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# CLOUD COMPUTING ADOPTION IN E-GOVERNMENT SERVICES: A COMPREHENSIVE POST-COVID-19 SYSTEMATIC REVIEW AND FUTURE DIRECTIONS

**RAGHED ALKHASAWNEH[1] *, ZAIHISMA CHE COB[2], and ALIZA BINTI ABDUL LATIF[3]**

[1,2,3] College of Computing and Informatics, Universiti Tenaga Nasional (UNITEN), Malaysia.

[1]PT21316@student.uniten.edu.my , [2]zaihisma@uniten.edu.my, [3]aliza@uniten.edu.my

**ABSTRACT**

Cloud computing has emerged as a pivotal technology in transforming public sector services, particularly in the wake of the COVID-19 pandemic, which accelerated the global shift toward digital governance. This study conducts a comprehensive systematic literature review to examine the adoption of cloud computing in e-government services, underscoring its growing relevance in enhancing efficiency, scalability, and citizen engagement. The goal of this review is to identify the key factors influencing cloud adoption in government organizations, explore the most frequently applied IT/IS theoretical frameworks, and assess how the pandemic has reshaped adoption trends and priorities. Based on the analysis of 50 peer-reviewed studies from seven scholarly databases, the study hypothesizes that cloud adoption in e-government is significantly influenced not only by technological and organizational factors but also by external pressures such as public health crises and evolving citizen expectations. The findings confirm this hypothesis by revealing that while cloud computing offers substantial advantages, such as cost-effectiveness, improved accessibility, and service innovation, its adoption is challenged by data security concerns, legal barriers, and varying levels of institutional readiness. Additionally, the review identifies a shift toward citizen-centric service models post-pandemic, emphasizing the need for inclusive and resilient digital infrastructures. The study also highlights a gap in the literature, noting a limited diversity in publication sources and keywords, and encourages future research to broaden its scope. Practically, the insights gained can support policymakers and decision-makers in designing more adaptive, secure, and user-focused cloud-based e-government services. This review uniquely contributes by contextualizing cloud adoption within the post-COVID-19 digital transformation of the public sector.

**Keywords**: *Cloud Computing, E-government Services, Adoption, Benefits, Challenges, Systematic Literature Review, IS/IT Models, COVID-19.*

## 1. INTRODUCTION

The rapid and ongoing advancements in information and communication technology (ICT) have positioned cloud computing as a critical element driving the enhancement and evolution of e-government services across various sectors globally, encompassing both developed and developing nations [1], [2]. Many governments worldwide have adopted cloud computing to bolster their e-government projects and initiatives, leading to notable improvements in the operational performance of public institutions [3]. Additionally, cloud computing contributes to increased productivity in e-government services and offers multiple advantages in terms of efficiency and effectiveness [4]–[6].

A cloud-based approach to e-government significantly reduces the expenditures associated with technological infrastructure and other expenses required by traditional e-government systems [7], [8]. Additionally, cloud computing increases the transparency of government institutions and, thus, increases citizens' engagement in e-participation in all the services provided by electronic government initiatives [2], [9], [10]. Additionally, many governments are undergoing digital transformation, digitalizing, and automating their systems to fulfill citizens' needs for easy and fast access to services. One of the promising technologies assisting governments in this trend is cloud computing [11].

Moreover, the adoption and integration of cloud computing with e-government services contribute to enhancing the level of security measures, ensuring privacy, and increasing the level of citizens' and stakeholders' trust in e-government services [12]–[14]. E-government services can also be improved by using cloud computing as it increases the efficiency of these institutions and the possibility of collaboration and coordination among them so they can provide efficient and effective services to citizens and all other stakeholders [8], [15], [16].

Although cloud computing provides many benefits for e-government, it still faces many challenges worldwide, especially in developing countries [2], [17], [18]. Several technological challenges are associated with adopting cloud computing in e-government services, including security, complexity, and compatibility of government assets and systems [1], [19]. Furthermore, hidden, or excessive expenses may prevent institutions from adopting governance systems [20], [21]. A major problem facing developing countries is the initial costs associated with cloud computing adoption at the early stage of the adoption decision [22].

Similarly, several organizational factors may influence the adoption of cloud computing in e-government services, including the lack of support from top managers in these organizations, the size of the organization, and the readiness of the organization in terms of modern technology acceptance [23]–[25]. As well as the lack of IT infrastructure contributes to some of these issues [26], [27].

In addition to the factors above, institutions are also influenced by external factors related to their surroundings and work environment. For example, there may be a lack of legislation and policies governing cloud computing in e-government. Government organizations are also subject to external pressures and demands from citizens and stakeholders to provide the best services possible [1], [28].

Moreover, certain human elements might hinder the adoption of cloud computing in e-government services [24], such as the lack of cloud knowledge or the absence of Internet and technology skills among government sector employees [21], [28].

Resistance from employees to technological changes can also pose a crucial challenge to the institution [29]. Moreover, a lack of trust and awareness in technology among end-users can also hinder cloud adoption decisions [30]. Additionally, governments that neglect citizens' needs and expectations when designing e-services based on cloud computing may result in a significant challenge, leading to the failure of e-government projects [16].

In light of the swift progress in technology, cloud computing has become indispensable, prompting numerous sectors to embrace it to boost productivity, enhance efficiency, and offer convenient services to both citizens and customers while conserving effort and resources. Various fields, such as education, healthcare, and industry, have integrated cloud computing into their operations, thereby increasing their efficiency and effectiveness. As a result, governments are also adopting this approach, as cloud computing has proven to be an effective means of reducing costs, effort, and time [4].

This paper seeks to explore the existing research concerning the implementation of cloud computing in e-government and public sector e-services. It will evaluate the advantages and obstacles associated with integrating cloud computing into e-government frameworks. Additionally, the paper will pinpoint the crucial elements that facilitate successful cloud adoption within an e-government setting. Furthermore, the study will examine the theories and models employed in prior research on cloud adoption. The goal is to critically evaluate the current literature on cloud computing in e-government systems and identify research gaps. This will provide policymakers and practitioners across various countries with valuable insights into the factors that encourage effective cloud adoption of e-government services. The study will delve into the application of innovative technology in less-explored areas by addressing five research questions and offering recommendations for future research.

This article will examine studies published from early 2020 to late January 2023 by exploring numerous esteemed academic databases. The selection of this timeframe was influenced by several factors, including the global surge in technological advancement, necessitating an evaluation of the rapid integration of modern technology. Moreover, to the best of the researchers' knowledge, the recent systematic review on cloud adoption by [31] has reviewed articles published before 2020. It is worth mentioning that between the end of 2019 and the beginning of 2020, COVID-19 impacted most countries worldwide, resulting in most countries closing their borders and imposing comprehensive lockdowns and restrictions on citizens' movements. During this period, technology was available to compensate for the restrictions and provide e-

services, ensuring the continuity of citizens' daily lives. Governments and other sectors, including education, healthcare, electronic payments, and e-commerce, have turned to emerging technologies, such as cloud computing, to address the consequences of the pandemic. As a result, cloud technology has played a significant role in maintaining business continuity and enhancing e-government systems' effectiveness.

Thus, this systematic literature review is guided by the following research questions:

1) What research evidence describes the adoption of cloud computing in e-government systems?
2) What are the benefits of using cloud computing in e-government systems?
3) What challenges may slow the widespread adoption of cloud computing in e-government systems?
4) Which theories/theoretical models are used to support the adoption of cloud computing in e-government systems?
5) What key factors influence the adoption of cloud computing in e-government systems?

## 2. RELATED WORK

Database searches reveal that there are limited systematic literature reviews addressing the adoption of cloud computing in e-government and public sector e-services. A recent investigation by [31] explored the advantages, models, and methodologies employed in current research and analysis techniques for cloud computing in e-government. However, it did not tackle the primary obstacles impeding cloud adoption in e-government services. Furthermore, the study concentrated solely on empirical research, overlooking other studies that might have offered valuable insights into cloud adoption. The review period was restricted to 2010-2020, preceding the COVID-19 pandemic. Consequently, the motivations and factors for adoption may have shifted due to the pandemic, requiring new strategies and plans to handle emergencies.

Assaf et al. [20] carried out a systematic review focusing on cloud computing within the realm of e-government. Their research aimed to pinpoint the advantages and obstacles that cloud computing presents to e-government projects. The study identified 12 advantages, and 8 challenges linked to cloud computing. The results highlighted that cost savings, improved security, and scalability are the most notable benefits. Conversely, the most significant challenges for organizations were related to security and privacy issues. Additionally, the study noted that cloud computing adoption in e-government has not been as thoroughly researched as in other areas. The authors suggested that future systematic reviews should incorporate a wider range of databases and broaden the search keywords [32].

In a systematic review conducted by [33], the focus was on the security requirements for cloud adoption in e-government and public sector e-services. However, this study did not explore the adoption factors, models, and benefits. Meanwhile, [27] conducted a study that exclusively examined security issues, while neglecting other organizational and technological challenges. Additionally, the study only analyzed cloud computing adoption factors in e-government using the technology adoption models DOI and UTAUT (Unified Theory of Acceptance and Use of Technology) and ignored other adoption models that consider key factors from various perspectives [27]. Therefore, this systematic review aims to bridge the gap in literature and present an overview of the current state of the art related to the adoption of cloud computing in e-government and public sector domain through exploring the following perspectives:

1- Presenting evidence on the major topics explored in previous research on cloud computing adoption in e-government and making recommendations for future research.
2- Identifying the benefits and challenges of cloud computing for e-government and exploring future perspectives.
3- Identifying the most significant factors that influence cloud computing adoption in e-government and the theories and IS models adopted by previous studies to provide holistic insights on cloud-based e-government initiatives. This may encourage countries to accept and adopt cloud computing for public sector services, in e-government.

## 3. METHODOLOGY

### 3.1 Review protocol

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [34] guidelines were followed in this systematic literature review to provide a transparent and clear review reporting process.

### 3.2 Sources and searching strings

Several scholarly research databases have been surveyed based on the research questions and eligibility criteria listed in Table 1 to retrieve the most related articles. Web of Science, IEEE Xplore, Scopus, Emerald Insight, ScienceDirect,

ResearchGate, and Google Scholar were searched to retrieve the primary studies.

A keyword string (Benefits OR Challenges OR "adoption factors") AND "cloud computing" AND (e-government OR public sector) was used to select the eligible articles.

### 3.3 Inclusion and exclusion criteria

The inclusion criteria defined the period from the start of 2020 to the end of January 2023. Articles in the English language was included in this study, excluding other studies written in different languages. Moreover, only articles discussing cloud adoption in e-government services and the public sector were included in this study, journal articles or conference proceedings. Table 1 depicts the inclusion and exclusion criteria applied to retrieve the influential papers that answer the research questions and achieve the study objectives.

*Table 1 Inclusion and Exclusion Criteria*

| Inclusion Criteria | Exclusion Criteria |
|---|---|
| Time Span (Jan/2020-Jan/2023) | Any article published before 2020 |
| The article must be in the English Language | Published articles not in the English language. |
| Articles Published in Journals and Conferences. | Technical Articles and Periodic Articles Published by News Websites, Trade Journals, Magazines, and Unreliable Resources. |
| Articles Related to the Adoption of Cloud Computing in E-government or Public Sector | Articles Related to Adoption of Cloud Computing in Other Sectors Apart from E-government or Public Sector. |

### 3.4 Quality assessment

To ensure the quality of each primary study included in this systematic literature review, an evaluation score was conducted on each study. The score was based on the questions presented in Table 2. Hence, studies that obtained a 50% or higher score were considered for this SLR. As a result, 50 studies were included in the review.

*Table 2 Quality Assessment Criteria*

| QA ID | Checklist Question | Answer |
|---|---|---|
| QA1 | Is the research objective clearly defined? | Yes= 1/Partially= 0.5/No= 0 |
| QA2 | Is the theory/model/framework described? | |
| QA3 | Is the Methodology clearly described and appropriately adopted? | |
| QA4 | Do the research findings provide clear and beneficial implications, results, and recommendations? | |
| QA5 | Does the study answer one research question at least? | |

## 4. DEMOGRAPHIC RESULTS

As shown in Figure 1. The scholarly databases yielded 818 articles matching the critical word string. 594 duplicate articles were removed, and 224 articles were assessed based on title,

abstract, and keywords, resulting in 126 articles being excluded as irrelevant at this stage. Hence, 98 articles are available for full-text reading. Based on quality assessment criteria, as shown in Table 2, 48 articles were excluded as they did not provide clear and deep answers to the research questions. Thus, the quality assessment criteria in Table 2 included 50 articles as primary studies in this SLR. The primary studies consisted of (43/50, 86%) research articles and (7/50, 14%) conference proceedings. Figure 2 shows the number of primary studies retrieved from each database.

Consequently, the primary studies were thoroughly examined to obtain data and information. Articles have been divided into three categories (empirical, conceptual, and reviews). Moreover, a study matrix was constructed to collect demographic data from each article, including the authors, year of publication, type of articles, country of publication, and continent of publication. Further, the literature matrix was also designed to extract as much valuable information as possible to introduce and support the research questions, including the aim of the study, theories, methodology, method adopted, key factors investigated, key findings, limitations, and recommendations for future research.

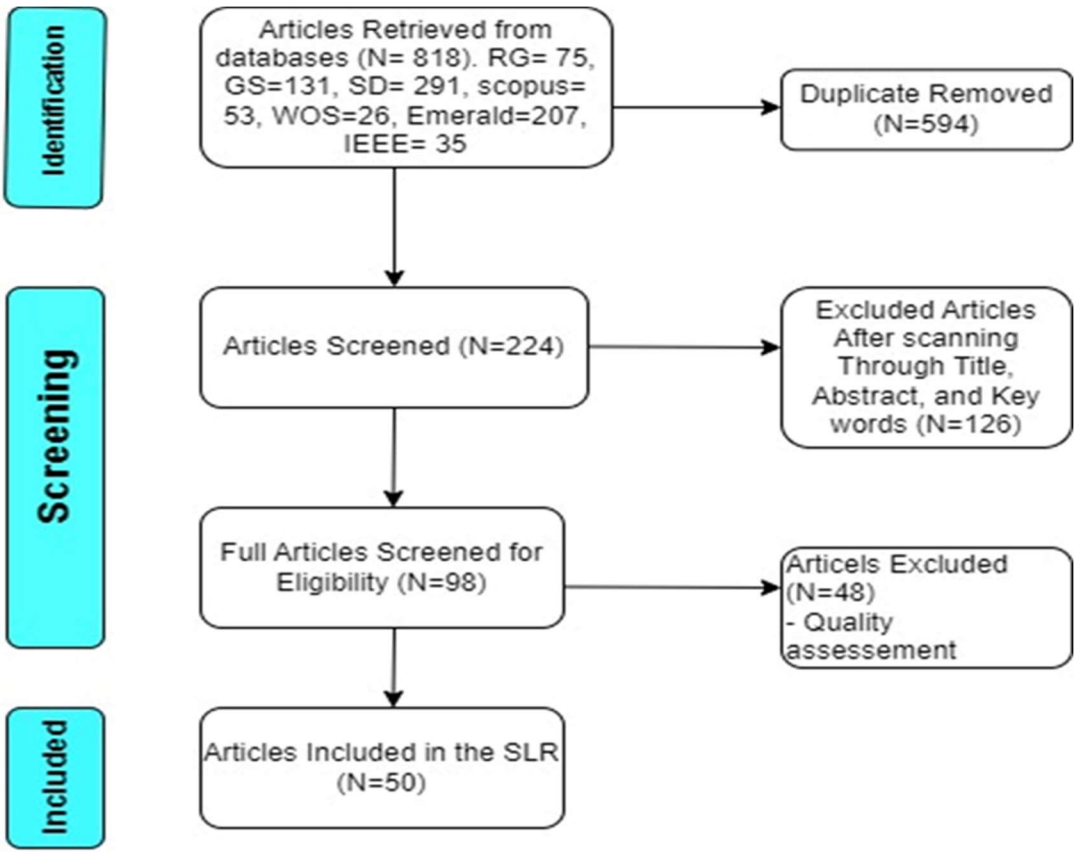


*Figure 1. PRISMA Diagram for Systematic Review.*

A further analysis of the studies included in this SLR revealed three main types: empirical studies (34/50), conceptual studies that presented models and frameworks without empirical results (2/50), and literature reviews (13/50). However, one bibliometric study, which is not classified within these classifications, was included because it answered some research questions. In addition, by identifying the purpose and objectives of each primary study, three themes emerged:

- Investigations into utilizing cloud computing in e-government at an individual and organizational level.

- Analysis of the benefits and challenges of adopting cloud computing in e-government services.
- Examinations of the outcomes of implementing cloud computing in e-government services.

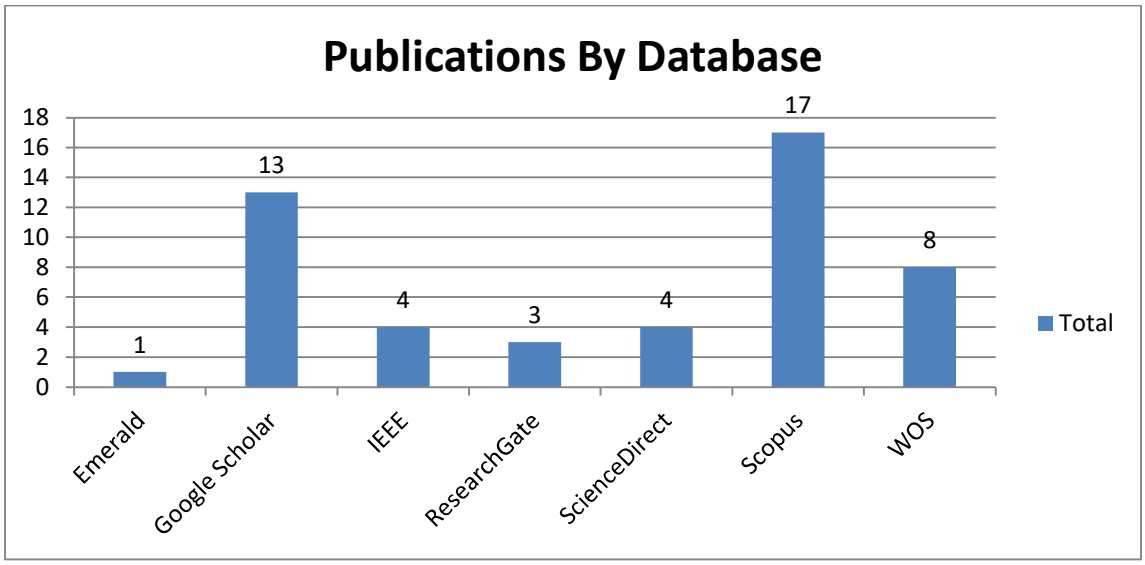


*Figure 2. The Distribution of Primary Studies by Database*

### 4.1 Publications by Year

According to Figure 3, a consistent number of articles were published from 2020 to 2022, with a slight increase in 2020. This trend reflects the shift towards technology and remote work due to the COVID-19 pandemic. The reason why the number of articles is low in 2023 could be due to the fact that the data extraction period only covered until the end of January 2023, and not enough publications have been released yet.

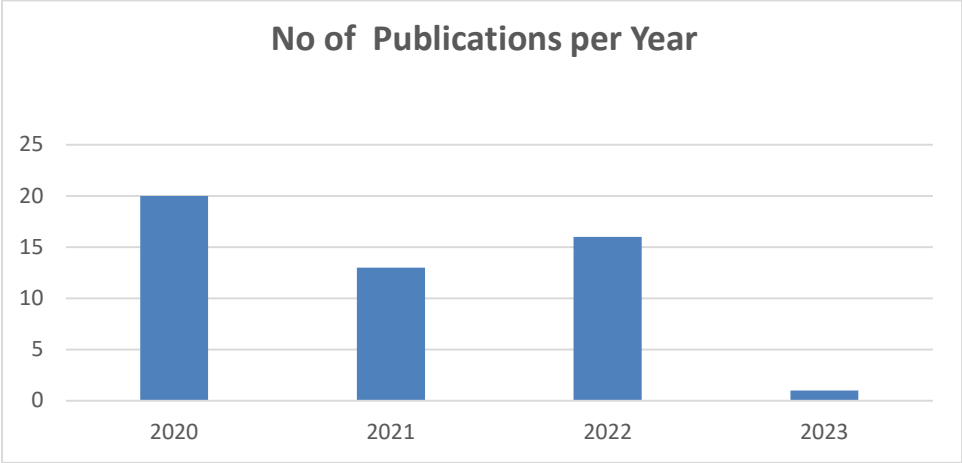


*Figure 3. The Distribution of The Primary Studies by Year*

### 4.2 Publication by Countries and Continents

As shown in Figure 4, Saudi Arabia topped the countries in the number of articles published, with five articles, followed by Malaysia and Australia with four articles each, while the remainder of the countries published between one and three articles.

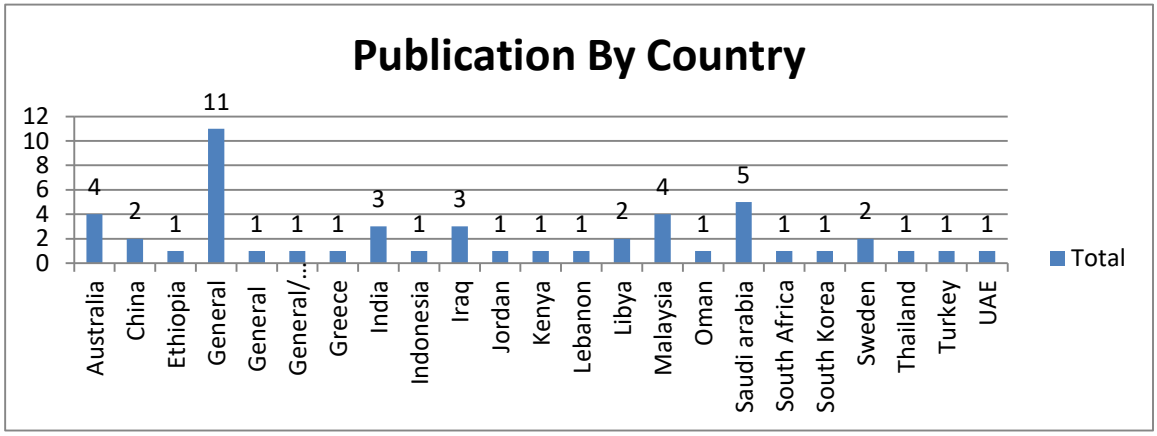


*Figure 4. Publications by Country*

Based on the data presented in Figure 5, the Asian continent has the highest number of published articles on the topic, accounting for an average of 50%. In comparison, Africa and Australia lag with 12% and 8%, respectively. Moreover, 24% of the articles discussed the topic generally or reviewed previous articles without mentioning any specific countries or continents. Finally, the European continent has contributed with only 6% of retrieved primary articles. One explanation for the high number of articles from Asian countries is the increased recognition of the importance of modern technology. This may have led to a tendency among scientific and research communities to publish many articles on the adoption and use of cloud computing in e-government. On the other hand, Europe has adopted modern technology earlier, which may explain the limited number of articles produced by European countries.

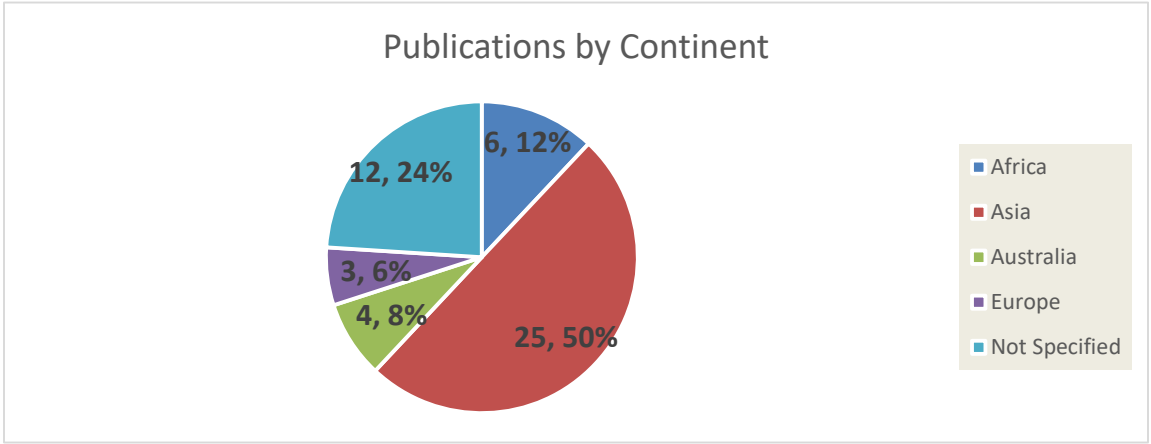


*Figure 5. The Distribution of the Primary Studies by Continent*

## 5. RESULTS RELATED TO THE RESEARCH QUESTIONS

The primary studies included in this SLR were critically assessed to provide insightful answers to the research questions regarding cloud computing adoption in e-government. The research focused on the evidence of cloud adoption, the benefits realized, the challenges encountered, and the factors influencing adoption. Furthermore, the article delved into the theories and models employed in previous studies on the adoption factors and challenges. Investigating the primary studies in this SLR has revealed the following results:

### 5.1 Research on Cloud Adoption in E-government

Previous research indicates that adopting cloud computing is an ongoing process. Many studies offer recommendations to help organizations achieve best practices. This discussion provides government organizations with information on the typical implications of cloud computing and encourages policymakers to consider its significant benefits.

After reviewing the full texts of 50 primary studies included in this SLR, three major classifications were determined. The first type, presenting reviews and exploratory overviews (13/50, 26%), was divided into two subcategories: systematic literature reviews (4/13) and traditional exploratory reviews (9/13). Second, conceptual research (2/50, 4%) which proposed frameworks, models, and architectures without empirical investigation. The largest category (34/50, 68%) consisted of empirical studies offering empirical results based on various theoretical perspectives. Quantitative, qualitative, and mixed studies are classified into subcategories based on research methodology. In addition, a bibliometric study (1/50, 2%) that answered some research questions was included in the SLR.

In the review and general view studies (12/65), cloud computing was viewed from different perspectives in public sectors. Based on the methodology adopted by the authors, these studies were classified into two subcategories. A systematic literature review (4/12) used a rigorous and predefined methodology to extract data on adopting cloud technology in government e-services. A study by [31] outlined benefits, challenges, theories, and models adopted by authors, methodologies, and critical adoption factors that help governments and organizations implement cloud computing. Furthermore, other studies examined cloud computing adoption's technical requirements and implementation opportunities in the public sector [27], [33]. In addition, Assaf et al., (2021) explored the benefits and risks of implementing cloud computing.

Furthermore, the second sub-category (8/12) investigated the adoption of cloud technology from a general overview and presented an exploratory vision of the adoption and implementation of cloud computing in government organizations related to the benefits of cloud in M-government [18]. Investigating the reasons that lead organizations to adopt cloud computing in their critical infrastructure and the impact of adopting cloud on national security [4], [35], the challenges that hinder government organizations to adopt cloud computing in their systems [23] and the readiness of governments to adopt cloud-based records management system [36].

In addition, two studies have established models for the factors that affect cloud adoption in an e-government setting. However, they have not provided any empirical evidence. [37] conducted a study that established a model based on technological factors and trust to explore the impact of cloud adoption on e-government performance. Meanwhile, [38] proposed a cloud-based Android application that would improve e-government services for citizens.

Finally, this SLR comprises empirical studies (34/50) of previous research to investigate cloud adoption by government agencies and the public sector. The studies explored various information systems models and applied theoretical frameworks or well-known theories to assumptions and hypotheses. The literature identifies several subcategories based on the methodology adopted by each study. Studies using the quantitative approach (23 out of 34) were based on a literature review [30], [39]–[42], theories, and information technology models (e.g [1], [10], [12], [17], [25], [43] ). The studies presented hypotheses and provided empirical results using surveys and questionnaires to collect the primary. The second sub-category was the qualitative approach (6/34), in which researchers interviewed participants or conducted case studies to build their results and conclusions [5], [8], [29], [44]–[46]. Moreover, some studies used a mixed-method approach (5/34) to investigate the cloud-critical adoption factors by conducting interviews and testing the results empirically [16], [25], [26], [43], [47].

Furthermore, analyzing the results of this article, three essential themes were identified based on the objectives of the previous primary studies. Firstly, most previous studies have examined the issue of cloud computing utilization in e-government services by looking at the factors that influence its

adoption. This includes the factors investigated from both organizational and individual perspectives. Secondly, studies have examined the benefits of incorporating cloud computing technology into e-government systems and the most prominent challenges organizations may face when adopting cloud-based technologies. Lastly, the effect of adopting cloud computing on e-government efficiency regarding performance, effectiveness, and citizens' satisfaction and active participation in the decision-making process has received the least attention from researchers in previous studies.

Therefore, many primary studies in this SLR utilized quantitative methods to generate results and test theories. However, only a small number of studies employed a mixed method. Furthermore, very few studies focus on developing theories using a qualitative approach. Additionally, prior research has examined the crucial factors for adopting cloud technology within an organization or from an individual perspective. However, there have been limited studies on the relationship between cloud adoption and the outcomes and values of its successful implementation.

### 5.2 The Benefits of Cloud Computing in E-Government Systems

Cloud computing adoption in e-government services can bring numerous benefits to government institutions from various perspectives. As a result, many developing countries have recognized the significance of incorporating modern technology, such as cloud computing, into their government technological systems. This can help provide e-services to citizens and other beneficiaries from various sectors, in line with the remarkable accomplishments of developed countries. Previous studies have revealed numerous benefits of implementing cloud computing in e-government initiatives. By introducing advanced technology elements in government e-services, cloud computing can effectively eliminate obstacles caused by a lack of technological infrastructure. This is especially crucial in countries with inadequate infrastructure, where many e-government projects have failed. Besides reducing expenses and saving financial resources, adopting cloud computing can contribute to long-term savings [48] for government institutions despite the potentially high initial costs.

Moreover, using cloud computing by government services helps enhance the quality of services delivered to citizens, boost the efficiency and effectiveness of e-services, and increase productivity. By incorporating the cloud into their electronic services, organizations can provide flexible services that adjust to the demand for computing services, enhance security and privacy measures, and offer easy and convenient access to services through various user-friendly means and tools for citizens and partners. Furthermore, adopting cloud computing in electronic government allows for data backup, disaster recovery, and protection against emergencies.

Cloud computing has become an essential tool in e-government, helping governments to transform their services and automate their procedures [11], [37]. By adopting cloud computing, government institutions can collaborate and coordinate with one another, providing a shared source of information and resources. This helps streamline government operations and procedures while saving time and money for both service providers and citizens. Overall, cloud computing is critical in facilitating the electronic transformation of government services and supporting citizens and other beneficiaries across various sectors.

Cloud computing enhances citizens' confidence in electronic government services, creating opportunities for citizen participation in government decision-making while promoting transparency and accountability. One of the significant benefits of cloud computing for electronic government services is the ability to establish communication channels between governments and citizens, thanks to its efficiency in handling, processing, and managing vast amounts of data. This enables the provision of services characterized by high availability, as cloud computing seamlessly integrates with electronic systems in state government institutions.

As a result, cloud computing presents a multitude of benefits for e-government services. Both providers and users can gain from integrating cloud technology into e-government systems and services. Cloud computing is pivotal in bolstering the technological infrastructure of government entities, enhancing national economic conditions by cutting costs and aiding digital transformation, promoting citizen involvement and e-participation in decision-making, and enhancing the delivery of e-government services due to its advantageous features. It also ensures transparent and accountable services for citizens and stakeholders. Figure 6 illustrates the key advantages of cloud adoption in e-government services, categorized into cost and operational benefits, service quality, and innovative benefits.

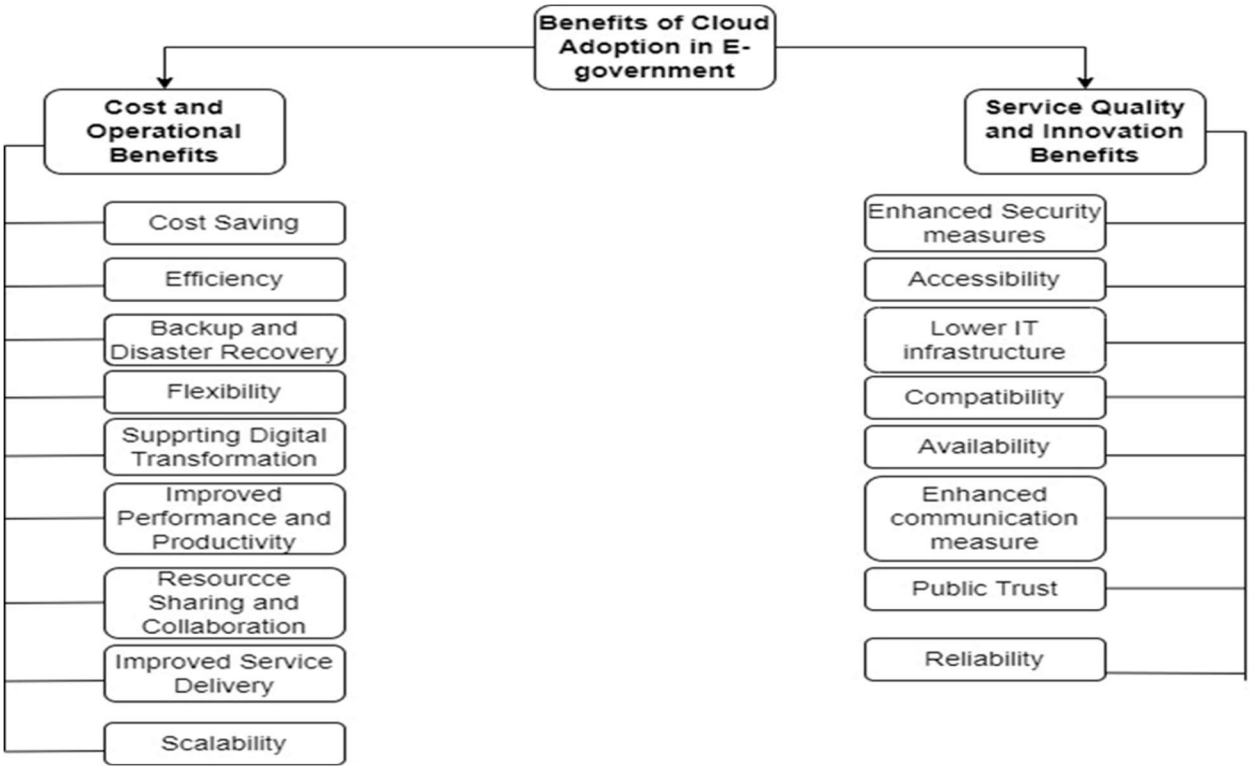


*Figure 6. Benefits of Cloud Adoption in E-government Services*

### 5.3 Challenges Facing the Adoption of Cloud Computing In E-Government Systems

Although cloud adoption offers many benefits to e-government services, many countries still encounter challenges when adopting cloud computing for e-government initiatives (Abied, Ibrahim, Kamal, et al., 2022; Al-Dwairi & Jditawi, 2022; Karim, 2022). Previous studies have identified numerous obstacles hindering policymakers in different countries worldwide from incorporating and utilizing emerging technologies, such as cloud computing, into their e-government systems. The challenges facing the adoption of cloud computing into e-government services can be categorized into several categories. The first category, technical challenges, includes various issues that hinder the decision to adopt cloud computing into e-government services (Abied et al., 2022a). Security is the most significant challenge facing policymakers and users when considering cloud adoption for e-government services. As governments deal with a vast amount of sensitive data belonging to government organizations and their citizens, securing this data is a significant concern for governments, and they put significant effort into preserving it. Therefore, many concerns arise regarding the Internet and virtual data center security. The challenge of adopting cloud technology, known as cloud complexity, is a significant concern for e-government services [26]. While it can be complicated, some researchers suggest governments mitigate this challenge through robust security measures. In addition, data privacy and confidentiality pose a significant technological challenge. Numerous government organizations are hesitant to embrace cloud computing due to privacy concerns. The association of privacy with security is a problem many e-government services encounter when considering cloud adoption. Privacy is a significant obstacle that both government organizations and citizens face in adopting and embracing cloud technology [23], [32]. Another challenge governments face when adopting cloud-based e-government services is the ability of their technological systems to adapt to innovative technologies like cloud computing. Many studies have highlighted compatibility as a significant obstacle in transforming to cloud-based e-

government services (Hadi et al., 2021; Kyriakou et al., 2020). Furthermore, a major technological challenge hindering cloud adoption is reliable internet connectivity. Since cloud computing relies heavily on internet access, weak or unavailable internet connections may deter government organizations in various countries, especially those still developing, from adopting cloud technology [2], [25], [27].

The organizational challenges are the second category of significant obstacles to cloud adoption. In many developing countries, the lack of IT infrastructure challenges implementing cloud-based e-government (Abied et al., 2022b). The excessive costs of installing new infrastructure also impact on the decision to adopt cloud technology. In addition, the reluctance and hesitance of top management to endorse the decision to adopt cloud technology can significantly impact the adoption process [1]. When executives are uninformed about the advantages of cloud adoption or actively oppose change within their organization, this can create a significant obstacle that may slow down or even prevent adoption altogether.

Moreover, governments face a challenge in implementing cloud technology for e-government services due to a lack of policies and regulations [9]. Such policies and regulations are crucial to govern the relationship between governments and cloud service providers [46]. They prevent data misuse, control data loss, and ensure service level agreements regulate the adoption process. Failure to meet citizens' and stakeholders' expectations and demands and external pressure can hinder the adoption decision in countries aiming to deploy cloud computing into their e-government systems [16]. Hence, policymakers must consider environmental challenges to utilize cloud-based e-government services without fear of failure successfully [43].

Certain human factors can hinder the adoption of cloud computing in e-government initiatives across various countries globally. These factors include cultural norms, attitudes, citizens' trust in government and the internet, computer self-efficacy, lack of cloud technology awareness, and resistance to change among government employees and citizens. These challenges are particularly prominent in developing countries and are considered significant hindrances to adopting cloud computing in e-government and public sector e-services [7].

Overall, governments have various challenges to consider before adopting innovative technologies for their e-government and public sector e-services. These challenges include technological, organizational, environmental, and human factors. Governments must address these challenges to identify any potential failures at an early stage when implementing cloud computing. Figure 7 identifies the challenges facing cloud adoption in e-government services.

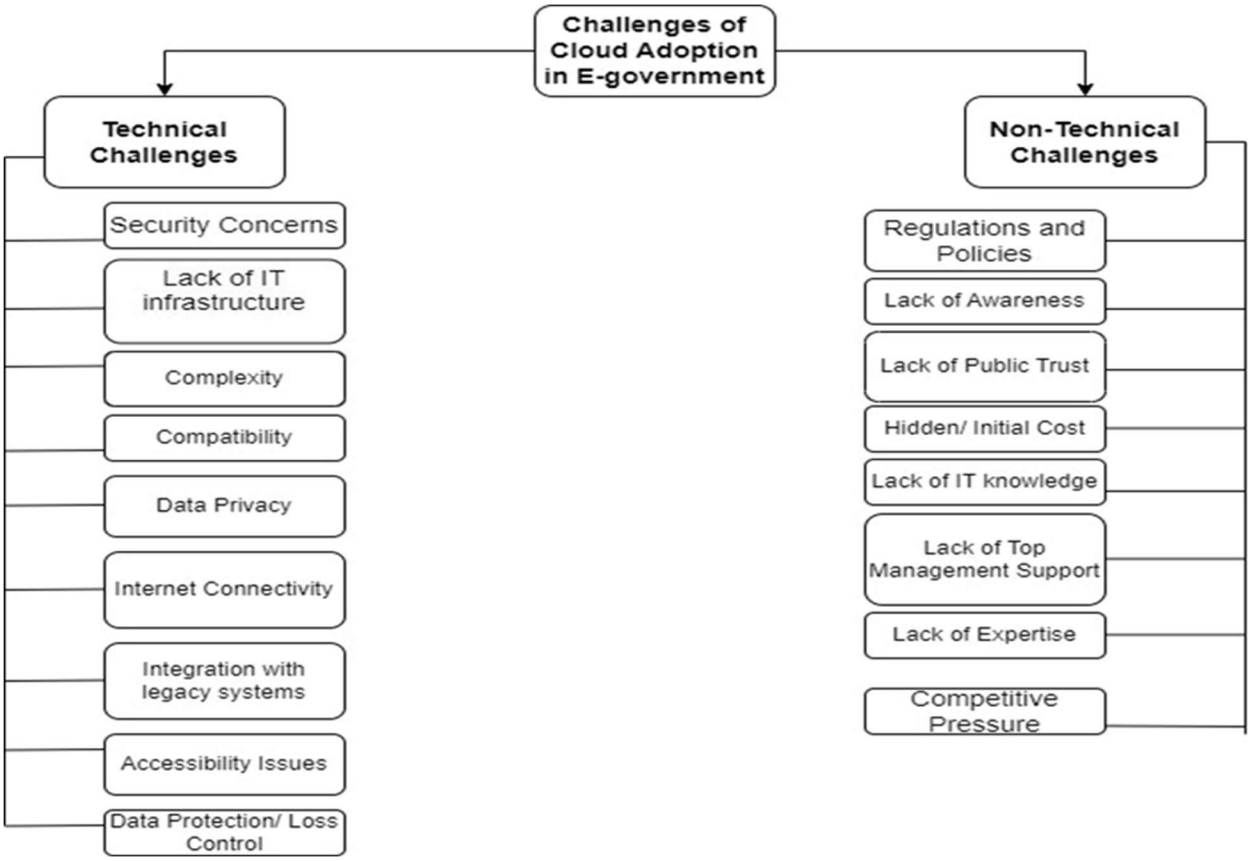


*Figure 7. The Challenges Facing Cloud Adoption in E-Government Services.*

### 5.4 The Theories Utilized in Cloud Adoption Studies

Two main theories have been distinguished after analyzing previous studies on cloud adoption in e-government services. The first type examines how organizational factors impact the decision to accept and adopt cloud computing. The second type looks at individual motivations for adopting cloud computing, whether from the supply or demand side. Thus, the included primary studies are categorized based on their focus, either on organizational or individual-level theories.

Table ***3*** displays prevalent theories and models used in primary studies on both organizational and individual levels.

Previous studies have implemented different theories based on the data presented in

Table ***3***, including organizational and individual perspectives. However, most studies have focused on investigating critical adoption factors from an organizational perspective, with few studies examining adoption decisions from an individual perspective. The most favored theory from an organizational perspective is the technology-organizational-environmental (TOE) framework [10], [28], [51], [52]. Additionally, the framework (TOE) has been combined with other theories to gain a more thorough and complete comprehension of government decisions' critical influence on adopting cloud computing for their e-government and public sector e-services. It has been combined with the diffusion of innovation theory (DOI) [1], [53], with DOI and HOT-Fit (Hadi et al., 2021), with DOI and desired framework [19], with Trust factor theory (TFT) and innovation theory (INT) by (Liang et al., 2021), and with (DOI) and information success model (IS) [3].

*Table 3. The Theories Used in the Primary Previous Studies.*

| Category | Theory/Model | Source |
|---|---|---|
| Organizational Level | TOE + DOI | [1], [53] |
| | TOE | [10], [28], [51], [52] |
| | TOE + DOI + HOT-fit | [24] |
| | TOE + DOI + Desire Framework | [19] |
| | TOGAF + ADM | [46] |
| | TOE+ TFT+ INT | [54] |
| | Transformation Theory | [5] |
| | TOE + DOI + IS model | [3] |
| | Institutional theory | [29] |
| | Transaction Cost Theory | [45] |
| | DOI | [50] |
| | DOI + RBV | [55] |
| Individual Level | TAM | [11] |
| | UTAUT | [6], [9] |
| | UMEGA | [7] |
| | UTAUT+ TRI | [56] |
| | SERVQUAL | [57] |

Apart from using the TOE framework, few studies used other management theories like institutional theory, transactional cost theory, and transformation theory.

Likewise, from individual-level studies, two studies have utilized the unified theory of acceptance and
use of technology (UTAUT) as the theoretical base. However, the technology acceptance model (TAM), UMEGA, and SERVQUAL have been implemented once each, as indicated in
Table ***3***.

### 5.5 The Key Factors Influencing the Adoption of Cloud Computing in E-Government Systems

The fifth research question was answered by examining empirical studies conducted at both the organizational and individual levels, as suggested by [58], [59]. Each primary study delved into the critical factors that influence the adoption of cloud computing in e-government, and the public sector was included in the analysis. The data collected from these studies was analyzed using the method outlined by [59] and organized according to the source, purpose, methodology, theory/model employed, dependent and independent variables, and implementation level as the key findings from each study. The criteria were applied separately to both individual and organizational-level studies. Table 4 and Table 5 show individual and organizational factors and constructs that have been investigated in the previous studies respectively

To classify the factors for both organizational and individual levels, some steps have been conducted as the following:

1- Each independent variable was extracted from each research and logged as mentioned by the study and the author.
2- The variables were thoroughly re-evaluated to define and identify the variables having the same conceptual meaning with different names, as utilized by various authors.
3- After deleting duplicate variables, the remaining variables were sorted and grouped according to their dominant aspect themes according to their common characteristics.

According to the criteria mentioned above and the methods used by [58], [59], the factors from the individuals-based level studies were divided into three themes, as listed in Table 4. Similarly, the factors influencing cloud adoption from organizational-based level studies were grouped into six main themes, as shown in Table 5.

Overall, the analysis of prior studies indicated that most research focused on organizational factors; however, a limited number focused on individual factors. Institutions often implement innovative technology to keep pace with advancements, improve efficiency, and increase productivity.

However, studying the adoption of cloud computing from an individual's perspective is just as crucial as studying it from an organizational viewpoint. Technological advancements often lead to cultural and social changes that impact on the institutions, the people working in them, and those who use their services. Hence, the significance of such studies lies in understanding the impact on individuals and organizations.

*Table 4 Cloud adoption factors from individual-level studies*

| Factor | Construct | Authors of the study |
|---|---|---|
| **Technological** | Security | [6], [9], [11], [16], [30], [39], [56], [57]. |
| | Performance Expectancy (PE) | [6], [7], [9], [11], [56]. |
| | Effort Expectancy | [6], [7], [9], [11], [56]. |
| | Mobility | [6], [56] |
| | Compatibility | [6], [56] |
| | Availability | [9], [16]. |
| | Privacy | [11], [16]. |
| | Reliability | [57]. |
| | Service quality | [16], [42], [57]. |
| **Human** | Awareness | [6], [16], [56]. |
| | Trust | [7], [30], [42]. |
| | IT knowledge | (Amron et al., 2021, 2022 |
| | Attitude/Perceived risk/ Computer self-efficacy | [7]. |
| | Top management support (TMS) | [6], [56]. |
| **Socio-economics** | Social/External influence | [6], [9], [11], [56]. |
| | Service price | [39], [42]. |

The importance of individual perspectives lies in any technological advancement bringing about changes in cultural and social contexts. Introducing emerging technologies causes significant changes in an organization's culture and environment, affecting human resources' behavior and attitudes. Hence, most individuals resist change when faced with unfamiliar patterns in their usual behavior. Research has revealed that technological changes alone cannot ensure an organization's success and performance if users do not accept and use the technology [7], [56]. Therefore, the attitudes and perceptions of users, which shape their behavior towards adopting emerging technologies, are just as vital as the technological aspects within the organization.

*Table 5. Cloud Adoption Factors from Organizational-level Studies*

| Factor | Construct | Authors of the study |
|---|---|---|
| **Innovative** | Relative advantage (RA) | [1], [3], [24], [25], [28], [50], [52], [53], [60] |
| | Complexity | [1], [17], [19], [24]–[26], [28], [50], [60] |
| | Compatibility | [1], [3], [17], [19], [24], [25], [28], [50], [52], [60] |
| **Technological** | Security | [1], [3], [60], [17], [24], [28], [43], [44], [47], [50], [52] |
| | Privacy | [5], [24], [25], [28], [43] |
| | Availability | [17], [28] |
| | Flexibility | [5], [43] |
| | Perceived ease of use (PEU) | [25], [52] |
| | Interoperability | [26] |
| | Perceived Risks | [3], [54] |
| | Backup and disaster recovery | [10], [28] |
| **Organizational** | Top management support (TMS) | [1], [3], [17], [19], [25], [28], [49], [52], [60] |
| | Technology readiness | [1], [25], [52], [53], [55] |
| | Organizational readiness | [3], [54], [61] |
| | IT Infrastructure | [26], [28] |
| **Environmental** | Government regulations | [44], [53], [21], [25], [27]–[29], [34], [37], [43] |
| | CP | [1], [28], [43] |
| **Human** | IT/Cloud knowledge | [19], [28], [44], [49], [55], [60] |
| | Trust | [1], [25], [44], [52]–[54] |
| | Awareness | [1], [43] |
| | Attitude | [1] |
| **Benefits** | Cost | [10], [19], [28], [43], [52], [53], [60] |
| | Perceived/ Anticipated benefits | [19], [54] |

Behavioral factors are crucial for emerging technologies, such as cloud-based e-government services, to be accepted and utilized [11]. This will ensure that such technologies persist sustainably and continue to be used [57]. Furthermore, users' satisfaction plays a significant role in accepting and adopting innovative technologies, like cloud-based e-government services. Therefore, examining the adoption of cloud computing from a user-centric perspective is essential to determine the adoption factors from an individual level point of view [16], [42].

## 6. DISCUSSION

This systematic review's main purpose is to examine cloud computing in e-government and public sector e-services. The study aims to provide an overview of the current state of research in this area, highlighting the benefits of cloud adoption and the main challenges, theories, and factors investigated in previous studies.

This review identified 50 articles published from 2020 to the end of January 2023, which were relevant to this study. The findings indicate that there has been a significant increase in the number of publications focused on the adoption of cloud technology in e-government services, particularly after the COVID-19 outbreak. This increase is in contrast to the SLR by [31], which identified fewer articles before the outbreak.

In response to the pandemic, many countries worldwide have turned to technology to mitigate its impact and ensure the continuity of daily life activities for citizens and businesses [10]. According to this review, Asia produced the highest number of publications during the pandemic compared to other continents. It is important to note that Europe had already recognized the significance of innovative technology in the public sector before the pandemic, while Asia was slower to acknowledge it. However, African countries are still facing economic and IT infrastructure challenges, which are hindering successful cloud adoption.

Many developing countries are showing increasing interest in adopting cloud technology for e-government services. Previous studies have

highlighted the need for further investigation in this area, especially in Asian and African nations. Therefore, the findings of this study could aid policymakers and practitioners in comprehending the benefits of cloud technology adoption and offering theoretical solutions to overcome any challenges associated with its implementation. Additionally, the review provides recommendations for future research on unexplored areas of interest based on the current cloud adoption issues in e-government and public sector e-services.

Cloud computing provides numerous benefits for e-government, as highlighted by this Systematic Review analysis. The study reveals two categories of benefits that cloud adoption offers in e-government and the public sector in general. The first category is cost and operational, including cost savings, digital transformation, improved service delivery, increased efficiency, resource sharing, backup and disaster recovery, and overall government performance and productivity. The second category is service quality and innovation benefits. It includes enhanced security measures, minimized IT infrastructure assets, the establishment of public trust, improved communication channels, and reliable access to e-government services. These benefits are essential for establishing trust and providing efficient e-government services while reducing costs.

Although there is a considerable amount of literature on the benefits of cloud computing adoption in e-government services, more research is still needed to understand the relationship between service quality and cloud adoption. Therefore, future research could examine how adopting cloud computing can impact the quality of service provided by e-government initiatives from the perspective of citizens, as they are the primary target of e-government services. It is important to investigate the valuable outcomes related to the cloud-based e-government context, such as users' intention to use, satisfaction, public trust, citizens' engagement, and expectations, from a citizen-centric perspective. Moreover, little research has been conducted on the impact of cloud adoption on government organizations' performance and outcome benefits. Thus, the influence of cloud adoption on government organizations' performance requires more research, specifically on the efficiency, effectiveness, and productivity of e-government services.

While previous research has highlighted the benefits of cloud adoption, many challenges still need to be addressed before making an adoption decision. This study has identified two main categories of challenges. The first category is technical challenges that are related to technology itself. In contrast, the second category is non-technical challenges related to the surrounding environment and human factors. These challenges must be considered before deciding on cloud adoption.

Technical challenges include security and privacy concerns, inadequate IT infrastructure, integration with legacy systems, internet connectivity, and data management. On the other hand, non-technical challenges revolve around government regulations, high initial costs, inadequate top management support, limited IT knowledge, insufficient public trust, and lack of awareness. However, despite the results identified in this study on cloud adoption challenges, further investigation is needed into challenges related to cloud-based e-government services, including security, privacy, complexity, government regulations, and human factors, from citizens' point of view.

Moreover, this SLR has analyzed the theories and models used by previous studies to identify the most critical factors for adopting cloud computing in e-government and public sector e-services. The results revealed that two types of studies have been conducted to identify these factors: organizational and individual level studies. Organizational-level studies explored the critical factors from an organizational point of view, focusing on the external and internal factors within the organization. Different theories, such as the TOE framework, defined and identified the critical factors. The TOE framework investigates the factors from technological, organizational, and environmental perspectives. However, other theories, such as diffusion of innovation (DOI), institutional theory, and transformation theory, have received less attention in previous primary studies. According to [31], some researchers considered DOI factors as part of the technological constructs in TOE. This explains why the TOE framework is the most prominent theory for investigating the diffusion of innovations at the organizational level.
On the other hand, The UTAUT model has been used in many studies to identify principal factors that influence individuals' decisions to adopt innovative technologies. This model provides a comprehensive overview of several factors, such as technological characteristics, facilitating conditions, and social influence that impact the adoption of innovative technologies. In comparison, other well-known technology acceptance models, such as TAM, UMEGA, and the Delone and McLean Information Systems Success Model, have been applied in fewer studies. Factors such as perceived usefulness,

perceived ease of use, attitude, intention to adopt/use, satisfaction, and intention to continue use are crucial for the success and sustainability of cloud-based e-government services. However, limited research has been conducted on these factors from individual perspectives in the context of cloud adoption in e-government services [6], [9], [11], as compared to traditional e-government services. Therefore, more research is necessary to determine the most significant factors from the perspectives of individuals, whether government employees or citizens, using these theories and models.

This study has some limitations. The primary studies reviewed were obtained from seven scholarly databases that focused on peer-reviewed articles and conference proceedings. Future research can expand upon this by searching for more databases and various publications, such as book chapters and organizational reports, to expand knowledge on cloud computing adoption. Additionally, using more inclusive keyword strings can help collect more data. Moreover, adopting innovative technologies is an ongoing process; it is possible that other studies have addressed some of the identified research gaps while conducting this study.

## 7. IMPLICATIONS

### 7.1 Practical Implications

This study provides several practical implications for policymakers, government managers, and e-government service providers. First, it highlights the importance of cloud computing adoption in improving the efficiency, service quality, and cost-effectiveness of public sector operations. Policymakers should prioritize fostering the necessary infrastructure and regulatory frameworks to address security, privacy concerns, and IT infrastructure gaps, particularly in developing countries and regions with low technological readiness. Governments can enhance public trust by ensuring robust data protection mechanisms and transparency in cloud computing policies.

Moreover, as the adoption of cloud computing in e-government services continues to grow, it is critical for policymakers and managers to pay attention to both the technical and non-technical barriers. Addressing challenges such as integration with legacy systems, insufficient top management support, and public awareness can ease the transition to cloud computing. Government agencies should also focus on promoting the benefits of cloud computing among employees and citizens, fostering a culture of innovation, and ensuring that employees have the skills to effectively manage cloud-based systems.

Finally, the practical implications also extend to the need for governments to adopt a citizen-centric approach in their cloud computing adoption strategies. Understanding the needs and expectations of citizens, as well as evaluating the impacts of cloud adoption on user satisfaction and service delivery, can help ensure that cloud-based services align with the goals of public sector efficiency and service excellence.

### 7.2 Theoretical Implications

From a theoretical standpoint, this study contributes to the body of knowledge on cloud adoption by identifying key factors and challenges that shape the adoption process in e-government services. The study expands on existing adoption models, particularly the Technology-Organization-Environment (TOE) framework, by incorporating both technological and organizational factors, and by emphasizing the need for a broader understanding of individual-level factors through theories like the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT).

The findings suggest that further theoretical exploration is necessary to develop an integrated model that accounts for both organizational and individual-level factors in cloud adoption. Future studies could enhance the existing models by incorporating a more comprehensive view of factors such as user attitudes, perceived ease of use, and perceived usefulness, which influence the adoption of cloud computing at the individual level, including both government employees and citizens.

Additionally, the review highlights the need for more research that explores the interplay between different theories and models. The limited application of theories such as Diffusion of Innovation (DOI), institutional theory, and transformation theory in the context of cloud adoption within the public sector offers opportunities for future research to integrate these frameworks into a unified theoretical approach. This theoretical integration could provide a deeper understanding of the factors influencing cloud adoption and how they affect public sector decision-making, service quality, and performance outcomes.

Moreover, future studies could consider the role of moderating and mediating factors in cloud adoption, particularly in examining how environmental, organizational, and individual factors interact. By addressing these gaps, future research can enrich the theoretical foundation of cloud adoption in e-government services, ultimately

offering new insights for both academic and practice.

## 8. CONCLUSION

This systematic literature review highlights the increasing attention given to cloud adoption in e-government systems, particularly in developing countries, as evidenced by the growing number of publications post-COVID-19. The studies analyzed show a diverse range of research methodologies, including quantitative, qualitative, and mixed-method approaches, underscoring the contemporary relevance and focus of this topic. The review examined both the benefits and challenges associated with cloud adoption, categorizing the benefits into cost and operational advantages, as well as service quality and innovation. Conversely, the challenges were divided into technical concerns, such as security, data privacy, and IT infrastructure, and non-technical issues, including the lack of regulations and human behavioral factors. Furthermore, the study identified the key theories and critical factors influencing cloud adoption, which were classified across organizational, technological, environmental, individual, and financial contexts. These findings provide a comprehensive overview of the current landscape of cloud adoption in e-government systems and offer valuable insights for future research and policy development in this area.

## 9. LIMITATIONS AND FUTURE WORK RECOMMENDATIONS

This SLR identified several limitations in the current body of research on cloud adoption in e-government services. One of the primary limitations is the lack of sufficient focus on the benefits of cloud adoption, with many studies primarily concentrating on the challenges, particularly security and privacy issues. The absence of research on post-adoption benefits, such as increased productivity, improved service quality, enhanced efficiency, and cost-effectiveness, presents a gap that needs to be addressed. Additionally, while studies have explored the technological and organizational challenges of cloud adoption, critical factors like integration with legacy systems, interoperability, reliability, and availability have not been adequately examined. These aspects are essential for a deeper understanding of the adoption process and will help improve cloud adoption strategies, particularly in developing countries with less advanced IT infrastructure.

Another limitation identified in the SLR is the insufficient investigation into the relationship between cloud adoption and service quality from a citizen-centric perspective. Future research should explore how users' acceptance and satisfaction with cloud-based e-government services influence adoption decisions. The lack of individual-level research on cloud adoption is also a critical gap, as most studies have focused on organizational factors. Further research should examine the characteristics that motivate individuals to adopt cloud computing in e-government services and explore the differences in productivity and performance between adopters and non-adopters through comparative studies.

Moreover, the SLR highlighted a gap in examining the indirect effects of moderating and mediating factors on the relationship between influential factors and cloud adoption decisions. Research into the indirect effects from both organizational and individual perspectives would provide a clearer understanding of the adoption process and help overcome obstacles related to cloud adoption in e-government services. While most studies focused on technological, organizational, and environmental factors, other crucial factors such as human, value, and benefits aspects remain underexplored and should be examined in future studies.

Methodologically, this SLR suggests the need for more empirical studies utilizing qualitative and mixed methods. Most reviewed studies employed quantitative approaches, which may not capture the nuanced perspectives and deeper insights required to understand the adoption process comprehensively. Future research should incorporate qualitative and mixed-method approaches to explore the complexities of cloud adoption in e-government services more effectively. Finally, the review identified a need for further theoretical exploration to better understand critical adoption factors. While several management theories, such as institutional theory, transformation theory, and transaction cost theory, have been applied, more theories should be investigated to gain a holistic view of cloud adoption in the public sector. Theoretical development in this area is crucial for expanding the theoretical foundations of cloud computing adoption and advancing both the academic and practical understanding of the subject.

In conclusion, while the body of research on cloud adoption in e-government services has grown, significant gaps remain. Future studies should address the limitations identified in this review and explore new dimensions of cloud adoption, particularly in developing countries, to enhance the effectiveness and sustainability of e-government services.

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