

Cloud Computing Adoption and Performance of Civil Servants in Enugu State

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Abstract

The study evaluated the Cloud Computing Adoption and Performance of civil servants in Enugu state. The specific objectives are to: Examine the relationship between Internet connectivity and work efficiency; and ascertain the relationship between secure access control and output of Civil servants in Enugu state. The area of the study was Enugu State. The study used the descriptive survey design approach. The primary source of data was the administration of questionnaire. A total population of 265 staff was used. 237 staff returned the questionnaire and accurately filled. Data was presented and analyzed using Likert Scale and the hypotheses using Z - test. The findings indicated Internet connectivity had significant positive relationship with the work efficiency $Z(8.558)$, $P < .05$ and Secure access control had significant positive relationship with output of Civil servants in Enugu state, $Z(10.082)$, $P < .05$. The study concluded that Internet connectivity and secure access control had significant positive relationship with work efficiency and output of Civil servants in Enugu state. The recommended among others those Government agencies should prioritize the provision of reliable and high-speed internet connections in all departments.

Keywords: Cloud computing adoption, Internet connectivity, Secure access control, Civil servants performance, Enugu State Nigeria.

Cite: Chukwu, C., Fred., O. E. & Mbah, P. C. (2026). Cloud Computing Adoption and Performance of Civil Servants in Enugu State. *International Journal of Organizational Intelligence and Systems*, 4 (1), 1-18. <https://doi.org/10.5281/zenodo.18527627>

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Introduction

The swift progress in information and communication technologies (ICT) has revolutionized the public sector, with cloud computing standing out as a key transformative innovation. Cloud computing involves providing computing resources such as servers, storage, databases, networking, software, and analytics via the internet, delivering accelerated innovation, scalable resources, and cost efficiencies. For governments and civil service organizations, this technology offers substantial advantages, including improved service delivery, greater operational efficiency, and lower IT expenditures. Increasingly, adopting cloud computing has shifted from an optional enhancement to a strategic imperative in the public sector, particularly for civil servants. By enabling centralized access to data and applications from various locations, it promotes enhanced collaboration, transparency, and evidence-based decision-making in governance. This shift holds significant potential to boost civil servants' performance through increased productivity, quicker service provision, and better responsiveness to citizens' needs, although success depends on factors like infrastructure quality, supportive policies, security measures, organizational preparedness, and employees' digital skills (Okoye et al., 2021).

In public administration, cloud computing serves as a vital enabler of civil servants' performance by supplying flexible, scalable infrastructure that improves data availability and streamlines service processes. Amid evolving service demands and operational complexities, it equips agencies with the adaptability required to achieve contemporary governance objectives. The technology allows civil servants to access government data and applications in real time from anywhere, facilitating remote work, expedited decisions, and more efficient workflows that eliminate redundancies and improve task handling across departments. For example, shared cloud platforms enable seamless collaboration on policy documents, database management, and communication without location constraints. Centralized cloud systems also ensure data consistency, accuracy, and reliability, freeing civil servants from hardware limitations while benefiting from advanced security features like encryption and automated backups provided by cloud vendors (Ukwu et al., 2023).

Furthermore, cloud computing reduces reliance on expensive physical infrastructure and ongoing maintenance, which is especially valuable for budget-constrained public institutions. Civil servants can utilize sophisticated cloud-hosted applications without needing powerful local devices, allowing governments to redirect funds toward priority areas and optimize resource use. This cost-effectiveness supports higher productivity levels. Additionally, cloud systems promote greater transparency and accountability in public administration through traceable records, audit trails, and activity monitoring, which help curb inefficiencies and corruption. By enabling experimentation with innovative digital tools via models like Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS)—including analytics and citizen engagement solutions—cloud computing empowers civil servants to address modern challenges and meet rising public expectations. However, barriers such as skill deficiencies, resistance to change, and data sovereignty issues persist, underscoring the need for targeted training and capacity development. Against this backdrop, the study specifically assessed the adoption of cloud computing and its effects on the performance of civil servants in Enugu State.

Statement of the Problem

Cloud computing adoption has significantly reduced the burden on public sector organizations, including civil service institutions, by eliminating the need for substantial upfront investments in costly hardware, servers, and on-premises infrastructure. Instead, entities pay only for the resources they consume on a usage-based model, leading to lower overall IT expenses, more predictable budgeting, and greater financial efficiency. This pay-as-you-go approach enables seamless scalability, allowing public agencies to rapidly expand or contract computing power,

storage, or other capabilities in response to fluctuating workloads or seasonal demands—without the delays or expenses associated with traditional procurement. Moreover, cloud solutions grant civil servants flexible, location-independent access to applications and data via any internet-connected device, supporting remote work, travel, and collaborative efforts across dispersed teams. Leading providers further bolster reliability through advanced security protocols like encryption, firewalls, access controls, automated backups, and disaster recovery mechanisms, helping maintain business continuity and protect sensitive government information even during unforeseen disruptions.

Despite these advantages, successful cloud implementation in the public sector faces notable obstacles that can undermine its effectiveness and, consequently, the performance of civil servants and IT staff. Challenges include technical complexities in deployment, unreliable internet connectivity (particularly prevalent in developing regions like Nigeria), inadequate secure access controls, deficiencies in data governance expertise, and persistent budget limitations. Additional hurdles encompass data security risks, difficulties integrating cloud systems with outdated legacy infrastructure, and the requirement for extensive training to build digital skills among personnel. Failure to address these issues can limit the realization of cloud benefits, such as streamlined operations and enhanced productivity. Non-adoption perpetuates reliance on inefficient, high-maintenance local systems, resulting in elevated costs, hindered information sharing, reduced real-time collaboration, and heightened vulnerability to data breaches due to the absence of cutting-edge provider safeguards. This, in turn, diminishes work efficiency, output quality, and overall service delivery to citizens. In light of these dynamics, the study specifically examined cloud computing adoption and its implications for the performance of civil servants in Enugu State.

Objectives of the Study

The main objective of the study was to evaluate the Cloud Computing Adoption and Performance of civil servants in Enugu state. The specific objectives are to:

- i. Examine the relationship between Internet connectivity and work efficiency of Civil servants in Enugu state.
- ii. Ascertain the relationship between secure access control and output of Civil servants in Enugu state.

Research Questions

The following research questions guided the study

- i. What is the relationship between Internet connectivity and work efficiency of Civil servants in Enugu state?
- ii. What is the relationship between secure access control and output of Civil servants in Enugu state?

Statement of the Hypotheses

- i. Internet connectivity has relationship with the work efficiency of Civil servants in Enugu state.
- ii. Secure access control has relationship with output of Civil servants in Enugu state.

Scope of the study

The scope of the study was limited to evaluating the Cloud Computing Adoption and Performance of civil servants in Enugu state. Specifically, it focuses on examining the the relationship between Internet connectivity and work efficiency, relationship between secure access control and output of Civil servants in Enugu state. The geographical location is Enugu State - south east, Nigeria.

Review of Related Literature

Conceptual Review

Cloud Computing

Cloud computing involves the on-demand provision of IT resources—such as storage, computing power, servers, databases, and applications—delivered over the internet, offering scalability, cost savings, and access from anywhere. It removes the requirement for organizations to purchase and maintain physical hardware, instead enabling flexible, agile operations through pay-per-use models that shift expenses from capital to operational. Key characteristics include on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service, allowing quick adaptation to varying demands while minimizing upfront investments and enhancing collaboration and efficiency (Mell & Grance, 2011; Alshamaila et al., 2017; Hashem et al., 2020; Marston et al., 2021).

Cloud Computing Adoption

Cloud computing adoption describes the strategic shift by organizations, individuals, or governments from conventional on-premises IT setups to cloud-based solutions for storage, processing, and software needs. This process encompasses technological integration as well as adjustments in strategy, culture, and operations to fully leverage cloud advantages like improved efficiency, scalability, and innovation. Success hinges on elements such as perceived benefits (e.g., cost reduction and flexibility), organizational preparedness, data security, regulatory adherence, and overcoming integration hurdles, with utilization spanning models like IaaS, PaaS, and SaaS (Ali, Soomro, & Shah, 2020; Nwaiwu & Mtsweni, 2021; Abubakar et al., 2023; Chatterjee et al., 2022).

Components of Cloud Computing Adoption as used in the study

Internet Connectivity

Internet connectivity denotes the capacity for devices and users to connect to and interact with the internet through technologies like broadband, mobile, wireless, or satellite networks, facilitating access to online resources, cloud platforms, and digital services. Reliable, high-speed connectivity forms the essential foundation for effective digital operations, communication, innovation, and inclusion, enabling participation in e-government, online education, and broader digital economies (Agyepong et al., 2018; Sharma & Saini, 2021; Goggin, Martin, & Dwyer, 2022).

Secure Access Control

Secure access control involves mechanisms to regulate and limit entry to systems, networks, data, or facilities, ensuring only authorized users gain access while blocking unauthorized attempts. It incorporates authentication, authorization, and auditing processes to safeguard resources, adhering to principles like least privilege. In cloud settings, it enhances identity verification, mitigates cyber risks, and protects sensitive information through robust controls (Khan & Al-Yasiri, 2018; Tawalbeh et al., 2020; Zhou et al., 2021).

Performance

In the context of cloud computing, performance measures how effectively a cloud system provides services—including storage, processing, and networking—with high speed, reliability, scalability, and responsiveness to fulfill user requirements under varying conditions. It is evaluated through indicators such as low latency (minimal delay in data transfer), high throughput (volume of data processed over time), uptime, and overall efficiency, which are vital

for user satisfaction, business continuity, and on-demand resource handling (Youseff, Butrico, & Da Silva, 2017; Ali et al., 2020; Alenezi & Faisal, 2022).

Components of Performance as used in the study

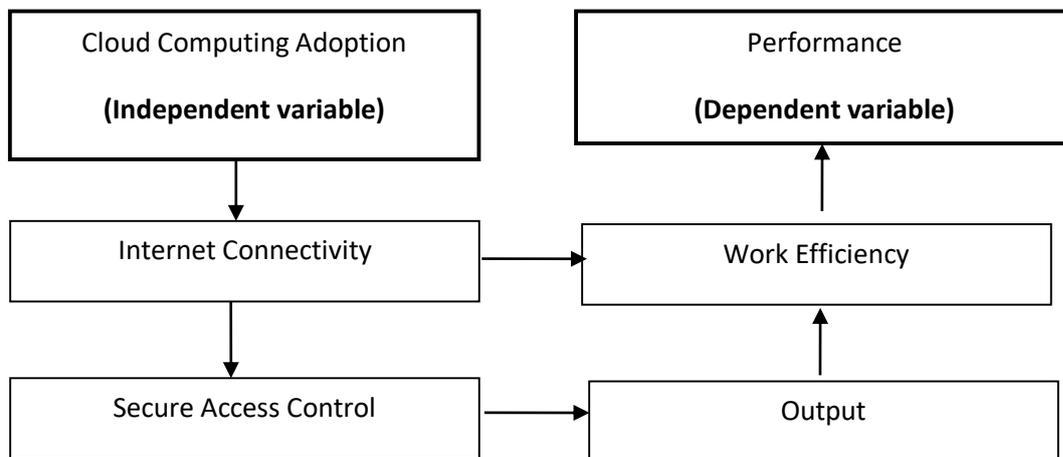
Work Efficiency

Work efficiency in cloud computing refers to the effective and optimal utilization of resources—such as processing power, storage, and bandwidth—to maximize productivity, minimize waste, latency, or energy use, and adapt dynamically to workloads. It is achieved through automation, streamlined processes, balanced load distribution, and reduced manual intervention, leading to faster task completion, fewer bottlenecks, and higher overall output (Baporikar, 2019; Kissi, Nat, & Idowu, 2020).

Output

Output in cloud computing encompasses the final results, deliverables, and value generated by cloud-based applications and services, including processed data, analytical results, application responses, and performance metrics. These outputs reflect productivity and goal attainment in digital environments, serving as key indicators of efficiency and success in meeting organizational objectives through scalable, accessible solutions (Nwachukwu & Chladkova, 2017; Osinowo & Ashraf, 2020).

Conceptual Models of the study



Source: Researchers' Model, 2025

Fig. 2.1: Researchers' Model, 2025

The diagram above shows the linkages between the various components of Cloud Computing Adoption and performance of civil servants in Enugu state. Cloud Computing Adoption has Internet Connectivity and Secure Access Control as the components of the independent variable while Performance has Work Efficiency and Output as the components of dependent variables.

Theoretical Framework

The following theories guided the study:

- i. Technology Acceptance Model (TAM) - (Fred Davis, 1986)
- ii. Diffusion of Innovation (DOI) Theory - (Everett Rogers, 1962)

Technology Acceptance Model (TAM) anchors the study because it is more directly concerned with the individual decision-making process related to technology use, which aligns closely with the study's focus on how cloud computing adoption affects the performance of civil servants. It provides a clearer framework for analyzing the study.

Technology Acceptance Model (TAM), developed by Fred Davis in 1986, focuses on how individuals decide to adopt and use new technology based on two key perceptions: usefulness and ease of use. It emphasizes the role of personal attitudes in influencing technology adoption and how these attitudes affect job performance. In the case of civil servants, TAM helps to understand how their perception of cloud computing tools influences their willingness to use them and how this, in turn, impacts their effectiveness at work.

Diffusion of Innovation (DOI) Theory, introduced by Everett Rogers in 1962, explains the process by which innovations spread through a social system over time. It considers factors such as the perceived benefits of the innovation, its compatibility with existing practices, and the influence of social networks. This theory is useful in examining how cloud computing adoption is encouraged within government institutions and how it gradually becomes accepted across different levels of the civil service.

Empirical review

Internet connectivity and work efficiency

Recent studies highlight the critical role of technology, ICT, and related innovations in influencing employee and organizational performance in Nigeria's public sector and related industries. Obioma (2019) examined technology's impact on public sector workers' productivity in federal ministries, departments, agencies (MDAs), and related entities, arguing that deficiencies in technology utilization—stemming from inadequate training programs, lack of organizational interest in scheduling computer and internet skills development, and management failures—lead to reduced productivity, poor performance, and broader negative economic effects, as evidenced by surveys showing employee disinterest and low output. Ukwu et al. (2023) investigated ICT utilization for social service delivery in Enugu State's local government councils, identifying potential applications like e-health, e-construction, and e-education to bridge grassroots service gaps amid globalization, while noting barriers such as personnel shortages, insufficient equipment, and funding constraints that hinder effective deployment. Parsoya (2023) addressed the productivity paradox—where IT investments often fail to yield expected gains—and explored internet connectivity's positive effects on workplace productivity, including a practical case of business model redesign for substantial efficiency improvements, emphasizing its importance for labor productivity and economic growth in developing contexts.

Onyema (2023) assessed ICT usage levels and their effects on employee performance in the Nigerian civil service through a cross-sectional survey of 1007 federal civil servants, finding a significant positive correlation between greater ICT deployment and improved performance, attributing poor public service delivery (e.g., in healthcare, education, and infrastructure) to limited ICT availability, low adoption rates, and insufficient skilled staff. Odunayo and Fagbemide (2024) explored remote work's impact on organizational efficiency in Nigeria's telecommunications industry post-COVID, using quantitative data from 275 participants across roles to demonstrate a significant positive

relationship between remote practices and industry metrics, while stressing the need for supportive organizational culture, collaborative regulatory frameworks, and strategies to address cultural, regulatory, and technological challenges for optimal implementation. Collectively, these studies underscore technology's potential to enhance productivity, service delivery, and efficiency in Nigeria's public and private sectors, tempered by persistent barriers like training deficits, infrastructure limitations, and adoption challenges that require targeted interventions for meaningful gains.

The relationship between secure access control and output of Civil servants in Enugu state

Recent studies emphasize the critical role of security measures, access controls, personnel safeguards, and modern work arrangements in enhancing trust, efficiency, and integrity within public administration and e-government systems. Civelek et al. (2016) highlighted the security threats accompanying e-government services—such as cyber attacks driven by financial motives or infrastructure disruption—and stressed the importance of robust solutions like data encryption, intrusion detection, user authentication, and comprehensive policies to prevent unauthorized access, data alteration, or theft, thereby building high levels of user confidence and trust among citizens, businesses, and government entities for successful e-government initiatives. Penelova (2021) provided an overview and comparative analysis of various access control models, evaluating them on parameters including user identity storage, delegation of trust, fine-grained policies, flexibility, scalability, time-based rules, workflow control, and application areas, while noting the evolution toward more complex models and prospects for future developments in information security. Kryshchanovych et al. (2022) analyzed personnel security within public administration, underscoring the civil service's central role in improving system efficiency through professional, competent staff, and positioning strengthened personnel security as a key reform direction to support effective managerial decision-making.

Umoh and Ekpo (2022) assessed biometrics' impact on fraud control in Akwa Ibom State's civil service, finding a significant relationship between employee identity numbers, electronic payroll systems, and reduced fraud, with the technology successfully eliminating ghost pensioners, duplicate payments, and underpayments via digitized databases, though challenges like feasibility, privacy concerns, data leaks, application issues, and integration with national identification persisted. Dos Santos et al. (2022) examined telework and management control systems (MCSs) in Brazil's Federal Public Ministry through structural equation modeling on 468 employees, revealing that perceived telework efficiency and certain MCSs (action and personnel controls) positively relate to congruence between civil servants' individual and organizational objectives, yet personnel controls negatively moderated the telework-congruence link when intensified, indicating context-specific effects on alignment in remote public sector settings. Collectively, these works illustrate the interplay of technological security, access governance, human resource protections, and adaptive management practices in bolstering public sector performance, trust, and resilience against risks.

Gap in Empirical Review

The studies done were carried outside the Cloud Computing Adoption and Performance of civil servants in Enugu state and did not focus to best of my knowledge on the Internet connectivity and work efficiency and secure access control and output of Civil servants in Enugu state. Most of the studies reviewed analyzed their data through Descriptive statistics and appropriate inferential statistics, Pearson Moment Correlation Coefficient, Kendall's correlation and Kruskal Wallis test, Partial Least Square Structural Equation Modeling (PLS-SEM), and Multiple Regression Analysis (MRA) method, while the present study made use of Pearson correlation coefficient (r) to test the hypotheses. Therefore, the study aimed at filling this research gap by evaluating the Cloud Computing Adoption and Performance of civil servants in Enugu state

Methodology

Research Design

Research design serves as a road map or plan or action showing what and how the researchers will carry out step by-step procedure of accomplishing the research endeavour. Succinctly put, it consists of the blue print for collection, evaluation and analysis of the necessary data for a study. For the study, the descriptive sample survey was employed. Descriptive analysis entails the systematic collection and prescription of data to give a clear picture of a particular situation.

Sources of Data

Sources of data for the empirical study were primary and secondary source.

Primary Sources

Questionnaire: - Data were obtained from information supplied by the respondents to questions contained in the questionnaire distributed to them and the questions are framed in the most simple and unambiguous ways to enable respondents answer those questions accurately.

Secondary Data

Secondary data are the already existing data collected by the investigator agencies and organizations. Secondary data include government publications, websites, books, journal articles, internal records etc.

Government Publications: The government publications collection consists of publications produced by the federal government and state government.

Area of the study

The areas of the study Enugu Metropolis, Enugu state, Nigeria.

The Population of the Study

The target population of the study consists of selected staff from the ministries in Enugu state civil servants who are in position and using ICT in Enugu Metropolis. They were chosen due high number of staff and ethical standard. The total population for the study was two hundred and sixty five(265). (See table for population distribution of the relevant ministries under study).

Table 3.1 Population of the firms understudy

S/N	State Ministries	Selected Staff	Percent
1	Min. of Finanace	43	16
2	Min. of Transports	58	22
3	Min. of Justice	54	21
4	Min. of Educations	62	23
5	Min. of Woman Affairs	48	18
Total		265	100

Source: Human Resources Department in February 2025

Sample Size Determination

The whole population was used due to small number staff of the study was drawn from the staff of the ministries under study using stratified sampling method.

Instrument for Data Collection

The questionnaire was designed and administered on the selected respondents in the organisations. The responses generated were used thereafter for data analysis. The responses from the participants were measured using 5-likert scale as follows: Strongly Agree [SA] –5 points, Agree A – 4 points, Undecided UN – 3 Points, Disagree [D] – 2 points and strongly Disagree SD – 1 point.

Validity of the Instrument

To ascertain the validity of the research instrument, the researcher subjected to face to face validation by giving it to a panel of judges comprising of three internal assessors, and two management experts that examined the items, and agreed that they were in line with the objectives of the study. Finally, the design of the questionnaire was made easy for the respondents to pick their preferred choice from the options provided.

Reliability of the Instrument

To test for reliability of the instrument, the study distributed 10 copies of the questionnaire to other firm’s s outside the study and, the Cronbach Alpha method was used to compute the internal consistency reliability estimate of the items. The instrument had an overall reliability Cronbach Alphaco-efficient of 0.83 which indicated that the instrument was reliable and, therefore, considered appropriate for use.

Table 3.3a Cronbach Alpha Reliability Test

		N	%
Cases	Valid	10	100.0
	Excluded	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Table 3.3b Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	NO of Items
.83	.85	20

SPSS 20.0 Output

Methods of Data Analyses

Data was collected, coded, grouped into frequencies, and arranged into tables for ease of reference. Data from the questionnaire was collected and analyzed using simple percentages and mean. To determine the nature and strength of relationship between the research variables, Pearson Correlations was used to test the hypotheses with aid of Special Package for Statistical Software (SPSS). For the 5-point likert scale questions, the scale and decision rule stated below was used in analysing the findings.

Scale

- Strongly Agree (SA) - 5
- Agree (A) 4
- Neutral(N) 3
- Disagree (D) - 2
- Strongly Disagree(SD) 1

Decision Rule

- If Mean >3.0, the respondents agree
- If mean ≤3.0, the respondents disagree

Data Presentation, Analysis and Interpretation of Data

Distribution and Return of Questionnaire.

The chapter presents and analyzes the data collected for the study. The presentation and interpretation of data were based on the questionnaire administered to the marketers under study.

Table 4.1 shows the Distribution and Return of the Questionnaire

Table 4.1 Distribution and Return of the Questionnaire

Firms	Distributed	No Returned	percent	No not Returned	Percent
i. Min. of Finance	43	40	15	3	1
ii. Min, of Transports	58	54	22	4	1
iii. Min.of Justice	54	43	20	11	5
iv. Min. of Educations	62	57	23	5	2
v. Min. of Womans Affairs	48	43	18	5	2
Total	265	237	89	28	11

Source: Field Survey, 2025

Two hundred and sixty five (265) copies of the questionnaire were distributed to the respondents and two hundred and thirty seven (237) copies were returned representing Eighty nine (89) percent, while twenty eight (28) copies of the questionnaire were not returned representing seven (7) percent. That showed a high rate of response.

4.2 Data presentation

Table 4.2.1.1: Responses on the relationship between Internet connectivity and work efficiency of Civil servants in Enugu state.

	5 SA	4 A	3 N	2 DA	1 SD	ΣFX	- X	SD	Decision
1 Reliable internet access allows civil servants to communicate more effectively within departments and across ministries through emails, instant messaging platforms and video conferencing.	480 96 40.5	216 54 22.8	177 59 24.9	44 22 9.3	6 6 2.5	923 237 100.0	3.89	1.117	Agree
2 Internet connectivity quickens the pace of interdepartmental coordination, reduces delays in file movement, thereby increasing efficiency	600 120 50.6	200 50 21.1	105 35 14.8	30 15 6.3	17 17 7.2	952 237 100.0	4.02	1.249	Agree
3 Online platforms offer civil servants access to virtual training programs, webinars, and professional courses that enhance their skills	500 100 42.2	200 50 21.1	162 54 22.8	32 16 6.8	17 17 7.2	911 237 100.0	3.84	1.244	Agree
4 With internet connectivity, civil servants can perform certain duties remotely, increasing flexibility and continuity of government services	520 104 43.9	288 72 30.4	87 29 12.2	26 13 5.5	19 19 8.0	940 237 100.0	3.97	1.228	Agree
5 The availability of internet connectivity enables civil servants to access government portals, databases, and regulatory information in real-time	620 124 52.3	268 67 28.3	54 18 7.6	34 17 7.2	11 11 4.6	987 237 100.0	4.16	1.132	Agree
Total Grand mean and standard deviation							3.976	1.194	

Source: Field Survey, 2025

Table 4.2.1.1, 150 respondents out of 237 representing 63.3 percent agreed that Reliable internet access allows civil servants to communicate more effectively within departments and across ministries through emails, instant messaging platforms and video conferencing with the mean score of 3.89 and standard deviation of 1.117. 170 respondents representing 71.7 percent agreed that Internet connectivity quickens the pace of interdepartmental coordination, reduces delays in file movement, thereby increasing efficiency with mean score of 4.02 and standard deviation of 1.249. 150 respondents representing 63.3 percent agreed that online platforms offer civil servants access to virtual training programs, webinars, and professional courses that enhance their skills with mean score of 3.84 and standard deviation of 1.244. 176 respondents representing 74.3 percent agreed that with internet connectivity, civil servants can perform certain duties remotely, increasing flexibility and continuity of government services with mean score of 3.97 and standard deviation of 1.228. 191 respondents representing 80.6 percent agreed that The availability of internet connectivity enables civil servants to access government portals, databases, and regulatory information in real-time with a mean score of 4.16 and standard deviation 1.132

Table 4.2.1.2: Responses on the relationship between secure access control and output of Civil servants in Enugu state.

		5	4	3	2	1	ΣFX	-	SD	Decision	
		SA	A	N	DA	SD		X			
1	Secure access control systems (like biometric authentication, keycards, or digital logins) prevent unauthorized access to government resources and sensitive areas.	425 97 40.9	360 83 35.0	21 14 5.9	60 30 12.7	40 13 5.5	906 237 100.0		3.93	1.212	Agree
2	The Secure access control systems limit interruptions and distractions, enabling civil servants to work more efficiently and focus on their responsibilities.	525 105 44.3	432 108 45.6	45 15 6.3	6 3 1.3	6 6 2.5	1014 237 100.0		4.28	.843	Agree
3	Reduced risk of cyber or physical data breaches improves trust in public services and allows civil servants to focus on delivering services rather than dealing with the aftermath of security incidents	610 122 51.5	380 95 40.1	42 14 5.9	10 5 2.1	1 1 .4	1043 237 100.0		4.40	.733	Agree
4	Secure access control supports data collection that helps management monitor civil servants' work patterns, allowing for better supervision, evaluation, and resource allocation.	555 111 46.8	412 103 43.5	39 13 5.5	8 4 1.7	6 6 2.5	1020 237 100.0		4.30	.854	Agree
5	Modern access control systems creates accountability and encourages punctuality and consistent attendance, which directly improves overall output.	435 87 36.7	472 118 49.8	39 13 5.5	28 14 5.9	5 5 2.1	979 237 100.0		4.13	.914	Agree
Total Grand mean and standard deviation									4.208	0.9112	

Source: Field Survey, 2025

Table 4.2.1.2, 180 respondents out of 237 representing 69.4 percent agreed that secure access control systems (like biometric authentication, keycards, or digital logins) prevent unauthorized access to government resources and sensitive areas with the mean score of 3.93 and standard deviation of 1.212. 213 respondents representing 89.9 percent agreed that The Secure access control systems limit interruptions and distractions, enabling civil servants to work more efficiently and focus on their responsibilities with mean score of 4.28 and standard deviation of .843. 217 respondents representing 91.6 percent agreed that reduced risk of cyber or physical data breaches improves

trust in public services and allows civil servants to focus on delivering services rather than dealing with the aftermath of security incidents with mean score of 4.40 and standard deviation of .733. 214 respondents representing 90.3 percent agreed that secure access control supports data collection that helps management monitor civil servants' work patterns, allowing for better supervision, evaluation, and resource allocation with mean score of 4.30 and standard deviation of .854. 206 respondents representing 86.5 percent agreed that Modern access control systems creates accountability and encourages punctuality and consistent attendance, which directly improves overall output with a mean score of 4.13 and standard deviation .914

Test of Hypotheses

Hypothesis One: Internet connectivity has relationship with the work efficiency of Civil servants in Enugu state.

One-Sample Kolmogorov-Smirnov Test

	Reliable internet access allows civil servants to communicate more effectively within departments and across ministries through emails, instant messaging platforms and video conferencing.	Internet connectivity quickens the pace of interdepartmental coordination, reduces delays in file movement, thereby increasing efficiency	Online platforms offer civil servants access to virtual training programs, webinars, and professional courses that enhance their skills	With internet connectivity, civil servants can perform certain duties remotely, increasing flexibility and continuity of government services	The availability of internet connectivity enables civil servants to access government portals, databases, and regulatory information in real-time
N	237	237	237	237	237
Uniform Parameters ^{a,b}	Minimum	1	1	1	1
	Maximum	5	5	5	5
Most Extreme Differences	Absolute	.405	.506	.422	.493
	Positive	.025	.072	.072	.080
	Negative	-.405	-.506	-.422	-.493
Kolmogorov-Smirnov Z	6.236	7.795	6.496	7.584	8.558
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000

a. Test distribution is Uniform.

b. Calculated from data.

Decision Rule

If the calculated Z-value is greater than the critical Z-value (i.e $Z_{cal} > Z_{critical}$), reject the null hypothesis and accept the alternative hypothesis accordingly.

Result

With Kolmogorov-Smirnon Z – value ranges from 6.236< 8.558 and on Asymp. Significance of 0.000, the responses from the respondents as display in the table is normally distributed. This affirms the assertion of the most of the respondents that Internet connectivity had significant positive relationship with the work efficiency of Civil servants in Enugu state.

Decision

Furthermore, comparing the calculated Z- value ranges from 6.236< 8.558 against the critical Z- value of .000(2-tailed test at 95 percent level of confidence) the null hypothesis were rejected. Thus the alternative hypothesis was accepted which states Internet connectivity had significant positive relationship with the work efficiency of Civil servants in Enugu state

Hypothesis Two: Secure access control has relationship with output of Civil servants in Enugu state.

One-Sample Kolmogorov-Smirnov Test

	Secure access control systems (like biometric authentication, keycards, or digital logins) prevent unauthorized access to government resources and sensitive areas.	The Secure access control systems limits interruptions and distractions, enabling civil servants to work more efficiently and focus on their responsibilities	Reduced risk of cyber or physical data breaches improves trust in public services and allows civil servants to focus on delivering services rather than dealing with the aftermath of security incidents	Secure access control supports data collection that helps management monitor civil servants' work patterns, allowing for better supervision, evaluation, and resource allocation.	Modern access control systems creates accountability and encourages punctuality and consistent attendance, which directly improves overall output.	
N	237	237	237	237	237	
Uniform Parameters ^{a,b}	Minimum	1	1	1	1	
	Maximum	5	5	5	5	
Most Extreme Differences	Absolute	.509	.649	.666	.653	.615
	Positive	.055	.025	.004	.025	.021
	Negative	-.509	-.649	-.666	-.653	-.615
Kolmogorov-Smirnov Z	7.844	9.987	10.247	10.052	9.467	
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000	

a. Test distribution is Uniform.
b. Calculated from data.

Decision Rule

If the calculated Z-value is greater than the critical Z-value (i.e $Z_{cal} > Z_{critical}$), reject the null hypothesis and accept the alternative hypothesis accordingly.

Result

With Kolmogorov-Smirnon Z – value ranges from 7.721< 10.082 and on Asymp. Significance of 0.000, the responses from the respondents as display in the table is normally distributed. This affirms the assertion of the most of the respondents that Secure access control had significant positive relationship with output of Civil servants in Enugu state.

Decision

Furthermore, comparing the calculated Z- value ranges from 7.721< 10.082 against the critical Z- value of .000(2-tailed test at 95 percent level of confidence) the null hypothesis were rejected. Thus the alternative hypothesis was accepted which states that Secure access control had significant positive relationship with output of Civil servants in Enugu state.

Discussion of Findings

Internet connectivity has relationship with the work efficiency of Civil servants in Enugu state.

The results of Hypothesis One indicate a significant positive relationship between internet connectivity and the work efficiency of civil servants in Enugu State, as evidenced by calculated Z-values ranging from 6.236 to 8.558, which substantially exceed the critical Z-value of 0.000 (demonstrating strong statistical significance). This finding is reinforced by relevant literature on the link between connectivity, ICT, and performance. Parsoya (2023) explored the relationship between internet connectivity and workplace productivity, synthesizing recent research and presenting a practical case where internet utilization, through complete business model redesign, yielded exceptionally high productivity improvements, underscoring its essential role in driving efficiency gains in developing economies. Similarly, Onyema (2023) examined ICT usage levels in the Nigerian federal civil service via a cross-sectional survey and found a significant positive correlation between greater ICT deployment—including reliable internet access—and enhanced employee performance, attributing suboptimal service delivery in part to limited connectivity and ICT infrastructure. Together, these studies support the notion that robust internet connectivity serves as a foundational enabler for improved work efficiency and overall productivity among civil servants in resource-constrained public sector contexts like Nigeria.

Secure access control has relationship with output of Civil servants in Enugu state.

The results of Hypothesis Two reveal a significant positive relationship between secure access control and the output of civil servants in Enugu State, as demonstrated by calculated Z-values ranging from 7.721 to 10.082, which greatly surpass the critical Z-value of 0.000 (indicating robust statistical significance). This outcome is corroborated by pertinent literature emphasizing the role of effective access controls in enhancing security, integrity, and performance in public sector systems. Penelova (2021) provided a comprehensive overview and comparative analysis of access control models in information technology security, detailing how these models regulate requests to system resources through varying designs, components, policies, and applications, and noting the ongoing evolution toward more sophisticated frameworks to address growing technological complexities. Similarly, Umoh and Ekpo (2022) investigated the implementation of biometrics for fraud control in the Akwa Ibom State civil service, finding a significant association between employee identity numbers, electronic payroll systems, and improved fraud prevention, which contributed to more accurate, reliable, and high-quality administrative outputs by eliminating issues such as ghost workers, duplicate payments, and identity deception. Together, these studies support the conclusion that robust secure access mechanisms—whether through advanced models or biometric verification—directly bolster the quality, accuracy, and productivity of civil servants' deliverables in resource-constrained public administration environments.

Summary of Findings, Conclusion, Recommendation and Contribution to Knowledge

Summary of Findings

- i. Internet connectivity had significant positive relationship with the work efficiency of Civil servants in Enugu state, $Z(8.558)$, $P. < .05$
- ii. Secure access control had significant positive relationship with output of Civil servants in Enugu state, $Z(10.082)$, $P. < .05$

Conclusion

The study concluded that Internet connectivity and secure access control had significant positive relationship with work efficiency and output of Civil servants in Enugu state. Cloud computing adoption in Enugu State holds great

promise for transforming public service delivery. With strategic planning, capacity building, and infrastructural support, the performance of civil servants can be greatly enhanced through the sustained use of cloud technologies. Cloud computing enables government agencies to access shared digital resources, data storage, and computing power on-demand via the internet, leading to improved flexibility, efficiency, and service delivery.

Recommendations

- i. Government agencies should prioritize the provision of reliable and high-speed internet connections in all departments. Efficient internet connectivity is a critical enabler of real-time communication, fast data access, and seamless use of digital tools that enhance civil servants' performance. Poor connectivity leads to delays in task execution and frustration among staff, reducing overall productivity.
- ii. Government agencies should adopt Role-Based Access Control systems to ensure that civil servants only access data and applications relevant to their roles. This minimizes the risk of unauthorized access, enhances operational focus, and improves the accuracy and speed of task execution, thereby increasing productivity.

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