile countries often experience incremental improvement without structural integration. From the table below data in 2024, Sudan's EGDI score (0.27594) remains considerably below the global average (0.6382), the regional average (0.4247), and the sub-regional average (0.5776) which shown in table 2 below. The continuous performance gap indicates structural limitations in Sudan's Online Service Index (OSI), Telecommunication Infrastructure Index (TII), and Human Capital Index (HCI), aligned with global comparative findings. The empirical movement observed in Sudan agrees with broader theoretical and policy analyses in digital governance literature. The World Bank (2021) highlights governance instability, weak institutional coordination, and limited regulatory capacity as crucial barriers to sustainable digital transformation in developing countries. Comparably, the International Telecommunication Union (2023) recognizes broadband penetration, ICT infrastructure expansion, and digital skills development as primary factors of national digital performance indices. The temporary improvement recorded in 2020 may reflect incremental reforms in service digitization; however, the subsequent regression supports prior evidence suggesting that digital government advancement requires long-term policy continuity and institutional integration (UN DESA, 2022). Countries experiencing political or economic disruption frequently demonstrate index inconsistency due to interrupted reform cycles and incoherent implementation structures (World Bank, 2021).

Table 1. Sudan E-Government Development Index

| Year | Rank | Value   |
|------|------|---------|
| 2003 | 146  | 0.20618 |
| 2004 | 147  | 0.23082 |
| 2005 | 150  | 0.23695 |
| 2008 | 161  | 0.21860 |
| 2010 | 154  | 0.25417 |
| 2012 | 165  | 0.26095 |
| 2014 | 154  | 0.26062 |
| 2016 | 161  | 0.25389 |
| 2018 | 180  | 0.23940 |
| 2020 | 170  | 0.31540 |
| 2022 | 176  | 0.29720 |
| 2024 | 178  | 0.27594 |

Data source: UN reports

Table 2. E-Government Development Index

|                         |        |
|-------------------------|--------|
| EDGI World average      | 0.6382 |
| EDGI Region average     | 0.4247 |
| EDGI Sub-region average | 0.5776 |

Data source: UN reports

### 3. Research Hypothesis

To complete this study, the following hypotheses were formulated to investigate the challenges impeding the adoption of e-government in Sudan from the perspective of higher education employees.

**H1:** There are managerial, organizational and financial challenges and constraints hindering e-government development and implementation in Sudan.

**H2:** There are technological challenges and constraints hindering e-government development and implementation in Sudan.

**H3:** There are social challenges and constraints hindering e-government development and implementation in Sudan.

### 4. The study model

To achieve the study objectives three main dimensions representing the independent variables, which reflect the nature of the relationship between the adoption and implementation of e-government as a dependent variable were proposed such as follows:

A) The financial, managerial, and organizational challenges hinder the adoption and implementation of e-government initiatives.

B) Technological challenges and constraints such as poor internet quality, high communication costs, and lack of coverage in a wide geographical area hinder the establishment and development of e-government in Sudan.

C) The social challenges and constraints that hinder the establishment and implementation of the e-government project in Sudan

A study model has been proposed as shown in Figure 1 below:

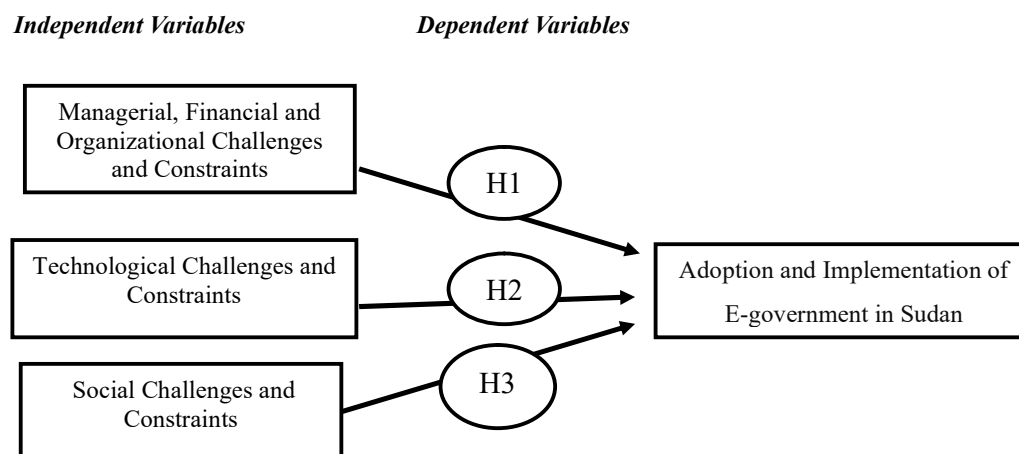


Figure 1. Conceptual Framework

The conceptual model as in figure 1 above illustrates how the adoption and implementation of e-government in Sudan are affected by three main challenges and constraints: financial, administrative, and organizational issues; technological problems; and social barriers.

### 5. Research Methodology

This study reveals the degree of practice of e-government in Sudan and the challenges and constraints according to the perspective of higher education sector employees. The study sample consisted of 195 professionals from the higher education sector who work in the deployment of e-government technologies in

Sudan, and the study employed a quantitative technique using a structured survey questionnaire. This study answers the following research questions such as the relationship between the electronic services that the government provides to its citizens through electronic channels and citizens' satisfaction. The statistical relationship between online government services and socio-economics standards of developing countries which eventually led to the development and implementation of e-government in Sudan.

### *5.1 Research Design*

This study mainly focuses to identify the challenges and constraints faced during the development and implementation of e-government in Sudan according to the perspective of higher education sector employees. The participants of the study belong to different educational institutions such as public and private sectors, also were diversified in ages, years of experience, academic qualification and gender. A quantitative approach was used to collect data from the employees of higher education sector. Using a random sampling method the data was collected from 195 employees of higher education sector through a structured questionnaire. The items of the questionnaire were designed after thoroughly reviewing the previous literature. In this study, we categorically evaluated the challenges and constraints of e-government development and implementation in three different dimensions. In the first dimension, managerial, financial and organizational challenges were examined by incorporating 13 different items. In the second dimension the technological challenges and constraints were identified by integrating 12 items and in the third dimension the social challenges and constraints were examined with the combining of 10 items. The agreement from the participants and ethical approval from the higher education sectors was collected before conducting the study. The collected data first organized in the excel sheet, then each item was coded categorically according to the dimensions of the questionnaire. The descriptive statistical tests and chi square were applied on the dataset and the results were generated through SPSS.

### *5.2 Participants of the Study*

The government and private higher education sector employees participated in the study to identify the challenges and constraints faced during the development and implementation of e-government.

### *5.3 Data Collection Method*

The data was collected through a structured questionnaire from 195 employees of higher education sector using a random sampling method.

## **6. Data Analysis**

The Statistical Package of Social Sciences (SPSS) was used to analyze the data. The descriptive statistical methods and chi square test were applied on the data set to generate the results.

### *6.1 Ethical Considerations*

The ethical approval and the agreement of participants was necessary to examine the implementation of E-Government in Sudan from the perspective of Higher Education Sector employees. A complete consideration of ethical principles and to respect the autonomy was mandatory to conduct any research. In this study, we also maintained the confidentiality and privacy of participants' responses which was essential to protect their privacy and prevent any potential harm or consequences. The approach to conduct the study was crucial in the context of cultural sensitivity and awareness, respecting the unique context and values of Sudanese society. This study provides equal opportunity and ensures that all voices within the Higher Education Sector were heard and represented, regardless of rank or background.

### *6.2 Validity and Reliability*

It was crucial to validate the items of the questionnaire from the previous literature to produce credible results. Ensuring the validity and reliability of the data was a major concern to maintain the accuracy and the truthfulness of the study's conclusion in relation to the research questions and aim of the study to identify the challenges and constraints, faced during the development and implementation of e-government according to the perspective of higher education sector employees. A survey research method was employed to enhance the validity and gather comprehensive and representative data. In this study, standardized protocols were also maintained, to ensure coding reliability, and detailed documentation of research procedures. By precisely addressing validity and reliability considerations the study generates credible results regarding the challenges and constraints faced by Higher Education Sector employees in the context of e-government implementation in Sudan.

Table 3. Reliability Statistics

|                   | Cronbach's Alpha | N of Items |
|-------------------|------------------|------------|
| First Dimension   | 0.798            | 13         |
| Secon Dimension   | 0.847            | 12         |
| Third Dimension   | 0.857            | 10         |
| General Dimension | 0.913            | 35         |

The above table 3 demonstrates the internal consistency using Cronbach's alpha. Reliability was acceptable to be excellent across all dimensions: The first dimension ( $\alpha = 0.798$ ; 13 items), the second dimension ( $\alpha = 0.847$ ; 12 items), and the third dimension ( $\alpha = 0.857$ ; 10 items). The aggregate General scale demonstrated excellent reliability ( $\alpha = 0.913$ ; 35 items). Generally, Cronbach's Alpha coefficients above 0.70 were considered acceptable, while coefficients above 0.80 were pointing out of good internal consistency reliability. Therefore, Cronbach's Alpha coefficient of 0.798,0.847,0.857 and 0.913, which sequentially obtained in this analysis suggests that the items in the scale used were highly consistent in measuring the same underlying construct which demonstrates strong reliability.

## 7. Results and Discussion

The following results are summarized from the data collected through the questionnaire of the 195 employees of higher education sector.

### 7.1 Statistical Analysis of Demographic Characteristics:

Table 4. Demographic Data

| Item                   | Category                  | Frequency | Percentage |
|------------------------|---------------------------|-----------|------------|
| Sex                    | male                      | 93        | 47.7       |
|                        | female                    | 102       | 52.3       |
| Age                    | Less than 30              | 6         | 3.1        |
|                        | 30 and less than 40       | 31        | 15.9       |
|                        | 40 and less than 50       | 70        | 35.9       |
|                        | 50 and above              | 88        | 45.1       |
| Years of Experience    | Less than 5 years         | 9         | 4.6        |
|                        | 5 years and less than 15  | 57        | 29.2       |
|                        | 15 years and less than 25 | 77        | 39.5       |
|                        | 25 years and above        | 52        | 26.7       |
| Academic Qualification | High school               | 31        | 16         |
|                        | Graduate                  | 56        | 29         |
|                        | Postgraduate              | 108       | 55         |

In the above table 4 descriptive statistics provide valuable information regarding the demographic and professional characteristics of a sample population of 195 individuals, as examined within a particular study. Across the variables of sex, age, years of experience, and academic qualification, notable trends be revealed. The study participants response regarding the demographic characteristics indicates a generally balanced and experienced sample with high educational attainment.

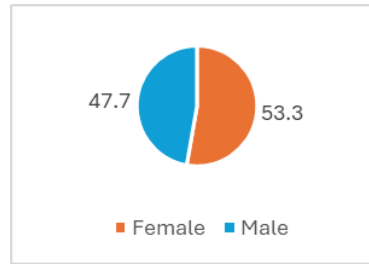


Figure 2. Gender Distribution

7.1.1 *Gender distribution:* Figure 2 above shows a near balance between male and female respondents. Females constitute a proportion of (52.3%, n = 102) while males (47.7%, n = 93). This distribution suggests minor gender bias and enhances the representative of the sample in terms of sex.

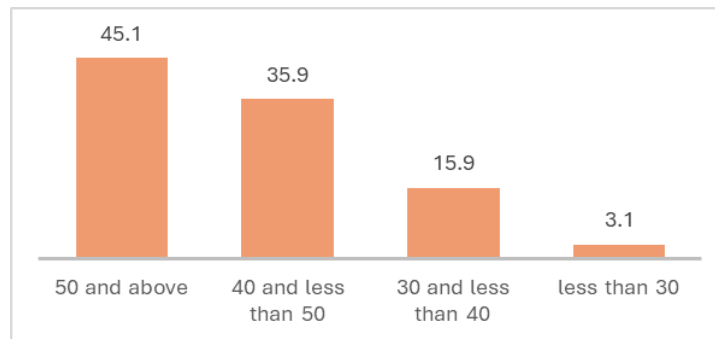


Figure 3. Age Distribution

7.1.2 *Age distribution:* Figure3 above reveals that the majority of participants fall among age group 50 years and above which represent (45.1%, n=88), followed by those age group 40 to less than 50 years (35.9%, n = 70). Respondents aged 30 to less than 40 years represent 15.9% (n = 31), while those age groups fall below 30 years form a small proportion (3.1%, n = 6). This distribution results indicate that the sample is predominantly consisting of mature individuals, which may reflect professional stability and aggregated experience.

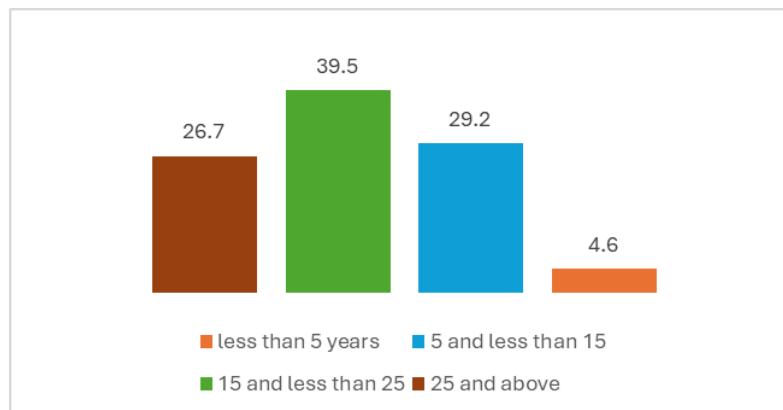


Figure 4. Years of Experience

7.1.3 *Years of experience:* Figure 4 above shows the largest proportion of respondents have 15 to less than 25 years of experience (39.5%, n = 77), followed by category of 25 years and above (26.7%, n = 52). Participants in group 5 to less than 15 years of experience represent 29.2% (n = 57), while those in the group have less than 5 years of experience a count of 4.6% (n = 9). Overall, most of the respondents possess over 15 years of experience, this indicates a highly experienced sample.

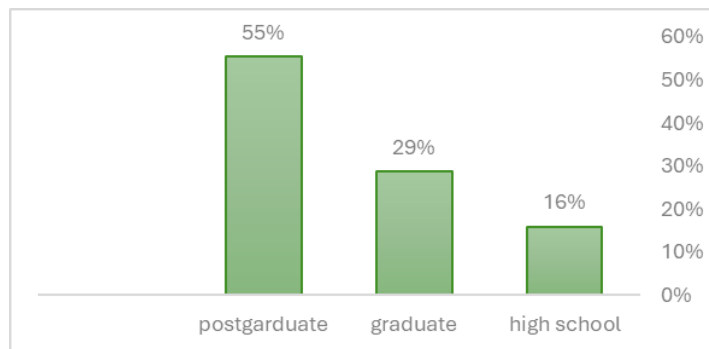


Figure 5. Academic Qualifications

7.1.4 *Academic qualifications*: The results reveal that the majority of the participants hold postgraduate degrees (55%, n = 108), while a graduate's proportion is (29%, n = 56). Only 16% (n = 31) have a high school qualification. This result regarding academic attainment provides evidence that the respondents are well-trained to provide informed and reliable insights related to the study topic.

7.2. *H1: There are managerial, organizational and financial challenges and constraints hindering e-government development and implementation in Sudan.*

Table 5. Managerial, Financial and Organizational Challenges and Constraints

| Statements   | Mean | Std. Deviation | Chi Square | Asymp. Sig. |
|--|------|----------------|------------|-------------|
| Changing governments and lack of sustainable methodology disrupt e-government progress                         | 4.56 | 0.766          | 317.795    | 0.000       |
| E-government initiatives are influenced by the change of the managers.   | 4.01 | 1.079          | 117.949    | 0.000       |
| Lack of awareness of e-government among managers poses challenges to project building.                         | 4.54 | 0.683          | 190.662    | 0.000       |
| Managerial and employee resistance to change impedes e-government rollout.                                     | 4.13 | 1.005          | 146.769    | 0.000       |
| limitations in managerial and technical skills hinder e-government project execution                           | 4.38 | 0.766          | 152.221    | 0.000       |
| Shortage of Financial resources hinder e-government infrastructure development and project rollout             | 4.40 | 0.869          | 234.205    | 0.000       |
| Financial shortages for training impede the rollout and execution of e-government projects                     | 4.17 | 0.958          | 183.846    | 0.000       |
| Insufficient budgets pose obstacles to e-government project development and implementation                     | 4.40 | 0.809          | 225.949    | 0.000       |
| Inadequate legislation keeping pace with digital transformation challenges e-government project implementation | 4.21 | 0.930          | 95.851     | 0.000       |
| Lack of standardized digital frameworks poses challenges to e-government project rollout                       | 4.29 | 0.682          | 125.021    | 0.000       |
| Slow digital transformation adoption in government hinders e-government development                            | 4.44 | 0.681          | 157.595    | 0.000       |
| Lack of initiatives hinders e-government project implementation  | 4.07 | 0.944          | 59.379     | 0.000       |
| Unclear goals due to missing consensus hinder e-government project rollout                                     | 4.20 | 0.775          | 204.718    | 0.000       |
| The General Dimension  | 4.29 | 0.867          | 2495.791   | 0.000       |

Table 5 demonstrates various factors that influence the development and implementation of e-government initiatives, along with their associated mean values, standard deviations, Chi-square statistics, and significant levels. The mean values of the first dimension statements ranging between 4.01 and 4.56, which indicate a high level of agreement among respondents across all statements which provide the evidence to support H1. The highest mean value (4.56) is associated with the statement, "Changing governments and a lack of sustainable methodologies impede e-government development." The lowest mean value (4.01) is associated with the statement, "E-government initiatives are influenced by the change of the managers," which reflects that it is considered less critical compared to other statements. According to the mean values, respondents strongly agree or agree that factors such as failure to follow sustainable development methodology, changes in e-government projects according to institutional manager change, and the lack of awareness regards e-government concepts were significant challenges. Similarly, respondents reflect agreement regarding the challenges posed by factors such as resistance to change, limitations in managerial and technical skills, and insufficient financial resources. Furthermore, respondents agree on challenges related to legislative gaps, lack of digital transformation standards, government departments' slow adoption of digital transformation, absence of initiatives, and lack of consensus on e-government goals. The standard deviations range from 0.681 to 1.079, demonstrating uneven levels of consensus among respondents. The lowest standard deviation (0.681) is associated with the statement "Slow digital transformation adoption in government impedes e-government development," showing a higher agreement among respondents on this statement. However, the higher standard deviation (1.079) associated with the statement "E-government initiatives are influenced by manager change" provides evidence that there is more heterogeneity in participants' views regarding this statement. All statements have significant Chi-square values, ranging from 59.379 to 317.795, according to the Chi-Square Statistics. The high Chi-square values indicate that the documented responses significantly differ from what would be expected under the null hypothesis (i.e., there is a significant association between the statements and the respondents' views). Asymptotic Significance level (p-value) for all items is 0.000, which is below the standard alpha level of 0.05. This result indicates that all identified factors are statistically significant in their influence on e-government project implementation and development. These findings identify the perceived complexity and multifaceted nature of challenges hindering e-government development in Sudan which emphasize the importance of addressing these issues to facilitate successful implementation and progress in digital governance initiatives.

7.3. H2: *There are technological challenges and constraints hindering e-government development and implementation in Sudan.*

Table 6. Technological Challenges and Constraints

| Statements   | Mean | Std. Deviation | Chi Square | Asymp. Sig. |
|--|------|----------------|------------|-------------|
| Unclear infrastructure requirements need hinder e-government project development.                        | 4.22 | 0.800          | 116.487    | 0.000       |
| Poor network and telecommunication coverage, especially in rural areas, limits e-government development. | 4.54 | 0.826          | 218.518    | 0.000       |
| High telecommunications costs restrict citizens' use of e-government services.                           | 4.13 | 1.109          | 161.077    | 0.000       |
| Low computer and smartphone penetration hinders e-government implementation.                             | 3.37 | 1.217          | 65.846     | 0.000       |
| Low internet usage obstructs e-government development and implementation.                                | 3.41 | 1.225          | 56.513     | 0.000       |
| Limited ICT awareness among most citizens impedes e-government development.                              | 3.79 | 1.169          | 88.256     | 0.000       |
| Poor and limited electricity grid coverage in rural areas hinders e-government use.                      | 4.32 | 0.852          | 125.513    | 0.000       |
| Weak data and information security compromises trust and limits e-government expansion.                  | 4.12 | 0.920          | 156.513    | 0.000       |
| Lack of unified data standards represents a challenge to e-government project development.               | 4.11 | 0.804          | 112.918    | 0.000       |

|   |      |       |          |       |
|---|------|-------|----------|-------|
| Incompatible technology standards constitute challenges to e-government development.          | 3.99 | 0.876 | 146.872  | 0.000 |
| Inflexible legacy information systems impede e-government project development.                | 3.88 | 0.892 | 81.656   | 0.000 |
| Information systems that fail to meet beneficiaries' needs obstruct e-government development. | 3.92 | 0.976 | 162.615  | 0.000 |
| The General Dimension   | 3.97 | 1.036 | 1421.485 | 0.000 |

The above Table 6 results provide valuable information about the viewpoints of respondents regarding technological challenges and constraints related to e-government project development and implementation in Sudan. Respondents generally express agreement across the statements, with mean scores ranging from approximately 3.37 to 4.54 which provides evidence that supports H2. Specifically, participants agree or strongly agree that challenges such as the inability to determine required infrastructure requirements, poor telecommunications and network coverage, high costs of telecommunications services relative to income, and low penetration rates of computers and smartphones constitute significant obstacles to e-government development. Similarly, respondents perceive challenges in the limited number of internet users, lack of awareness and knowledge about ICT among citizens, poor or inadequate electricity grid coverage, weaknesses in data and information security, and lack of unified data standards and incompatible technology standards. Additionally, respondents identify challenges related to inflexible legacy information systems and information system designs that were outdated and fail to meet beneficiary needs. This dimension statements standard deviations ranging between 0.8 to 1.225, demonstrating irregular levels of concurrence among respondents. The lowest standard deviation (0.8) is associated with the statement "Unclear infrastructure requirements need impede e-government project development", showing a higher consensus among respondents on this statement. Furthermore, the higher standard deviation (1.225) associated with the statement "Low internet usage impedes e-government development and implementation" provides evidence that there is more heterogeneity in participants' opinions regarding this statement. All statements have significant Chi-square values, ranging between 56.513 and 218.518, according to the Chi-Square Statistics. The high Chi-square values indicate that the documented responses significantly differ from what would be expected under the null hypothesis (i.e., there is a significant association between the statements and the respondents' opinions). Sig. level (p-value) for all statements is 0.000, which is below the standard alpha level of 0.05. This result indicates that all identified factors are statistically significant in their influence on e-government project implementation and development. These findings highlight the multifaceted nature of challenges facing e-government initiatives in Sudan and identifies the need for comprehensive strategies to address infrastructure, connectivity, awareness, security, and technological issues to facilitate successful e-government implementation and usage.

*7.4 H3: There are social challenges and constraints hindering e-government development and implementation in Sudan.*

Table 7. Social Challenges and Constraints

| Statements   | Mean  | Std. Deviation | Chi Square | Asymp. Sig. |
|--|-------|----------------|------------|-------------|
| Limited awareness of e-government concepts represents a key constraint on its development and implementation.  | 4.00  | 1.096          | 139.923    | 0.000       |
| The high ratio of technical illiteracy among citizens hinders the development and implementation of e-government projects.                           | 4.067 | 0.969          | 65.615     | 0.000       |
| The emigration of skilled and trained individuals poses a major challenge to build e-government projects.  | 4.15  | 1.068          | 156.769    | 0.000       |
| Bureaucracy-driven reluctance of qualified individuals to work in the public sector hinders the development of e-government projects.                | 3.96  | 1.045          | 42.928     | 0.000       |
| The absence of competency-based assessment drives skilled employees away from the public sector, represents a challenge of e-government development. | 4.23  | 0.711          | 145.410    | 0.000       |

|   |      |       |          |       |
|---|------|-------|----------|-------|
| The absence of individual creativity recognition in public and private institutions hinders e-government development. | 4.26 | 0.790 | 124.979  | 0.000 |
| Relying on foreign experts poses a challenge to e-government project development.                                     | 3.65 | 1.193 | 55.026   | 0.000 |
| Communication gaps between national and foreign experts hinder e-government development.                              | 3.47 | 1.159 | 46.513   | 0.000 |
| Poor communication between technical experts and project beneficiaries hinders e-government implementation.           | 3.76 | 0.965 | 73.093   | 0.000 |
| Low trust in e-government applications among citizens and employees impedes their implementation.                     | 3.82 | 1.047 | 123.949  | 0.000 |
| The General Dimension   | 3.99 | 1.006 | 1195.805 | 0.000 |

The table 7 above, an overview of descriptive statistical results, provides information about participants' opinions regarding social challenges and constraints. In general, a mean score above 3.00 indicates agreement, while scores above 4.00 indicate strong agreement. Across the items, respondents generally express agreement, with mean scores ranging between 3.47 to 4.26 which supports H3 that social constraints have a significant impact on the development and implementation of e-government in Sudan. In particular, respondents agree or strongly agree that challenges such as the limited awareness of e-government concepts, high ratio of technical illiteracy, and the emigration of well-trained individuals abroad present significant obstacles to e-government development. Similarly, participants perceive challenges related to the bureaucracy-driven reluctance of qualified individuals to work in public sector institutions and the absence of competency-based evaluations leading to employee attrition. In addition, respondents identify challenges such as the absence of appreciation for individual creativity in both public and private sector institutions, reliance on foreign experts during e-government project initiation, and communication difficulties between national and foreign experts. Furthermore, challenges related to poor communication between technical experts and beneficiaries and low trust in e-government applications among citizens and employees were also highlighted. The item that represents the highest constraint is "The absence of individual creativity recognition." which scored the highest mean (4.26), followed by the "absence of competency-based assessment" which scored a mean of (4.23). This finding shows that human resource management and workplace culture are the primary social challenges and constraints. According to table 7 results, the lowest constraint, represented by the statement "Communication gaps between national and foreign experts" scored the lowest mean (3.47). The general dimension mean score was 3.99 with a standard deviation of 1.006, pointing out a high level of consensus that social factors are primary challenges and constraints. The Chi-Square values are high, ranging between 42.928 to 156.769 for individual statements and 1195.805 for the general dimension. P-Value (Sig.) for every single statement shows a significant value of 0.000; this Result means the distribution of responses is not due to random chance. There is a statistically significant agreement among the respondents regarding these social constraints. These findings spotlight the diverse array of challenges and constraints confronting e-government initiatives in Sudan, which emphasize the need for comprehensive strategies to address awareness, education, workforce retention, organizational culture, collaboration, and confidence-building to facilitate successful e-government implementation and adoption.

## 8. Recommendations

Based on the study findings, the following recommendations are outlined to enhance the development and implementation of e-government in Sudan:

- Ensure policy continuity  
Government institutions should build long-term e-government strategies endorsed by clear national digital transformation frameworks to ensure continuity and sustainability despite changes in leadership.
- Increase investment in e-government initiatives  
Sufficient and steady funding should be allocated for ICT infrastructure development, system integration, cybersecurity, and continuous capacity-building programs to support sustainable e-government implementation.
- Strengthen technological infrastructure

Priority should be given to expanding internet and telecommunications coverage, improving electricity grid reliability, and reducing access costs, particularly in rural areas.

- Enhance human capital and digital competencies  
Extensive training programs should be carried out to enhance digital literacy and awareness of e-government concepts among public and private sector employees.
- Foster awareness and trust in e-government services  
Public awareness campaigns should be organized to enhance citizens' understanding of the benefits of e-government, while also strengthening data protection and information security to improve trust and encourage adoption.
- Strengthen legal frameworks  
legislation related to electronic transactions, data governance, and cybersecurity should be updated to build trust and expedite e-government operations.
- Encourage innovation and workforce retention  
Public sector institutions should adopt competency-based evaluation systems, recognize individual creativity, and provide incentives to retain skilled employees and reduce reliance on external expertise.

## 9. Conclusion

This study provides an empirical brief outline of the challenges facing e government in Sudan through the perspective of 195 higher education sector employees. Three findings stand out. First, managerial; organizational; financial issues policy discontinuity amid government managerial changes, limited leadership awareness of e government, resistance to change, skills gaps, and chronic budget constraints emerge as the strongest, most consistently supported hindrances. Second, technological factors inconsistent telecom coverage (notably in rural areas), high connectivity costs, weak electricity supply, weak information security, and legacy, incompatible systems create persistent resistance that limits scale and reliability. Third, social barriers, low public awareness and digital literacy, talent out migration, insufficient recognition of creativity, lack of competency-based HR systems, and low trust weaken adoption and sustained use. In combination, these results support all three hypotheses (H1, H2, H3) and emphasize that Sudan's e government evolution is constrained by Interconnected governance, infrastructure, and human capital dynamics rather than technology alone. Methodologically, the study demonstrates strong internal consistency (overall  $\alpha = 0.913$ ), supporting confidence in the inferences obtained. practically, improvement relies on: (1) policy and managerial continuity grounded in sustainable methodologies; (2) foundational investments in connectivity, power, security, and interoperability; and (3) systematic capability building and HR reforms that reward excellence, sustain talent, and foster a culture of innovation and trust.

## 10. Limitation

The study limitations include the focus on higher education employees, which may not capture the full span and difference of stakeholder experiences. Future work should integrate time-based and qualitative approaches, include citizen and service delivery perspectives, and evaluate the impact of targeted policy and infrastructure interventions on actual usage and satisfaction with e-government services.

## 11. Future Research Directions:

Future studies should adopt mixed-method qualitative and quantitative approaches to examine how infrastructure investments and institutional reforms influence e-government adoption over time in Sudan. Additionally, comparative research with other developing countries could provide more profound insights and best practices for overcoming similar challenges. Finally, future work may integrate advanced analytical techniques such as machine learning algorithms to predict user adoption behavior and support data-driven e-government projects.

## Acknowledgment

The Researcher would like to thank the reviewers for their valuable comments and feedback on earlier version of this manuscript.

## References

- Abdoh, H.M., Saany, S.I., Jebur, H.H. and El-Ebiary, Y.A., 2020. The effect of PESTLE factors on e-government adoption in Jordan: A conceptual model. *International Journal of Engineering Trends and Technology*, pp.19–23.
- Adrees, M., Sheta, O., Omer, M., Stiawan, D. and Budiarto, R., 2019. A framework of promoting government services using social media: Sudan e-government case study. *Journal of Physics: Conference Series*.
- Adrees, M.S., 2022. Adopting e-government services in less developed countries according to the characteristics of business intelligence: Sudan as a model. *IJCSNS*, 22(11), p.204.
- Alcaraz-Quiles, F.J., Urquia-Grande, E., Muñoz-Colomina, C.I. and Rautiainen, A., 2018. E-government implementation: Transparency, accessibility and usability of government websites. In: *International e-government development: Policy, implementation and best practice*, pp.291–306.
- Al-Hujran, O., Al-Debei, M.M., Chatfield, A. and Migdadi, M., 2015. The imperative of influencing citizen attitude toward e-government adoption and use. *Computers in Human Behavior*, 53, pp.189–203. <https://doi.org/10.1016/j.chb.2015.06.025>
- Ashaye, O.R. and Irani, Z., 2019. The role of stakeholders in the effective use of e-government resources in public services. *International Journal of Information Management*, 49, pp.253–270.
- Bakunzibake, P., 2019. *Improving implementation of e-government services in Rwanda: An organisational perspective*. Örebro University.
- Bawack, R.E. and Kamdjoug, J.R.K., 2018. Adequacy of UTAUT in clinician adoption of health information systems in developing countries: The case of Cameroon. *International Journal of Medical Informatics*, 109, pp.15–22.
- Faraj, A.Q.A. and Alim, K.A.N., 2019. Integration of geographic information system and e-government in Sudan: Case study Ministry of Education Northern State. PhD thesis.
- Fenech, R., Baguant, P. and Ivanov, D., 2019. The changing role of human resource management in an era of digital transformation. *Journal of Management Information and Decision Sciences*, 22(2).
- Hanna, N.K., 2010. *Transforming government and building the information society: Challenges and opportunities for the developing world*. New York: Springer.
- Hujran, O., Alarabiat, A., Al-Adwan, A.S. and Al-Debei, M., 2023. Digitally transforming electronic governments into smart governments: SMARTGOV, an extended maturity model. *Information Development*, 39(4), pp.811–834.
- International Telecommunication Union (ITU), 2023. *Measuring digital development: ICT Development Index 2023*. Geneva: ITU. Available at: <https://www.itu.int>
- Jere, J.N. and Ngidi, N., 2020. A technology, organisation and environment framework analysis of ICT adoption by SMEs in Pietermaritzburg. *South African Journal of Information Management*, 22(1), pp.1–9.
- Kenis, A. and Lievens, M., 2016. Greening the economy or economizing the green project? *Review of Radical Political Economics*, 48(2), pp.217–234.
- Khan, A. and Krishnan, S., 2021. Citizen engagement in co-creation of e-government services: A process theory view. *Internet Research*, 31(4), pp.1318–1375.
- Kraus, S., Jones, P., Kailer, N., Weinmann, A., Chaparro-Banegas, N. and Roig-Tierno, N., 2021. Digital transformation: An Overview of the current state of research. *SAGE Open*, 11(3).
- Li, Q. and Abdalla, E.O., 2014. The e-government in Sudan: Challenges, barriers and prospects. In: *Proceedings of the International Conference on Global Economy, Commerce and Service Science (GECSS 2014)*.
- Malodia, S., Dhir, A., Mishra, M. and Bhatti, Z.A., 2021. Future of e-government: An integrated conceptual framework. *Technological Forecasting and Social Change*, 173, 121102.
- Masuku, M.M. and Jili, N.N., 2019. Public service delivery in South Africa: Political influence at local government level. *Journal of Public Affairs*, 19(4), p.e1935.

- Meijer, A., 2015. E-governance innovation: Barriers and strategies. *Government Information Quarterly*, 32, pp.198–206.
- Meiyanti, R., Utomo, B., Sensuse, D.I. and Wahyuni, R., 2018. E-government challenges in developing countries: A literature review. In: *2018 6th International Conference on Cyber and IT Service Management (CITSM)*.
- Mogale, B.H., 2021. *A review of critical factors impacting the implementation of e-government in developing countries*. Faculty of Humanities.
- Mumford, E., 2006. The story of socio-technical design. *Information Systems Journal*, 16(4), pp.317–342.
- Riany, K., Were, K. and Kihara, S., 2018. Influence of e-government strategy implementation on public service delivery in Kenya, pp.32–49.
- Saarikko, T., Westergren, U.H. and Blomquist, T., 2020. Digital transformation: Five recommendations for firms. *Business Horizons*, 63(6), pp.825–839.
- Sabani, A., 2021. Investigating transparency and e-government adoption. *Journal of Science and Technology Policy Management*, 12(2), pp.236–255.
- Sarker, M.N.I., Wu, M. and Hossin, M.A., 2018. Smart governance through big data. In: *International Conference on Artificial Intelligence and Big Data (ICAIBD)*.
- Savoldelli, A., Codagnone, C. and Misuraca, G., 2014. Understanding the e-government paradox. *Government Information Quarterly*, 31(S1), pp.S63–S71. <https://doi.org/10.1016/j.giq.2014.01.008>
- Sharma, S.K., Metri, B., Dwivedi, Y.K. and Rana, N.P., 2021. Challenges faced by service centers in rural India. *Government Information Quarterly*, 38(2), p.101573.
- Sheik, M.Y., Pavlyuk, D., Zervina, O. and Stukalina, Y., 2026. Drivers of e-government adoption in emerging economies. *Administrative Sciences*, 16(2), p.83. <https://doi.org/10.3390/admsci16020083>
- Špaček, D., Csótó, M. and Urs, N., 2020. Questioning citizen-centricity of e-government. *NISPAcee Journal of Public Administration and Policy*, 13(1), pp.213–243.
- Sulieyman, A.S., Hazineh, S., Eleyan, D. and Alkhateeb, M., 2022. E-government limitations and challenges. *International Journal of Scientific & Technology Research*, 11(1), pp.97–103.
- Sulistiaawaty, T., Surahman, F., Puspaningrum, I.I. and Wicaksono, Y., 2021. Knowledge management and e-government success. *Annals of the Romanian Society for Cell Biology*, 25(4), pp.12728–12741.
- United Nations, 2022. *United Nations e-government survey 2022: The future of digital government*. New York: UNDESA. Available at: <https://publicadministration.un.org>
- United Nations, 2024. *United Nations e-government survey 2024: Digital government for sustainable development*. New York: UNDESA. Available at: <https://publicadministration.un.org>
- Viana, A.C.A., 2021. Digital transformation in public administration. *International Journal of Digital Law*, (1), pp.29–44.
- Wairiuko, J.W., Nyonje, R. and Omulo, E.O., 2018. ICT infrastructure and e-government adoption in Kenya. *European Journal of Business and Management*, 10(30), pp.205–221.
- World Bank, 2021. *World development report 2021: Data for better lives*. Washington, DC: World Bank. Available at: <https://www.worldbank.org>
- Wright, V., 2019. Reshaping the state. In: *The State in Western Europe*. Routledge, pp.102–137.
- Wulandari, S.Z. and Adawiyah, W.R., 2025. Digitalization of governmental organizations. *Current Perspective on Business Operations*, 1(2), pp.70–84.
- Zeebaree, M. and Aqel, M., 2021. Weight-analysis of e-government implementation challenges. *Journal of Optimization in Industrial Engineering*, 14(Special Issue), pp.135–152.