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Cloud Computing Adoption in the South African Public Administration: A Systematic Analysis of Key Constraints

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Abstract: Globally, cloud computing has reshaped business models of various public sectors, leading to intensified efficiency in digital transformation and enhanced data administration. Although governments continuously provide seamless public services and effectively manage massive datasets using cloud computing, the South African public administration still faces challenges that impede the full realization of cloud services. This study explores the key constraints that the South African public administration faces in adopting cloud computing. This study adopts an interpretivist worldview and qualitative methodology, employing the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) technique to investigate the key constraints faced by the South African public administration in adopting cloud computing. Academic studies were retrieved from the ProQuest and ScienceDirect databases, spanning the years 2016 to 2025. A total of 20 studies were included in the systematic analysis. The findings of the systematic analysis reveal that inadequate digital infrastructure, limited digital competencies and insufficient legislative framework are fundamental constraints faced by the South African public sector. The study's findings can help policymakers develop a sound policy and strategy for managing cloud computing in the public sector.

Keywords: *Cloud Computing; Cloud Deployment Models; Public Administration; Constraints; South Africa.*

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I. INTRODUCTION AND BACKGROUND

The increasing use of information and communication technology (ICT) is critical in providing public services (Baloyi & Beyers, 2019). Globally, the advent of cloud computing has not only enhanced the management of vast datasets but also facilitated efficient access to electronic information through data centers in various sectors (Najana & Ranjan, 2024). While developed countries have been at the forefront of handling massive data via cloud-based services, developing countries like the South African public administration still find a path to managing such data (e.g., census) to thrive in the digital epoch and, at the same time, mitigate challenges brought about by cloud computing digital technologies such as regulatory framework challenges (Scholtz et al., 2016; Mohlameane & Ruxwana, 2020).

Although the acceptance of cloud computing surpasses the traditional (conventional) mode of storing data using server systems accessed through a local area network (LAN), it can leverage best practices, scalability and flexibility in retrieving that data, thereby increasing the efficiency and effectiveness of public administration (Yanamala, 2024). More to this, cloud computing has been viewed as a prominent vehicle for reforming and modernizing internal operations within the public sector, while diminishing costs associated with accessing public services and mitigating the impact of geographical distance to government premises (Abd Al Ghaffar, 2024). However, based on the recent scholarly empirical evidence, cloud computing in the South African public administration seems to be embryonic, and a lot needs to be done to invest in this cutting-edge technology if the innovative methodologies of managing data are to be heightened (Mkhatshwa & Mawela, 2023; Shibambu, 2025; Mmako & Kgopa, 2025).

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As a government agency, the State Information Technology Agency (SITA) ensures that the information and communication technology (ICT), particularly digital initiatives, are implemented in the South African public sector to enhance service delivery. To this end, in an attempt to embrace cloud computing and improve the storage of the public sector's data (e.g., patients' information), the South African government, through the Department of Communications and Digital Technologies (DCDT) in collaborating with SITA, has endorsed through the cabinet the "National Policy on Data and Cloud" as a model, intending to administer and use data via cloud computing digital transformation efficiently (DCDT, 2024). However, despite the strides made, the country's public sector appears to be struggling with the adoption of cloud computing, accompanied by a lack of academic research. Although this may be true, industries such as healthcare services, basic education, and statistics, among others, have been increasingly fascinated by embracing cloud services to provide cost-effective public services, notwithstanding ethical concerns (such as data privacy and security) and other pertinent disparities (Scholtz et al., 2016). Against this background, this study aims to address the following research question: *What key constraints does the South African public administration face in adopting cloud computing?*

II. THEORETICAL FRAMEWORK

The technology-organization-environment (TOE) model is embraced as a theoretical lens underpinning the study. Since cloud computing in the South African public sector is in a nascent phase, the TOE model is pertinent in ascertaining the capability of institutions (at the institutional level) in terms of the three contextual factors suggested by Tornatzky and Fleischer: technology, organization and environment (Tornatzky & Fleischer, 1990). To this end, while the public sector plays a crucial role in providing services to the public, it is essential to consider cloud computing adoption at the organizational level rather than the individual level, given its novelty. The rationale and feasibility of adopting the TOE model in this study are based on proven empirical evidence, theoretical relevance, and effectiveness in an environment where the embracement of innovative ways and technology adoption is predominant. Additionally, the TOE model has been widely employed in different public sector organisations in the technological domain, evaluated through the three contextual factors (Alfiani et al., 2024; Shibambu, 2025).

In brief, the technological context is shaped by the introduction of new technologies into the marketplace (Baker, 2012). Moreover, while the organizational context is concerned with assessing the organizational internal capacity (e.g., resources – human, technical, financial, etc.) to handle technological initiatives, the environmental context entails compliance with binding regulations governing technologies as imposed by the government (Baker, 2012). By implication, these contextual factors make a meaningful contribution whenever confronted with changes arising from technological business conditions and, as such, are relevant to cloud computing adoption by the South African public sector.

III. CLOUD COMPUTING OVERVIEW

Cloud computing refers to the framework that is significant in facilitating data sharing resources through digital transformation, necessitating slight management intervention (Scholtz et al., 2016). The characteristics that differentiate cloud computing from other emerging digital technologies (e.g., artificial intelligence [AI], the Internet of Things [IoT], virtual platforms, big data) are broad network access, rapid elasticity, measured service, and on-demand self-service (Shibambu, 2025), as illustrated in Fig. 1. On the other hand, cloud computing comprises four deployment and delivery models: public, private, community and hybrid (Brzozowska-Rup, 2024). Firstly, public cloud deployment involves providing cloud services to the general public, including, but not limited to, citizens and various institutions (Sonya et al., 2016). The public cloud deployment typically exists within the vicinity of the service provider, such as public sector organisations. Secondly, private cloud deployment involves a customized cloud service tailored to a specific institution, particularly various directorates within the public sector (Abd Al Ghaffar, 2024). Thirdly, community cloud deployment is concerned with offering cloud-related services to a cluster of institutions with identical industry's contextual determinants, such as operational environment, regulations, security and adherence issues (Senyo et al., 2018). Lastly, hybrid cloud deployment integrates public, private, and community deployment models to create a regulated technological environment that enhances the convenience of data sharing (Senyo et al., 2016). While these cloud computing deployment and delivery models offer varying degrees of security based on their cluster (i.e., ranging from least to most secure cloud environments), they are also prone to distinct cost-saving prototypes (i.e., reductions in expenditure – cost-saving frameworks) (Abd Al Ghaffar, 2024).

Additionally, cloud computing service models categorize services into three primary sets: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) (Mkhatshwa & Mawela, 2023). Whereas IaaS cloud service model depends intensely on the delivery of a variety of digital infrastructures (such virtual servers – Google Cloud, digital space and other imperative mainframe resources) from the suppliers (i.e., outsourcing) enabling consumers to access file into the cloud (Brzozowska-Rup, 2024), PaaS cloud service model allow consumers to construct, administer and implement their tailored functions utilizing remote ICT digital platforms (Jones et al., 2019). Contrariwise, the SaaS cloud service model is based on the principle that cloud digital infrastructure remains the responsibility of the supplier and services (e.g., computer applications – graphic design, word processing, presentations, spreadsheets, etc.) are distributed to consumers by means of web browser interfaces and programs (Jones et al., 2019). Fig. 1 portrays cloud service models, deployment models and service features.

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IV. RESEARCH METHODS

To respond to the research question *(What key constraints does the South African public administration face in adopting cloud computing?),* this study undertakes a systematic analysis, using Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) (Page et al., 2021). Guided by the interpretivist worldview, this study employs a qualitative methodology, utilizing the renowned PRISMA technique to examine the constraints faced by the South African public administration in adopting cloud computing. Moreover, the PRISMA technique helped identify themes and patterns relevant to the study. Even though PRISMA was initially designed for medicine and the health research speciality, it has been widely adopted and applied in other scholarly disciplines, such as social science studies (Ukeje et al., 2024). The benefits of embracing the PRISMA technique include: (1) it improves transparency, consistency and precision of collecting readily available data (secondary information), (2) it helps circumvent misrepresentation of the study's conclusions, and (3) it leads to dependable and trustworthy research findings (Page et al., 2021). This study follows the PRISMA suggested steps by Knobloch et al. in conducting systematic analysis: identification, screening, eligibility and inclusion (Knobloch et al., 2011).

A. The Identification and Selection Process

At the outset, relevant documents relating to the constraints of cloud computing adoption in the public sector were extracted from the prominent databases, such as ProQuest and ScienceDirect. The justification for considering these databases lies in their extensive coverage of literature related to technology, information systems, and other relevant topics. The search from the two databases was accomplished individually, based on the research titles, abstract and relevant key terms. The search strings were restricted to the key concepts, such as "cloud computing", "public administration", "constraints", "cloud deployment models", "public deployment model", "private deployment model", "community deployment model", "hybrid deployment model", "Infrastructure as a Service", "IaaS", "Platform as a Service", "PaaS", "Software as a Service", and "SaaS".

B. The Screening Process and Quality Appraisal

The documents were screened after a detailed search of the ProQuest and ScienceDirect websites to determine the inclusion and exclusion criteria. The records were scrutinized by reading the abstracts to ascertain their relevance. Further to that, the EndNote Referencing library (Version 21.5) and an Excel Spreadsheet (i.e., author, year, title, abstract, primary objective, methodology, findings) were used to manage the data. The software enabled the researcher to identify and sort documents while simultaneously eliminating repetitive ones. The documents were rigorously screened by assigning at least two independent assessors to mitigate bias. More to this, a comprehensive systematic analysis was conducted to enhance the reliability of the data collection process. The records included in this study are peer-reviewed journal articles, conference papers and grey literature (i.e., government reports and policy documents). To enhance data quality evaluation, the following factors were considered: relevance of the abstract, clear primary objective, detailed theoretical underpinnings (if applicable), justification of research methods, clearly stated research findings, and explicit attainment of secondary objectives. The records were coded as follows: A = record accepted for further evaluation, B = record accepted but requiring rigorous assessment for inclusion, and C = record rejected for inclusion in the systematic analysis.

C. Eligibility and Inclusion Criteria

The thorough screening process led to the determination of eligibility (inclusion and exclusion) criteria. Only records written in English were considered suitable for consideration due to the complexity of identifying interpreters for languages other than English. While non-abstract and identical records were disregarded as eligibility criteria, irrelevant documents were also removed. Due to the scarcity of research in cloud computing, particularly in developing countries, the document search, spanning from 2016 to 2025, was deemed suitable for inclusion. Studies conducted in the public sector were highly regarded for identifying relevant themes that can help respond to the research question.

V. RESULTS

The PRISMA flow chart (Fig. 2) illustrates the results of the search from the two databases (ProQuest and ScienceDirect), which generated a total of 1206 records (ProQuest: 754 and ScienceDirect: 452). While the screening process was unfolding, out of 1,206 documents, 985 were removed due to irrelevance, leaving 221. Following this, another screening phase took place, during which 23 non-abstract and identical records were eliminated from 221 records, leaving 198. Another round of the screening process was conducted to assess the quality, whereby 178 records were deleted due to poor quality, leaving 20. Therefore, all things considered, this study included 20 records comprising three categories that were deemed eligible (17 peer-reviewed journal articles, one conference paper, and two grey literature sources). Paper contributions were distributed across categories as follows: 85% peer-reviewed journal articles, 5% conference papers, and 10% grey literature.

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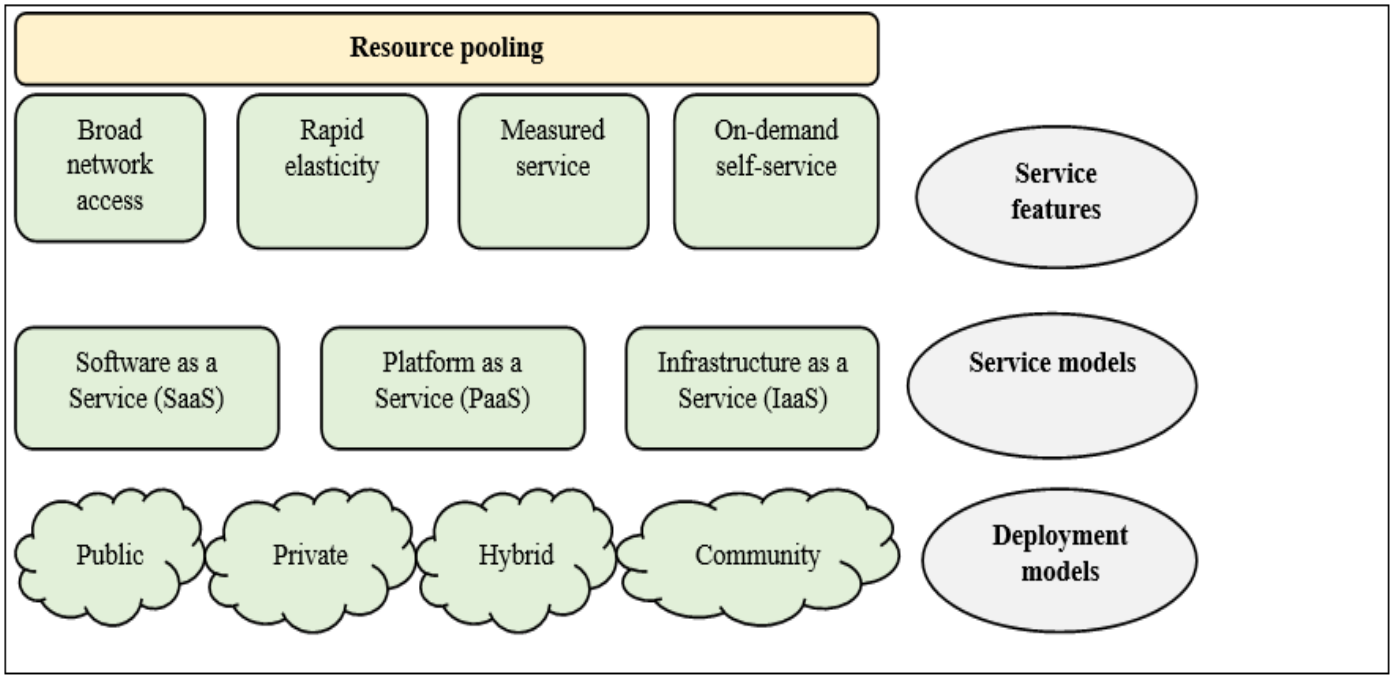

Fig 1 National Standards and Technology Institute Model of Cloud (Source: Shibambu, 2025).

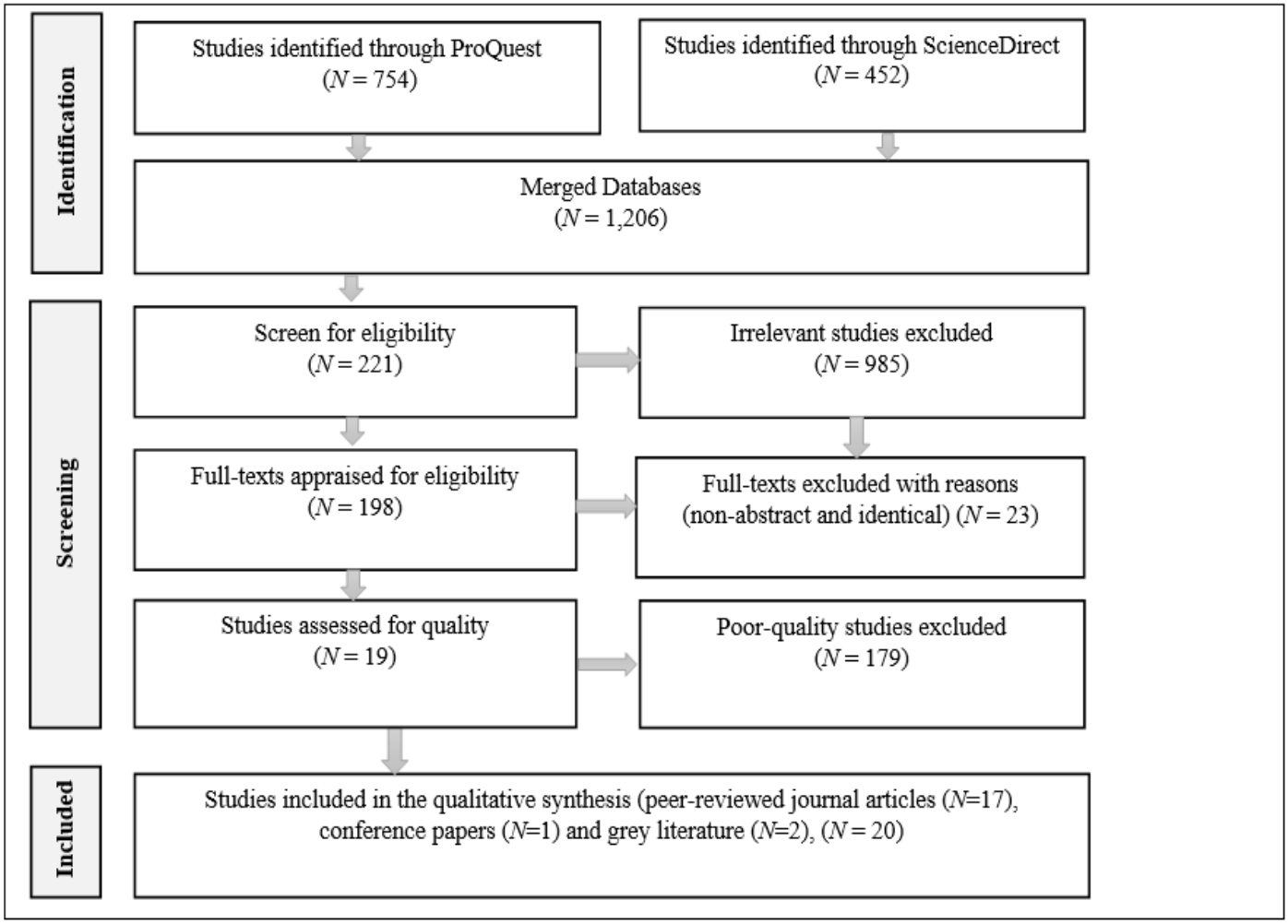

Fig 2 PRISMA Flow Diagram (Page et al. 2021).

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VI. DISCUSSION OF FINDINGS

This section discusses the findings emanated from the PRISMA technique in response to the research question: *What key constraints does the South African public administration face in adopting cloud computing?* The following themes were derived from the academic literature.

A. Inadequate Digital Infrastructure

Digital infrastructure is a key enabler for cloud computing in the public sector. Although cloud computing is replacing traditional server systems, without the capacity to invest in relevant virtual and cloud-based platforms, it is highly unlikely that the public sector will adopt modernized cloud services to deliver digitalized and efficient services to the community (Ionescu, 2025; Mmako & Kgopa, 2025). In a developing country context, for instance, inadequate infrastructure complemented by weaker internet connectivity and unreliable networks has been perceived as an obstacle hindering the adoption of cloud computing in the public sector (Amron et al., 2019). Henceforth, despite showing great interest in cloud computing due to the changes in the business environment, recent studies confirm that the South African public sector has been hindered by a limited ICT infrastructure that is not appropriate for adopting cloud services (Shibambu, 2025; Mojaki et al., 2025). This is consistent with the views of Mmako and Kgopa (2025), who note that even public hospitals in South Africa often face limited ICT infrastructure, which can lead to the manipulation of confidential information and deficiencies in patient data management. Furthermore, Mahusin et al. (2025) note that the public sector's paradigm shift from conventional *modus operandi* to cloud-based services, particularly in developing countries, remains a question due to the obfuscations and incompatibilities encountered in incorporating cloud computing into the existing infrastructure's systems and processes.

B. Limited Digital Literacy

Considering the burgeoning need to access several public services (e.g., health, education and municipal) through digital technologies (e.g., cloud computing, AI, the IoT, etc.), it is critical to capitalize on training and educating public servants to thrive in the digital era (Mahusin et al., 2025). That being the case, although the South African government has proclaimed the policy on the "Implementation program guide for the national digital and future skills strategy of South Africa," it aims to bridge the digital divide that has long existed in the country (DCDT, 2021). Generally, however, the strategy aims to reshape and remodel the public sector by accelerating and expanding existing programs and initiatives across various industries, with a focus on developing digital competencies, including cloud computing. Aside from that, the strategy also aimed to capacitate the targeted youth, aged between 18 and 35, to contribute to the country's economic growth. All things considered, the execution of such a policy is still dragging. As with other emerging digital technologies (e.g., AI, big data, virtual platforms, etc.), public servants require appropriate competencies to operate in the cloud computing environment (Shibambu, 2025). For example, while advanced economies (e.g., the United Kingdom, the United States of America, Australia, etc.) have yet employed cloud-based systems to administer data in various areas of public administration (e.g., healthcare services, education, and other non-profit institutions, *inter alia*), enabling scalable infrastructure and ensuring cost savings (Senyo et al., 2018; Scholtz et al., 2016), developing countries are still lagging in data governance primarily as a result of digital skills deficiencies (Alkhasawneh et al., 2025; Qatawneh, 2024).

C. Insufficient Legislative Framework

The legislative framework governing cloud computing plays a crucial role in the storage, handling, and retrieval of data, thereby saving costs associated with accessing public services (Mohlameane & Ruxwana, 2020). That said, it is argued that the speed at which digital technologies (including cloud computing) emerge calls for the rapid policy development and implementation (Senyo et al., 2016). As cited by Shibambu (2025), who opines that with the increasing adoption of emerging digital technologies (cloud computing, AI, the IoT, etc.) in the digital age, the policy and legal framework are imperative not only to ensure their smooth application but also to resolve persistent ethical issues encountered by many public sectors (data privacy and security). Furthermore, while operating in a cloud-based environment necessitates a regulated atmosphere, having a data security and privacy policy becomes vital in mitigating risks that may occur when utilizing cloud computing services in public administration and in improving society's needs (Najana & Ranjan, 2024). Most notably, "ensuring adherence to regulatory requirements remains a critical consideration for organisations leveraging cloud services, necessitating continuous monitoring and adaptation to evolving legal frameworks" (Yanamala, 2024:451). Moreover, considering that business conditions are ever-evolving and ubiquitous, the meticulous interpretation and appraisal of cloud computing's regulatory adherence are fundamental to streamlining public sector processes and delivering seamless, more efficient digital services (Brzozowska-Rup, 2024).

VII. CONCLUSIONS AND RECOMMENDATIONS

Cloud computing has significantly transformed government systems and processes in handling massive datasets. This study aimed to examine the key constraints that the South African public administration faces in adopting cloud computing within the digital landscape. The findings revealed three key constraints that the South African public sector faces in adopting cloud computing: inadequate digital infrastructure, limited digital competencies, and an insufficient legislative framework. As part of the legislative framework, the study identified that ethical concerns (privacy and security) are fundamental facets impacting the effective adoption of cloud computing in the South African public sector. Considering that the public sector in South Africa is at the early stages of embracing cloud computing, this study is significant in providing critical insights into the key constraints that are pivotal for enhancing this trailblazing digital technology. Furthermore, the implications of this study can assist policymakers and practitioners in the South African public sector in designing a policy and legislative

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framework that is imperative for accelerating the uptake of cloud computing.

Future studies can focus on the factors that should be considered when implementing cloud computing in the public sector of South Africa. Additionally, from a methodological perspective, future studies can employ both quantitative and qualitative research methods to gather primary data directly from respondents. For example, while quantitative methodology can employ a survey questionnaire to formulate hypotheses and generalize and validate research results pertaining to cloud computing, the qualitative approach can help gain rich data and insights from respondents through in-depth interviews, case studies, and focus groups. Lastly, future studies can suggest the development of a comprehensive or integrated research (conceptual) model for cloud computing that can help guide and provide direction about the design and implementation of such cutting-edge technology while taking into cognizance the findings and implications of this study (i.e., the contemplation of digital infrastructure, digital competencies and legislative framework).

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