

# Modeling Cloud Computing Adoption and its Impact on the Performance of IT Personnel in the Public Sector

Noorbaiti Mahusin<sup>1</sup>, Hasimi Sallehudin<sup>2</sup>, Nurhizam Safie Mohd Satar<sup>3</sup>,  
Azana Hafizah Mohd Aman<sup>4</sup>, Farashazillah Yahya<sup>5</sup>

Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia, Malaysia<sup>1, 2, 3, 4</sup>  
Faculty of Computing and Informatics, Universiti Malaysia Sabah, Malaysia<sup>5</sup>

**Abstract**—This study investigates the factors influencing cloud computing adoption in the public sector, emphasizing the performance of IT personnel. Through qualitative interviews with five IT management professionals in the public sector, we identify key challenges in integrating cloud computing systems. The primary issues include technical complexity, skill and knowledge deficits in data governance and budget constraints. These insights inform the development of the Cloud Computing Capacity and Integration Model for the Public Sector, which proposes a comprehensive strategy to address these barriers. Our findings identified five key challenges to cloud computing adoption in the public sector. First, compatibility issues and system integration challenges resulting from conflicts between cloud platforms and older infrastructure contributed to operational inefficiency. Second, data migration issues due to incompatible formats and structures resulted in data loss and delays. Third, network constraints, such as limited bandwidth and high latency, hampered cloud service performance. Finally, a lack of staff training and budget constraints hampered successful cloud integration, emphasizing the importance of focused capacity-building initiatives and additional financial support. Thus, the "Cloud Computing Integration and Cloud Computing Acceptance and Performance Model" (CCAPM) presented in this research paper aims to deliver a comprehensive model that tackles a wide array of technical, operational, and human resource challenges to create an effective cloud computing ecosystem, enhance the adoption of cloud computing within the public sector, elevate the capabilities of public sector IT personnel, and develop a secure, resilient, and sustainable cloud computing environment in the public sector.

**Keywords**—Cloud computing; cloud integration model introduction; performance of IT personnel; public sector; system integration

## I. INTRODUCTION

Cloud computing has emerged as one of the most influential and potential technologies in the modern IT world. The study in [1] highlight cloud computing's emergence as a powerful force in contemporary IT, offering on-demand services for computation, storage, and applications. This technology offers a variety of advantages including the ability to reduce costs, increase operational flexibility, and increase the scale and efficiency of IT services. The study in [2] point out that cloud computing delivers significant cost advantages. Organizations can leverage virtualization and cloud

infrastructure to pay only for what they use, eliminating the upfront costs associated with traditional IT investments. This translates to increased operational flexibility and improved scalability and efficiency of IT services. In the context of the public sector, the application of cloud computing is seen as a strategic step capable of bringing digital transformation to government services. The research in [3] argues that cloud computing adoption is a strategic move for the public sector, enabling them to deliver government services with greater efficiency and agility. However, there are various challenges and obstacles that public institutions have to face in the process of adoption and integration of cloud computing. According to study [4], public institutions face several hurdles when adopting and integrating cloud computing solutions. These challenges include security risks, network connectivity issues, cost and budget constraints, policy formulation, skills availability, and infrastructure readiness. This study will focus on two main problems: the complexity of integrating cloud computing systems with existing infrastructure and the lack of knowledge and skills in data governance.

The complexity in the integration of cloud computing systems with existing infrastructure in public institutions is one of the main challenges in the application of this technology. The study in [3] highlights the complex integration of cloud computing systems with existing public institution infrastructure as a significant challenge. The existing IT infrastructure in most public institutions may not be designed to support cloud technology, making the integration process complex and requiring significant changes. Integrating cloud technology into existing IT infrastructure in public institutions can indeed be complex due to various challenges highlighted in the research papers. The study in [5] identify security concerns, data leakage, and legal implications as key hurdles to cloud computing adoption in government organizations. This includes changes in IT architecture, software customization, and data restructuring. The study in [6] advocates for software restructuring, which entails modifications to IT architecture, software customization, and data restructuring to enhance software system performance and efficiency. The cost of integrating cloud computing can also be very high, especially if it requires the purchase of new equipment or major upgrades to existing infrastructure. Additionally, [7] said that supporting a large number of users in the cloud can necessitate increased network bandwidth, which

translates to higher expenses for both the service provider and potentially the customer.

In addition, the lack of knowledge and skills in data governance is also a big obstacle. Cloud computing requires a high level of understanding of data management, security, and compliance with relevant regulations. As the study [8] emphasizes, cloud computing necessitates a deep understanding of data management, security, and regulatory compliance. This ensures the integrity and protection of sensitive information entrusted to the cloud, mitigating the risk of breaches and unauthorized access. According to study [9], inadequate data and storage security can trigger a domino effect of negative consequences. These include data security breaches, non-compliance with regulations, and difficulties managing technological advancements. In the public sector context, a lack of training and professional development for IT personnel can result in slow and ineffective adoption of cloud computing technology. Building on the work of [10], a lack of awareness and training among IT staff emerges as a critical barrier to public sector information technology adoption. This highlights the importance of well-designed training programs to address these challenges and facilitate successful IT implementation.

This study attempts to achieve two main objectives regarding cloud computing adoption in public sector. It aims to establish the details behind the complexity of cloud computing systems integration with existing infrastructure, with special emphasis on technical, financial and organizational challenges and their correlation with the decision to accept or reject cloud technology. Secondly, this research intends to evaluate the impact of knowledge and skill gaps in data governance on cloud adoption of IT personnel. It will evaluate their knowledge and understanding of data governance principles and best practices, as well as the effectiveness of existing training and development efforts in strengthening their skills and competencies.

This study has great importance in the context of technology development and digital transformation in the public sector. The study in [11] research underscores the critical role of technological advancements and digital transformation in the public sector. These studies shed light on the multifaceted nature of digital transformation, emphasizing the need for a holistic approach that extends beyond mere technological innovation. According to study [12], several factors significantly contribute to IT project complexity. These factors include the involvement of diverse stakeholders, the implementation of new technologies, the presence of conflicting goals, and the ambiguity of project objectives. In addition, by analyzing the lack of knowledge and skills in data governance, this study can help in designing more effective training and professional development programs to increase the level of readiness of IT personnel to accept cloud computing technology. The study in [13] posit that analyzing IT personnel's data governance knowledge and skill gaps can be instrumental in designing targeted training programs. These programs would enhance their preparedness for adopting cloud computing expertise.

#### Interests and Contributions

This article has great importance in various aspects, especially to the government, community, industry, and the

development of science. Specifically, this study seeks to contribute significantly in the following ways:

First of all, this study provides an important contribution to the government in the context of the digital transformation of the public sector. However, the study in [14] integrating these systems presents complexities that require a thorough understanding to develop effective policies and strategies. This will not only increase operational efficiency but also reduce costs and improve the effectiveness of services to the public. The study in [15] explored how cloud computing integration enhances operational efficiency, reduces costs, and improves public service delivery which requires consulting key references for a comprehensive understanding.

Second, in terms of the community, this study will have a positive impact by strengthening the ability of public institutions to provide better services to the community. Wider use of cloud computing technology can open up new opportunities for innovation and development of applications that benefit local communities. According to study [16], cloud computing is an IT service model that delivers computing resources, including hardware and software, on-demand. This means they are readily available to users whenever needed, regardless of their device or location.

Third, from an industry perspective, this article provides valuable insight to decision-makers and IT managers in providing more appropriate infrastructure and facilitating the integration of cloud computing technology in the private sector. The study in [17] discuss the significant cost benefits of cloud computing, highlighting its ability to minimize IT infrastructure costs, ease deployment of new products, and reduce maintenance costs.

Finally, in terms of knowledge, this article will contribute to the existing literature by providing a deeper understanding of the challenges of cloud computing integration and deficiencies in data governance in public institutions. Cordella and Paletti's exploration of public value delivery complexities in public agencies sheds light on the challenges of effective governance and value creation. Understanding these intricacies is key to comprehending the obstacles public institutions face when integrating cloud computing and addressing data governance deficiencies [18]. This will provide a foundation for further research and strengthen the knowledge base in the field of information technology and management in Malaysia.

Overall, this article not only provides an in-depth analysis of the issues faced by public institutions in accepting cloud computing technology but also provides valuable guidance for policy preparation, community development, industry improvement, and the development of science in our country [19]. This study has a limited scope which allows a clear focus on specific and relevant issues to IT personnel without extending the study to aspects that may differ in the context of other grades in the public sector. [20], in their guidance from the JBI Scoping Review Methodology Group, advocate for engaging knowledge users in scoping reviews. This emphasis stems from the value stakeholders bring to the process, ensuring the research findings are relevant and applicable. Besides, [21] emphasizes the challenges associated with technology integration, particularly the complexities arising from merging diverse data types and

sources, as evidenced by a survey on data integration problems. Thus, this study aims to identify and analyze these factors in the hope of providing useful guidance to improve the adoption process of cloud computing in the public sector. Through this study, public institutions can be more prepared and competitive in the era of digital transformation.

## II. LITERATURE REVIEW

### A. Current State of Cloud Computing Adoption

Cloud computing revolutionizes IT by offering cost-effective, scalable solutions that streamline government operations and improve service delivery. Studies by [22] support this, highlighting cost reduction and enhanced services as key benefits [23]. However, challenges like integration complexity and a skilled workforce gap need to be addressed for successful implementation.

### B. Recent Studies and Theories

Cloud adoption in the public sector is a double-edged sword, according to recent research by [24] and [25]. While it offers potential benefits, there are significant challenges to overcome. Data security, regulatory compliance, and integrating cloud computing with existing infrastructure are all major hurdles [21][3]. Notably, the complexity of this integration remains a critical barrier to wider adoption.

### C. Contrasting Views

Cloud computing's impact on the public sector sparks debate. Research by [26] highlights its potential for increased flexibility and cost savings [2]. However, [27] point to initial investment costs and integration hurdles [7]. This suggests the actual value of cloud computing depends on each organization's preparedness and existing infrastructure.

### D. Identified Gaps

A notable gap in the literature is the specific challenges faced by IT personnel in the Malaysian public sector. While there is a wealth of general information on cloud computing adoption, few studies focus on the detailed impacts on IT personnel's performance and the specific barriers they encounter. This study aims to fill this gap by providing an in-depth analysis of these factors, focusing on the Malaysian public sector context [21].

### E. Literature Gap Addressed by the Study

This study tackles a critical gap by zeroing in on the twin challenges of complex system integration and the public sector's data governance skills shortage. According to study [28], the implementation of data integration in the public sector faces four main challenges: the lack of management support, policy standards and politics, the inability of human resources and the lack of governance. By delving into these areas, the research sheds light on how these factors significantly impact cloud adoption. The factors influencing cloud adoption are relative advantage, service quality, risk management, top management support, facilitating conditions, influence on cloud providers, server location and computer self-efficacy [29]. Furthermore, it offers practical solutions to overcome these barriers, paving the way for smoother cloud implementation.

### F. Introduction of Theoretical Framework

To strengthen the study's foundation, the well-established Technology Acceptance Model (TAM) is incorporated into the research framework. Developed by [30], TAM sheds light on how users within organizations perceive and adopt new technologies. This model emphasizes two key factors: perceived usefulness and perceived ease of use. By integrating TAM, the study aims to provide a more comprehensive understanding of cloud adoption in the public sector.

### G. Relevance of TAM

The TAM proves particularly valuable to this study. Perceived availability acts as a significant predictor of user perception and system/service quality, significantly influencing the adoption of sustainable cloud computing solutions [30]. TAM's core focus aligns perfectly: it delves into how IT personnel in the public sector perceive cloud computing, specifically the factors influencing their acceptance and use of this technology. By leveraging TAM, the research gains a structured framework to analyze the key drivers of cloud adoption in this context. TAM provides empirical evidence supporting the positive inclination of end users toward cloud computing adoption [31].

### H. Application of TAM in the Study

This study leverages TAM to explore key hypotheses. It predicts that the perceived ease of use will be negatively impacted by the complexity of integrating cloud computing with existing infrastructure. According to study [32], cloud computing adoption and utilization determinants encompass perceived ease of use, compatibility, security, technological readiness, organizational size, competitive pressures, trialability, cost-efficiency, and individual innovativeness. Conversely, the perceived usefulness is expected to rise with the improvement in IT personnel's performance driven by cloud adoption. Perceived availability emerges as a critical determinant of users' perceived utility and system/service quality, thereby influencing the adoption of sustainable cloud computing solutions [30]. By examining these relationships through TAM's structured framework, the study offers a systematic analysis of factors influencing cloud adoption in the public sector.

### I. Strengthening Academic Rigor

This study's integration of the TAM bolsters its academic credibility in several ways. TAM serves as a robust theoretical foundation, allowing for the development of well-defined hypotheses. TAM constitutes a theoretical framework for evaluating technology adoption within organizational contexts, a critical component of successful digital transformation initiatives [33]. Furthermore, it acts as a roadmap for data collection and analysis, guaranteeing that the research findings are firmly anchored in established theoretical concepts.

### J. Methodology Supported by Theoretical Framework

To understand IT personnel's perspectives on cloud computing adoption in the Malaysian public sector, this study utilizes qualitative interviews guided by the TAM. These in-depth discussions will explore perceived challenges, benefits, and the impact on IT staff performance—all key areas influencing TAM's core constructs. By analyzing the collected

data, the research aims to test TAM-derived hypotheses and shed light on the model's practical application within this specific context. This will offer valuable insights into the factors driving or hindering cloud adoption in the Malaysian public sector.

### III. RESEARCH METHODOLOGY

#### A. Qualitative Research Methods

This study delves into the factors influencing cloud adoption and its impact on public sector IT personnel performance through qualitative research methods. These methods are ideal for exploring complex issues in depth, as they allow researchers to capture the nuanced perspectives and lived experiences of individuals. This approach provides a richer understanding of the human element within cloud adoption in the public sector.

#### B. Nature of Qualitative Research

Qualitative research serves as a launchpad for deeper understanding. According to study [34], qualitative research is characterized by its naturalistic, contextualized, and interpretive nature, prioritizing the exploration of processes and developmental patterns over the delineation of definitive products or outcomes. Unlike quantitative methods that focus on numbers and broad generalizations, qualitative research delves into the 'why' behind human experiences. Qualitative research employs methodologies such as interviews, focus groups, and observation to delve into the underlying motivations and experiences that shape human behavior [35]. Through interviews, observations, and document analysis, it gathers rich, non-numerical data like words and meanings. This approach helps us uncover motivations, opinions, and underlying reasons, laying the groundwork for future studies and potentially informing quantitative research with well-defined hypotheses.

#### C. Suitability for the Study

1) Unpacking the intricacies of cloud adoption within the public sector demands a research approach that goes beyond the surface. Qualitative methods rise to this challenge. Qualitative research employs methodologies such as interviews, focus groups, and observation to investigate participants' perspectives and lived experiences, typically involving smaller sample sizes and iterative data collection until theoretical saturation is achieved [35]. By enabling in-depth exploration of IT personnel's perceptions and the factors influencing adoption and performance, qualitative research offers a nuanced understanding often missed by quantitative approaches. This rich data provides valuable insights that can guide successful cloud implementation in the public sector [36].

2) Qualitative research methods shine a light on the human dimension of cloud adoption in the public sector. According to Omar Ali et al., the adoption of cloud-based services within local government entities is significantly influenced by compatibility, complexity, cost, security considerations, anticipated benefits, and organizational scale [37]. By gathering detailed narratives and insights from IT personnel, researchers can uncover the rich tapestry of their experiences. This in-depth approach goes beyond just identifying barriers and facilitators; it reveals the nuanced contextual factors that influence how

cloud computing is adopted and implemented. Compatibility, relative advantage, security, trust, and reduced complexity are key determinants of positive attitudes toward cloud adoption [38]. This knowledge is crucial for crafting successful strategies for the public sector.

#### D. Data Collection Methods

1) To gather rich data on cloud adoption, this study employed semi-structured interviews. This method strikes a balance between focus and flexibility. A pre-defined interview guide ensures we cover key areas while allowing the conversation to flow organically and explore unexpected insights that emerge. This approach yields detailed and comprehensive data, providing a deeper understanding of IT personnel's experiences in the public sector.

2) This study went beyond interviews, to strengthen the credibility and comprehensiveness of the findings. Document analysis and observations were incorporated, employing a technique called triangulation. This multifaceted approach allowed for the verification and enrichment of the data. By examining relevant documents and potentially observing IT personnel interacting with cloud computing, the research paints a more complete picture of cloud adoption in the public sector.

#### E. Rationale for Choosing Qualitative Interviews

1) *Depth of understanding:* In-depth interviews are the key to unlocking the complexities of cloud adoption in the public sector. Research conducted in diverse geographic contexts, such as South Africa, underscores the efficacy of in-depth interviews in elucidating the facilitators, obstacles, and intricacies inherent in cloud computing adoption processes [4]. Unlike surveys, interviews allow for a nuanced exploration of IT personnel's experiences, perceptions, and attitudes. Such interviews afford IT professionals a venue to articulate their perspectives on factors impacting workplace well-being, including interpersonal relationships and individual work environment characteristics [39]. This deep dive reveals the 'why' behind their challenges and the specific benefits they anticipate. This rich understanding is crucial for crafting effective cloud implementation strategies tailored to the public sector.

2) *Flexibility:* The semi-structured nature of the interviews empowers researchers to delve deeper. Qualitative research offers a rich and nuanced exploration of participants' subjective realities, allowing for the emergence of unforeseen patterns and insights [40]. When IT personnel offer intriguing responses or areas of ambiguity arise, the flexible format allows for follow-up questions. This adaptability ensures researchers capture a comprehensive understanding of the challenges and nuances surrounding cloud adoption in the public sector.

3) *Rich data:* Interviews are the cornerstone of this study, unearthing the intricate tapestry of cloud adoption in the public sector. Research conducted by [3], [4] and [41] underscore the pivotal role of interviews in elucidating the determinants, advantages, and obstacles associated with cloud computing adoption within governmental organizations. Unlike

quantitative methods, interviews capture rich, qualitative data that reveal the interplay of technical hurdles, organizational dynamics, and human factors influencing the process. This nuanced understanding is essential for navigating the complexities of cloud adoption within the public sector.

#### F. Ethics Statement

This ethical statement explains the steps taken to ensure that this study is conducted in compliance with high ethical standards. This includes how participant consent is obtained and the steps taken to ensure data privacy.

#### G. Obtaining Participant Consent

Before the study was conducted, all participants were given a detailed explanation of the purpose of the study, the procedures to be carried out, and their rights as participants. Each participant was asked to sign a written consent form before participating in this study.

#### H. Ensuring Data Privacy

Regarding [42], data security and privacy issues in cloud storage systems are significant concerns, including unauthorized access, data leakage, and privacy disclosure. To ensure the privacy of participant data, the following steps are taken:

1) *Anonymity*: All information collected is anonymized [43], [44].

2) *Data storage*: Study data is stored in a password-protected electronic format [45].

3) *Confidentiality*: Participants' personal information is kept confidential [46].

4) *Data destruction*: After the study is completed, all personal data will be securely destroyed [43].

### IV. RESULT

This section adheres to a rigorous approach by presenting the interview findings objectively. Each theme identified within the data is reported without interpretation, allowing the participants' voices to shine through. Supporting quotes are carefully chosen to illustrate these themes, providing a clear picture of the key issues surrounding cloud adoption in the public sector.

#### A. Compatibility Issues and System Integration

Findings: Interview data revealed a significant hurdle: technical complexity and compatibility issues during cloud integration with existing infrastructure. Participants described difficulties aligning new cloud computing with legacy software and hardware, leading to operational disruptions and inefficiencies. One participant (Participant 1) echoed this sentiment, stating, 'The old system used was difficult to integrate because of numerous compatibility problems.'

Supporting Quotes:

- Participant 1: "This old system is kind of hard to integrate; it seems like there are a lot of bugs. It's really hard."
- Participant 3: "Integrating the cloud computing with our existing infrastructure has been a major headache due to compatibility issues."

#### B. Data Migration Problems

Findings: Data migration emerged as a critical barrier due to incompatible data formats and structures. Participants consistently reported challenges transferring data from legacy systems to the cloud, often resulting in data loss, corruption, or significant delays. As Participant 2 succinctly stated, 'Data migration is hampered by the incompatibility between old data formats and structures and new cloud computing systems.'

Supporting Quotes:

- Participant 2: "This data is not directly compatible with the cloud; it is difficult to transfer."
- Participant 4: "We faced numerous problems migrating our legacy data to the cloud due to different data formats."

#### C. Network Problems

Findings: Network limitations emerged as a major roadblock to cloud adoption. Participants consistently described the challenges of slow infrastructure and high latency. They reported that, insufficient bandwidth and unreliable internet connections hampered the smooth operation of cloud services, leading to frequent downtime and decreased productivity. As Participant 3 noted, 'Slow network infrastructure and latency problems impede the smooth integration of cloud computing.'

Supporting Quotes:

- Participant 3: "Insufficient network speed and delays in data transmission make the user experience less satisfactory."
- Participant 5: "Our internet connection is often too slow to handle the demands of cloud computing effectively."

#### D. Lack of Training and Knowledge

Findings: A critical knowledge gap emerged as a significant barrier to cloud adoption. Participants consistently highlighted the lack of training and knowledge among IT staff. They pointed out that many personnel are not equipped to effectively manage and implement cloud technologies, leading to improper usage and integration failures. This sentiment was echoed by Participants 4 and 1, who stressed the need for 'in-depth training in cloud technology management and integration' for IT personnel.

Supporting Quotes:

- Participant 4: "Without adequate training, staff do not have the necessary skills to carry out the integration process properly."
- Participant 1: "We need comprehensive training programs to equip our team with the necessary cloud computing skills."

#### E. Budget Constraints

Findings: Budgetary limitations emerged as a persistent hurdle. Participants consistently highlighted the challenges posed by limited financial resources. Upgrading hardware and software to meet cloud integration requirements proved difficult due to a lack of funds for these vital investments. This financial

constraint significantly hampers cloud adoption efforts, as Participant 5 poignantly noted: 'The lack of funds caused difficulties in updating the hardware and software required for cloud computing integration.'

**Supporting Quotes:**

- Participant 5: "The budget is not enough; the hardware upgrade is not affordable, and the software integration is crazy expensive."
- Participant 2: "We struggle to secure the funding needed to support our cloud computing initiatives."

These results provide insight that can be used to plan more effective strategies for integrating cloud computing and improving the performance of IT personnel in the public sector.

TABLE I. SUMMARY OF KEY FINDINGS

| Theme                          | Issues Identified                                   | Supporting Quotes  |
|--------------------------------|---|--|
| Compatibility Issues           | Technical complexity, system compatibility problems | "The old system used was difficult to integrate because there were many compatibility problems."                         |
| Data Migration Problems        | Incompatible data formats, transfer difficulties    | "Data migration is hindered by the incompatibility of old data formats and structures with new cloud computing systems." |
| Network Problems               | Slow network infrastructure, high latency           | "Slow network infrastructure and latency problems impede the smooth integration of cloud computing."                     |
| Lack of Training and Knowledge | Insufficient training, skill deficits               | "IT personnel need more in-depth training in cloud technology management and integration."                               |
| Budget Constraints             | Insufficient funds for upgrades                     | "The budget is not enough; the hardware upgrade is not affordable, and the software integration is crazy expensive."     |

Table I summarizes key findings into five themes which are compatibility issues, data migration problems, network problems, lack of training and knowledge, and budget constraints.

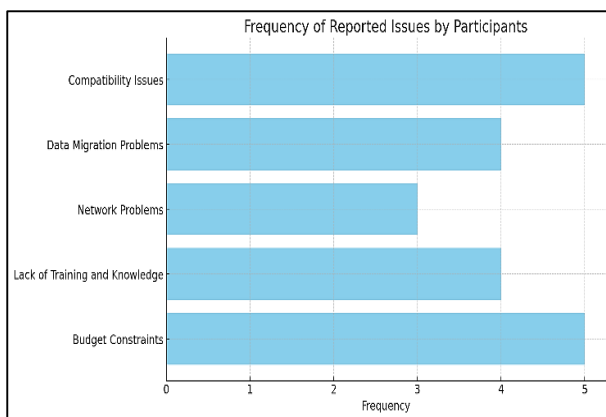


Fig. 1. Frequency of reported issues by participants.

Fig. 1 dives deeper into the challenges faced during cloud adoption within the public sector. This bar chart visually translates the participants' interview responses, highlighting the frequency of various issues reported. A quick glance allows for easy comparison, revealing which challenges were most prevalent among IT personnel.

Fig. 1 paints a clear picture of the roadblocks hindering cloud adoption in the public sector. Compatibility issues and budget constraints emerge as the most significant hurdles, with all 5 participants citing them. Data migration woes and the knowledge gap among IT personnel are also prevalent, reported by 4 participants each. Network limitations, though affecting slightly fewer (3 participants), remain a noteworthy challenge. This visual representation serves as a roadmap for successful cloud implementation. By prioritizing solutions that address these key areas compatibility, budget constraints, data migration, and IT skill development public sector organizations can pave the way for smoother adoption and ultimately unlock the full potential of cloud technologies for enhanced performance.

V. COMPARISON WITH PREVIOUS STUDIES

In order to understand how the findings of this study fit into a broader research context, it is important to compare the results of this study with those of previous studies. This section will highlight the similarities and differences between the findings of this study and the existing literature, providing a clearer picture of the challenges and opportunities in the adoption of cloud computing in the public sector.

A. Compatibility and System Integration Issues

- Findings: Participants reported significant technical complexity and compatibility issues when integrating cloud computing with existing infrastructure.
- Previous Research: The study in [4] stated that system compatibility is the main barrier to cloud adoption in the public sector. The study in [47] also emphasized the technical difficulties in integrating the new system with the old infrastructure.
- Comparison: Findings are consistent with these studies, reinforcing the view that compatibility issues are a common barrier to cloud adoption. This consistency across different contexts underscores the need for strategic planning and investment in compatible technologies to facilitate smoother integration.

B. Data Migration Problems

- Findings: Data migration was identified as a major challenge due to incompatibility of data formats and structures.
- Previous Research: The study in [32] emphasized the need for effective data migration strategies in cloud environments, noting similar challenges with compatibility and data migration difficulties. The study in [48] also documented data migration issues in their study.

- Comparison: Findings are consistent with these studies, showing that the problem of data migration is widespread and critical. This emphasizes the importance of robust data management strategies and tools in cloud computing adoption [49] [50].

#### C. Network Problems

- Findings: Network issues, including slow infrastructure and high latency, are significant barriers.
- Previous Studies: The study in [32] recommend increased data transmission speed and reduced latency in cloud environments, emphasizing similar network issues. The study in [19] also emphasized the need to upgrade network infrastructure to support cloud computing.
- Comparison: Findings are consistent with these studies, showing that network problems are a common barrier to cloud adoption. This consistency shows that upgrading the network infrastructure is essential for successful cloud integration.

#### D. Lack of Training and Knowledge

- Findings: Participants highlighted lack of training and knowledge as the main barrier.
- Previous Studies: The study in [10] emphasized the importance of training in improving the readiness of IT personnel for cloud adoption. The study in [10] also emphasized the need for ongoing professional development programs.
- Comparison: Findings are consistent with previous studies, emphasizing the need for comprehensive training programs to equip IT personnel with the skills necessary for effective cloud computing adoption [51] [52].

#### E. Budget Constraints

- Findings: Budget constraints were a recurring theme, with participants reporting difficulties in updating hardware and software.
- Previous Studies: The study in [25] emphasized the role of financial resources in successful IT integration. The study in [21] also documents the importance of budget allocation for IT upgrades and training.
- Comparison: Findings are consistent with these studies, suggesting that budget constraints are a significant barrier to cloud adoption. This consistency highlights the critical need for adequate funding and resource allocation to support cloud initiatives [53].

The findings of this study align closely with existing literature, validating the use of the Technology Acceptance Model (TAM) to analyze cloud computing adoption and its impact on IT personnel performance in the public sector. Consistent with previous research, participants reported significant challenges, including compatibility and system

integration issues, which [4] and [47] identified as major barriers to cloud adoption. Additionally, data migration problems, such as incompatible data formats, align with findings from [32] and [48], emphasizing the need for robust migration strategies. Network issues, including slow infrastructure and high latency, echo concerns highlighted by [19] and [32], reinforcing the necessity of upgrading network infrastructure to support cloud integration. The lack of training and knowledge was another critical barrier, supporting [10]'s assertion that professional development programs are essential for cloud readiness. Furthermore, budget constraints, a recurring theme in this study, align with [21] and [25], emphasizing the need for sufficient financial resources for technology upgrades and training. These findings collectively validate TAM's constructs of perceived usefulness and perceived ease of use, demonstrating how technical challenges, organizational readiness, and resource availability influence cloud adoption. Thus, incorporating these sector-specific barriers into CCAPM's model, the study offers a comprehensive model that not only reinforces established theories but also provides practical insights for overcoming adoption challenges and enhancing IT personnel performance in the public sector.

Overall, the findings of this study are consistent with many previous studies, emphasizing common issues such as system compatibility, data migration problems, network issues, lack of training, and budget constraints. Although some specific contexts are unique to the Malaysian public sector, the key challenges identified are consistent with the global literature. This suggests that better strategies and careful planning are needed to overcome these obstacles and maximize the benefits of cloud computing.

## VI. IMPLICATIONS

In this study, findings obtained from interviews with public sector IT personnel revealed several key issues that hinder the adoption of cloud computing. These findings include system compatibility and integration issues, data migration issues, network issues, lack of training and knowledge, and budget constraints. The practical implications of these findings are important to note for policymakers, IT managers, and public sector organizations to ensure a more effective and efficient implementation of cloud computing.

The findings of this study offer valuable insight into the real challenges faced in integrating cloud technology in public sector environments. By understanding and overcoming these barriers, stakeholders can develop more robust and relevant strategies to harness the full potential of cloud computing. Therefore, it is important to explore the practical implications arising from the findings of this study and provide recommendations that can help in increasing the uptake and use of cloud technology in the public sector.

This section will elaborate on the implications of this study's findings for three main groups: policymakers, IT managers, and public sector organizations. Each of these groups plays an important role in ensuring the successful implementation of cloud computing, and understanding the implications of this will allow them to take appropriate actions to address the identified challenges.

### A. For Policy Makers

1) *Strategic planning and investment*: Policymakers should prioritize strategic planning and investment in compatible technologies to facilitate the integration of cloud computing with existing infrastructure. This includes allocating funds to upgrade legacy systems and ensure compatibility with new cloud-based solutions.

2) *Infrastructure development*: There is a need for significant investment in network infrastructure to address the issues of slow speed and high latency. Policymakers should consider funding initiatives to improve broadband infrastructure and ensure reliable internet connectivity, which is essential for effective cloud computing.

3) *Training and development programs*: Policy makers should support the development of comprehensive training programs for IT personnel. This includes funding professional development initiatives focused on cloud technology management and integration, ensuring staff have the necessary skills and knowledge.

### B. For IT Managers

1) *Implementation of best practices*: IT managers should adopt best practices for data migration, including robust data management strategies and tools that address compatibility issues. This involves thorough planning and testing to ensure smooth data transfer.

2) *Resource allocation*: IT managers need to support adequate budget allocations to support necessary hardware and software upgrades. This includes presenting a strong business case for funding for cloud initiatives and training programs.

3) *Continuous learning*: IT managers should foster a culture of continuous learning and professional development in their teams. This can be achieved by organizing regular training sessions, workshops, and certifications in cloud technology.

### C. For Public Sector Organizations

1) *Policy development*: Public sector organizations should develop clear policies and guidelines for cloud adoption, addressing compatibility, data migration, network infrastructure, training, and funding. This policy should align with broader government strategy and ensure consistent implementation across departments.

2) *Collaboration and partnerships*: Organizations should collaborate with technology vendors, industry experts, and other public sector entities to share knowledge and best practices. Partnerships can also help in negotiating better terms and prices for cloud services and related infrastructure upgrades.

3) *Monitoring and evaluation*: Implement robust monitoring and evaluation mechanisms to assess the effectiveness of cloud adoption initiatives. This includes tracking performance metrics, identifying areas for improvement, and making data-driven decisions to optimize cloud computing implementations.

## VII. CONCLUSIONS

This study has conducted in-depth research on the factors that influence the adoption of cloud computing in the public sector, particularly on the performance of IT personnel. Through interviews with five participants who are IT experts in the public sector, the findings of this study offer valuable insight into the various challenges faced in the cloud computing integration process.

A summary of the key findings shows that there are several key barriers that affect the adoption of cloud computing. Among the main issues faced are system compatibility problems, deficiencies in the data migration process, inefficient network issues, lack of training and skills in data governance, as well as tight budget constraints. Study participants have provided insight into how these factors affect their ability to integrate and optimize the use of cloud technology in daily operations.

In the discussion of the findings, it is clear that these challenges are directly related to the objective of the study, which is to identify and analyze the factors that influence the adoption of cloud computing. From the data collected, main themes such as 'Compatibility and System Integration Issues', 'Data Migration Issues', 'Network Issues', 'Lack of Training and Knowledge', as well as 'Budget Constraints' were formed. These themes not only clarify the various technical and operational aspects that need to be addressed but also outline the need for a more comprehensive strategy that includes financial aspects and human resource development.

This study provides an important contribution to the field of cloud computing in the context of the public sector. First, it broadens the understanding of the specific challenges public institutions face in adopting cloud technologies, which are often different from the challenges faced by the private sector. Second, this study offers empirical evidence that supports the need for a more integrated approach in the implementation of this technology, emphasizing the importance of adapting infrastructure, training, and access to sufficient financial resources.

In conclusion, the findings from this study clearly show that although cloud computing offers many potential benefits, there are significant barriers to overcome to maximize its benefits in the public sector. Solutions to the issues identified in this study will require joint efforts between policy makers, technology managers, and IT practitioners to develop a comprehensive strategy that focuses not only on technology but also on improving organizational and individual capabilities. This will ensure that public institutions can take advantage of cloud technology to improve the efficiency and effectiveness of their services to the public.

In the context of solving the problem stated in the problem statement of this study—complexity in the integration of cloud computing with existing infrastructure and the lack of knowledge and skills in data governance in public institutions—the appropriate model needs to take into account technical, operational, and human resource development aspects. The proposed model is the "Cloud Computing Integration and Cloud Computing Acceptance and Performance Model" (CCAPM).



## A. CCAPM Model Formation

### 1) Preliminary assessment phase:

a) *Diagnostics of existing infrastructure:* The first step is to perform a thorough diagnostic of the existing information technology infrastructure to assess compatibility with cloud computing systems. This includes an assessment of software, hardware, and network configuration.

b) *Constraint and potential analysis:* Identify constraints such as compatibility issues, data security, and network requirements, as well as potential improvements through cloud computing.

### 2) Development and integration phase:

a) *Infrastructure development:* Upgrade or replace infrastructure components that are not compatible with cloud technology. This may include replacing old software, network upgrades, and installing better data security systems.

b) *System integration:* Integrate cloud computing with upgraded infrastructure using protocols and tools that ensure smooth data migration and continuous operations.

### 3) Capacity expansion phase:

a) *Training and human resource development:* Implement a comprehensive training program to improve the technical skills of IT personnel in managing and maintaining cloud computing systems. This includes training in data governance, cyber security, and disaster recovery.

b) *Expertise development:* Establish a specialized unit in cloud computing responsible for providing technical support, guiding daily operations, and guaranteeing compliance with public sector policies.

### 4) Continuous evaluation phase:

a) *Performance audit and evaluation:* Conduct periodic audits to evaluate cloud computing system performance, effectiveness of training provided, and adherence to security protocols.

b) *Iteration and refinement:* Based on the results of the audit, improvements should be made to the infrastructure and operational procedures to continue improving the performance and security of the system.

This CCAPM model is expected to solve the problem of the complexity of cloud computing integration by taking a holistic approach that does not only focus on technical aspects but also the development of human resource skills and capacity in the public sector. This model also aims to create a resilient and sustainable ecosystem that can adapt new technologies more quickly and efficiently, while maintaining a high level of security and compatibility.

This model includes four main phases in the process of integration and expansion of cloud computing capacity in the public sector, ranging from initial assessment, development and integration, capacity expansion, to continuous assessment for sustainable improvement. Each step in the model has a specific task aimed at overcoming the challenges stated in the problem statement of this study.

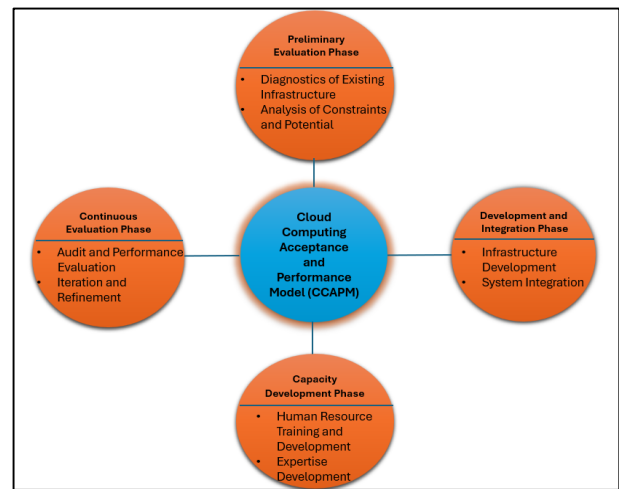


Fig. 2. Cloud Computing Acceptance and Performance Model (CCAPM).

This study has identified several key challenges in the adoption of cloud computing in the Malaysian public sector. Key findings include system compatibility and integration issues, data migration issues, network issues, lack of training and knowledge, and budget constraints. Complex system compatibility and technical problems hinder the seamless integration of cloud technology with existing infrastructure. Data migration problems, including the incompatibility of old data formats and structures with the new system, also add to these challenges. Network issues such as slow infrastructure and high latency reduce the effectiveness of using cloud technology. In addition, the lack of training and knowledge among IT personnel makes the process of adopting this technology difficult. Finally, budget constraints prevent the necessary investments to upgrade the hardware, software, and training needed to support cloud adoption. These findings emphasize the need for strategic planning, adequate investment, and comprehensive training programs to ensure the successful adoption of cloud computing in the public sector.

## VIII. FUTURE RESEARCH

Based on the findings of this study, there are several areas that require further research to deepen understanding and overcome challenges in cloud computing adoption.

1) First, future studies can focus on developing more effective data management strategies and tools to deal with data migration problems. This study can investigate the technical and methodological approaches that can be used to ensure a smoother and safer transfer of data.

2) Second, further research needs to be done to assess the effectiveness of training and professional development programs in improving the readiness of IT personnel for cloud computing. This includes research on what types of training are most effective and how best to deliver training content.

3) Third, future studies could examine methods to overcome budget constraints, including alternative funding models and strategies for obtaining financial support for cloud computing initiatives.

4) Finally, there is a need for more in-depth studies on the long-term impact of cloud computing on the performance of operations and services in the public sector. This study can help in understanding how this technology can be optimized to improve the efficiency and effectiveness of public services.

#### IX. LIMITATIONS

This study only involved five participants, which may not reflect the views of all IT personnel in the public sector. Also, this study is limited to the Malaysian context only.

1) *Research implications:* Findings from this study provide a basis for further research in cloud computing in the public sector. It suggests the need for a broader study involving more participants from a variety of geographic and technical backgrounds. Further research could explore the relationship between various technical, operational, and organizational factors with the effectiveness of cloud computing, including a comparative analysis between the public and private sectors.

2) *Practical implications:* These findings offer practical guidance for government agencies in planning and implementing cloud computing systems, emphasizing the need for improved infrastructure and better training programs.

#### ACKNOWLEDGMENT

This work was supported in part by Universiti Kebangsaan Malaysia, and in part by the Ministry of Higher Education Malaysia under Grant FRGS/1/2024/TK01/UKM/02/2.

NOORBAITI MAHUSIN received a B.Sc. from Universiti Malaysia Pahang, in 2006, and M.Sc. in Information Science from the Universiti Kebangsaan Malaysia, Bangi, Malaysia, in 2018, where she is currently pursuing her Ph.D. degree in Management Information Systems. She currently working on publish papers in reputed journals. Her current research interests including IoT and Artificial Intelligence.

HASIMI SALLEHUDIN is a Senior Lecturer with the Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia. His research interests include computer security and networks, and management information systems.

NURHIZAM SAFIE MOHD SATAR received the Diploma degree from UPM, with specialization in E-learning technology information systems adoption and diffusion cloud computing, the B.H.Sc. degree from IIUM, the M.I.T. degree.

AZANA HAFIZAH MOHD AMAN received her PhD, MSc and BEng in Computer and Information Engineering from International Islamic University Malaysia. She is currently working as senior lecturer at Research Center for Cyber Security, Faculty of Information Science and Technology (FTSM), The National University of Malaysia (UKM), Malaysia. Her research areas are computer system & networking, information & network security, IoT, cloud computing, and big data.

FARASHAZILLAH YAHYA is a senior lecturer at the Faculty of Computing and Informatics at Universiti Malaysia Sabah. Her research interests include data management, digital technology, cloud computing and cybersecurity. She holds a

PhD. in Computer Science from the University of Southampton, United Kingdom and a BSc. (Hons) Information System Engineering from UiTM, Shah Alam.

#### REFERENCES

- [1] Abdelhakim, M., Abdeldayem, M. M., & Aldulaimi, S. H. (2022, June). Information technology adoption barriers in public sector. In *2022 ASU International Conference in Emerging Technologies for Sustainability and Intelligent Systems (ICETISIS)* (pp. 355-360). IEEE. <https://doi.org/10.1109/ICETISIS55481.2022.9888805>
- [2] Agarwal, P. K. (2018). Public administration challenges in the world of AI and bots. *Public Administration Review*, 78(6), 917–921. <https://doi.org/10.1111/puar.12979>
- [3] Ali, O., Shrestha, A., Osmanaj, V., & Muhammed, S. (2020). Cloud computing technology adoption: An evaluation of key factors in local governments. *Information Technology & People*, 34(2), 666–703. <https://doi.org/10.1108/ITP-03-2019-0119>
- [4] Amin, R., & Vadlamudi, S. (2021). Opportunities and challenges of data migration in cloud. *Engineering International*, 9(1), 41–50. <https://doi.org/10.18034/ei.v9i1.529>
- [5] Atuluku, A. R., Osang, F. B., & Adebisi, A. A. (2022). Cloud computing adoption and use: A systematic review. *Advances in Multidisciplinary and Scientific Research Journal Publication*, 13(4), 29–64. <https://doi.org/10.22624/AIMS/CISDI/V13N4P3>
- [6] Beatrice, B., Burke, L., Kariuki, J., & Sereika, S. (2023). Lessons learned: Successes and challenges with technology-based data collection and intervention in a behavioral weight loss study. *Journal of the Academy of Nutrition and Dietetics*, 123(9), A16. <https://doi.org/10.1016/j.jand.2023.06.042>
- [7] Bolin, J., & Yang, M. (2018, March). Cloud computing: cost, security, and performance. In *Proceedings of the ACMSE 2018 conference* (pp. 1-1). <https://doi.org/10.1145/3190645.3190706>
- [8] Cordeiro, D., Franceschini, E., Amarís, M., Castro, M., Baldassin, A., & Lima, J. V. (2023). Green cloud computing: Challenges and opportunities. *Anais Estendidos do XIX Simpósio Brasileiro de Sistemas de Informação*, 129-131. [https://doi.org/10.5753/sbsi\\_estendido.2023.229291](https://doi.org/10.5753/sbsi_estendido.2023.229291)
- [9] Cordella, A., & Paletti, A. (2019). Government as a platform, orchestration, and public value creation: The Italian case. *Government Information Quarterly*, 36, 1-15. <https://doi.org/10.1016/j.giq.2019.101409>
- [10] Cresswell, K., Hernández, A. D., Williams, R., & Sheikh, A. (2022). Key challenges and opportunities for cloud technology in health care: Semistructured interview study. *Jmir Human Factors*, 9, e31246. <https://doi.org/10.2196/31246>
- [11] Dash, B., Sharma, P., & Swayamsiddha, S. (2023). Organizational digital transformations and the importance of assessing theoretical frameworks such as TAM, TTF, and UTAUT: A review. *International Journal of Advanced Computer Science and Applications*, 14(2), 1-6. <https://doi.org/10.14569/IJACSA.2023.0140201>
- [12] Davis, F. D. (1986). A Technology Acceptance Model for Empirically Testing New End-User Information Systems. *Theory and Results/Massachusetts Institute of Technology*.
- [13] Denny, E., & Weckesser, A. (2022). How to do qualitative research? *BJOG: An International Journal of Obstetrics & Gynaecology*, 129(7), 1166–1167. <https://doi.org/10.1111/1471-0528.17150>
- [14] Gkika, E. C., Anagnostopoulos, T., Ntanos, S., & Kyriakopoulos, G. L. (2020). User preferences on cloud computing and open innovation: A case study for university employees in Greece. *Journal of Open Innovation: Technology, Market, and Complexity*, 6(2), 1-21. <https://doi.org/10.3390/joitmc6020041>
- [15] Goodman, H. B., & Rowland, P. (2021). Deficiencies of Compliancy for Data and Storage: Isolating the CIA Triad Components to Identify Gaps to Security. In *National Cyber Summit (NCS) Research Track 2020* (pp. 170-192). Springer International Publishing. [https://doi.org/10.1007/978-3-030-58703-1\\_11](https://doi.org/10.1007/978-3-030-58703-1_11)
- [16] Gupta, N., & Sohal, A. (2022). Cloud Computing: Evolution, Research Issues, and Challenges. *Emerging Computing Paradigms: Principles*,

- Advances and Applications*, 1-17. <https://doi.org/10.1002/9781119813439.ch1>
- [17] Hasan, M. Z., Hussain, M. Z., Mubarak, Z., Siddiqui, A. A., Qureshi, A. M., & Ismail, I. (2023, January). Data security and integrity in cloud computing. In *2023 International Conference for Advancement in Technology (ICONAT)* (pp. 1-5). IEEE. <https://doi.org/10.1109/ICONAT57137.2023.10080440>
- [18] Heinze, C., Hartmeyer, R. D., Ringgaard, L. W., Bjerregaard, A.-L., Krølner, R. F., Allender, S., Bauman, A., & Klinker, C. D. (2023). Study protocol for the Data Health Study-A data-driven and systems approach to health promotion among vocational students in Denmark, 1-28. <https://doi.org/10.21203/rs.3.rs-3061625/v1>
- [19] Hwang, I., Kim, S., & Rebman, C. (2022). Impact of regulatory focus on security technostress and organizational outcomes: the moderating effect of security technostress inhibitors. *Information Technology & People*, 35(7), 2043-2074. <https://doi.org/10.1108/itp-05-2019-0239>
- [20] Junnier, F. (2024). Action and understanding in the semi-structured research interview: Using CA to analyse European research scientists' attitudes to linguistic (dis) advantage. *Journal of English for Academic Purposes*, 68, 101355. <https://doi.org/https://doi.org/10.1016/j.jeap.2024.101355>
- [21] Kashaija, L. S. (2022). E-records management readiness for implementation of e-government in local authorities of Singida Municipal Council. *Journal of the South African Society of Archivists*, 55, 41-55. <https://doi.org/10.4314/jsasa.v55i.4>
- [22] Khayer, A., Talukder, Md. S., Bao, Y., & Hossain, Md. N. (2020). Cloud computing adoption and its impact on SMEs' performance for cloud supported operations: A dual-stage analytical approach. *Technology in Society*, 60, 101225. <https://doi.org/10.1016/j.techsoc.2019.101225>
- [23] Kim, S., Andersen, K. N., & Lee, J. (2022). Platform government in the era of smart technology. *Public Administration Review*, 82(2), 362-368. <https://doi.org/10.1111/puar.13422>
- [24] Lastanti, N., & Djasuli, M. (2024). Optimizing the use of cloud technology in public sector management control (case study of e-government in Bandung City). *Eduvest - Journal of Universal Studies*, 4(5), 2014-2109. <https://doi.org/10.59188/eduvest.v4i5.1245>
- [25] Lulaj, E., Zarin, I., & Rahman, S. (2022). A Novel Approach to Improving E-Government Performance from Budget Challenges in Complex Financial Systems. *Complexity*, 2022(1), 1-16. <https://doi.org/10.1155/2022/2507490>
- [26] Maelah, R., Al Lami, M. F. F., & Ghassan, G. (2019). Management accounting information usefulness and cloud computing qualities among small medium enterprises. *International Journal of Management Studies*, 26(1), 1-31. <https://doi.org/10.32890/ijms.26.1.2019.10511>
- [27] Dibetle, M., & Kalema, B. M. (2023). Data security governance for Software-as-a-Service Cloud computing environment: A South African perspective, 1-14.
- [28] Mehtälä, J., Ali, M., Miettinen, T., Partanen, L., Laapas, K., Niemelä, P. T., Khorlo, I., Ström, S., Kurki, S., Vapalahti, J., Abdelgawwad, K., & Leinonen, J. V. (2023). Utilization of anonymization techniques to create an external control arm for clinical trial data. *BMC Medical Research Methodology*, 23(1), 1-11. <https://doi.org/10.1186/s12874-023-02082-5>
- [29] Mohamed, A., Ali, C., Fakhri, Y., & Noredine, G. (2022, October). A survey on the challenges of data integration. In *2022 9th International Conference on Wireless Networks and Mobile Communications (WINCOM)* (pp. 1-6). IEEE. <https://doi.org/10.1109/WINCOM55661.2022.9966419>
- [30] Mkhathshwa, B., & Mawela, T. (2023a). Cloud computing adoption in the South African public sector. *Indonesian Journal of Electrical Engineering and Informatics (IJEEI)*, 11(2), 537-552. <https://doi.org/10.52549/ijeei.v11i2.4464>
- [31] Nanos, I. (2020, September). Cloud Computing Adoption in Public Sector: A Literature Review about Issues, Models and Influencing Factors. In *Balkan Conference on Operational Research* (pp. 243-250). Cham: Springer International Publishing.
- [32] Naresh, P., P. R., Vempati, K., & Saidulu, D. (2020). Improving the data transmission speed in cloud migration by using MapReduce for Big Data. *International Journal of Engineering Technology and Management Sciences*, 4, 73-75. <https://doi.org/10.46647/ijetms.2020.v04i05.013>
- [33] Nassaji, H. (2020). Good qualitative research. *Language Teaching Research*, 24(4), 427-431. <https://doi.org/10.1177/1362168820941288>
- [34] Nghihalwa, E., & Shava, F. B. (2018, May). An assessment of cloud computing readiness in the Namibian government's Information Technology departments. In *2018 19th IEEE Mediterranean Electrotechnical Conference (MELECON)* (pp. 92-97). IEEE. <https://doi.org/10.1109/MELCON.2018.8379074>
- [35] Hassan, N. H. M., Ahmad, K., & Salehuddin, H. (2020). Diagnosing the issues and challenges in data integration implementation in public sector. *Int. J. Adv. Sci. Eng. Inf. Technol*, 10, 529-535.
- [36] Novianto, N. (2023). Systematic literature review: Models of digital transformation in the public sector. *Policy & Governance Review*, 7(2), 170. <https://doi.org/10.30589/pgr.v7i2.753>
- [37] Pańkowska, M., Pyszny, K., & Strzelecki, A. (2020). Users' adoption of sustainable cloud computing solutions. *Sustainability*, 12(23), 1-21. <https://doi.org/10.3390/su12239930>
- [38] Parthasarathy, S., Sivagurunathan, S., & Subramanian, G. H. (2022). What should a startup know about software customization? *International Journal of Information Technology Project Management*, 13(1), 1-13. <https://doi.org/10.4018/IJITPM.313945>
- [39] Pollock, D., Alexander, L., Munn, Z., Peters, M. D., Khalil, H., Godfrey, C. M., ... & Tricco, A. C. (2022). Moving from consultation to co-creation with knowledgeable users in scoping reviews: guidance from the JBI Scoping Review Methodology Group. *JBI evidence synthesis*, 20(4), 969-979. <https://doi.org/10.11124/jbies-21-00416>
- [40] Sadlier, A., & Baksh, N. (2022, March). Real-Time-as-a-Service Increases Efficiency, Agility and Consistency. In *SPE/IADC Drilling Conference and Exhibition* (p. D031S020R002). SPE. <https://doi.org/10.2118/208790-MS>
- [41] Sallehudin, H. A. S. I. M. I., Razak, R. C., Ismail, M. O. H. A. M. M. A. D., Fadzil, A. F. M., & Baker, R. O. G. I. S. (2019). Cloud computing implementation in the public sector: factors and impact. *Asia-Pacific Journal of Information Technology and Multimedia*, 7(2-2), 27-42. [https://doi.org/10.17576/apjitm-2018-0702\(02\)-03](https://doi.org/10.17576/apjitm-2018-0702(02)-03)
- [42] Yang, P., Xiong, N., & Ren, J. (2020). Data security and privacy protection for cloud storage: A survey. *IEEE Access*, 8, 131723-131740. <https://doi.org/10.1109/ACCESS.2020.3009876>
- [43] Shetty, J. P., & Panda, R. (2023). Cloud adoption in Indian SMEs—an empirical analysis. *Benchmarking: An International Journal*, 30(4), 1345-1366. <https://doi.org/10.1108/bij-08-2021-0468>
- [44] Stieninger, M., Nedbal, D., Wetzlinger, W., Wagner, G., & Erskine, M. A. (2022). Factors influencing the organizational adoption of cloud computing: A survey among cloud workers. *International Journal of Information Systems and Project Management*, 6(1), 5-23. <https://doi.org/10.12821/ijispm060101>
- [45] Thobejane, M., & Marnewick, C. (2020). The effective implementation of cloud computing through project management: Conceptual framework. *Journal of Contemporary Management*, 17(2), 416-444. <https://doi.org/10.35683/jcm20079.82>
- [46] Wang, X., Xia, D., Wang, Y., Xu, S., & Gui, L. (2020). A cross-sectional study of heat-related knowledge, attitude, and practice among naval personnel in China, 1-15. <https://doi.org/10.21203/rs.2.20828/v1>
- [47] Zhao, J., & Wang, W. (2019). Creative Combination of Legacy System and Map Reduce in Cloud Migration. *International Journal of Performability Engineering*, 15(2), 579-590. <https://doi.org/10.23940/ijpe.19.02.p22.579590>
- [48] Zutavern, S., & Seifried, J. (2021). Exploring well-being at work—An interview study on how IT professionals perceive their workplace. *Frontiers in Psychology*, 12, 1-18. <https://doi.org/10.3389/fpsyg.2021.688219>
- [49] Al-Jumaili, A. H. A., Muniyandi, R. C., Hasan, M. K., Singh, M. J., Paw, J. K. S., & Amir, M. (2023). Advancements in intelligent cloud computing for power optimization and battery management in hybrid renewable energy systems: A comprehensive review. *Energy Reports*, 10, 2206-2227. <https://doi.org/10.1016/j.egyrs.2023.09.029>
- [50] Badie, N., Hussin, A. R. C., Yadegaridehkordi, E., Singh, D., & Lashkari, A. H. (2023). A SEM-STELLA approach for predicting decision-makers' adoption of cloud computing data center. *Education and Information*

- Technologies*, 28(7), 8219-8271. <https://doi.org/10.1007/s10639-022-11484-9>
- [51] Usman, L. O., Muniyandi, R. C., & Usman, M. A. (2023). Efficient Neuroimaging Data Security and Encryption Using Pixel-Based Homomorphic Residue Number System. *SN Computer Science*, 4(6), 834. <https://doi.org/10.1007/s42979-023-02297-9>
- [52] Meri, A., Hasan, M. K., Dauwed, M., Jarrar, M. T., Aldujaili, A., Al-Bsheish, M., ... & Kareem, H. M. (2023). Organizational and behavioral attributes' roles in adopting cloud services: An empirical study in the healthcare industry. *Plos one*, 18(8), 1-23. <https://doi.org/10.1371/journal.pone.0290654>
- [53] Naseri, N. K., Sundararajan, E., & Ayob, M. (2023). Smart Root Search (SRS) in Solving Service Time–Cost Optimization in Cloud Computing Service Composition (STCOCCSC) Problems. *Symmetry*, 15(2), 272. <https://doi.org/10.3390/sym15020272>