

ASSESSING THE EFFECT OF INFORMATION AND COMMUNICATION TECHNOLOGY EXPENDITURE ON ORGANIZATIONAL EFFICIENCY: A COMPARATIVE STUDY OF SUB-SAHARAN FIRMS

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ABSTRACT

This study examines how information and communication technology (ICT) spending affected the efficiency of organizations in Sub-Saharan African businesses. The study used fixed effect regression, panel unit root tests, and descriptive statistics to analyze data from a balanced panel dataset that covered 16 companies between 2013 and 2024. The results showed that the impact of ICT spending on organizational efficiency varies. Software capitalization, software intensity, and ICT fixed asset investment all have substantial negative consequences, indicating inefficiencies brought on by misalignment and underuse of ICT resources. On the other hand, the ratio of ICT expenses to income has a beneficial impact on organizational efficiency, suggesting that flexible and adaptable ICT spending improves operational responsiveness. The study concluded that strategic allocation and efficient use are more important than ICT spending alone, which does not ensure efficiency advantages. By providing firm-level evidence from Sub-Saharan Africa, the findings add to the body of literature on ICT efficiency. To improve efficiency and competitiveness, managers and policymakers are urged to implement adaptable ICT investment strategies, bolster ICT governance, and match technology investments with organizational procedures.

Keywords: *Employee productivity, Firm size, ICT expenditure, Organizational efficiency, Sub-Saharan African firms.*

1 INTRODUCTION

In the era of rapid technological advancement, Information and Communication Technology (ICT) has become a vital tool for driving organizational efficiency and productivity. ICT expenditure,

encompassing investments in hardware, software, and digital services, is widely recognized as a catalyst for digital transformation and enhanced operational performance. The Organization for Economic Co-operation and Development (OECD, 2019) emphasizes that strategic ICT investments play a critical role in fostering productivity and competitiveness across economies. Similarly, empirical studies, such as the International Monetary Fund's (IMF, 2023) analysis of the United Arab Emirates (UAE), reveal that ICT investments yield significant economic dividends, particularly in fostering non-oil sector growth. Despite the global recognition of ICT's importance, the specific impact of ICT expenditure on organizational efficiency particularly in emerging markets remains an area requiring further exploration.

Therefore, this study seeks to investigate the relationship between ICT expenditure and organizational efficiency, drawing insights from international and national contexts.

2. Literature Review and Hypothesis Development

Global Perspectives on ICT Investments

The OECD (2019) reports that ICT investments have become fundamental to the modernization of public and private sector activities, with countries prioritizing such expenditures to accelerate digital transformation. By improving business processes, communications, and decision-making capabilities, ICT investment enhances organizational efficiency and economic growth.

The IMF (2023) study focusing on the UAE found that ICT expenditures have a larger multiplier effect on non-oil GDP compared to non-ICT investments. This suggests that targeted ICT spending not only stimulates economic growth but also fosters structural transformation and improved organizational outcomes. Erman, Rojko, and Lesjak (2020) corroborated these findings by highlighting that both traditional ICT expenditures (e.g., infrastructure) and newer forms (e.g., digital services) significantly influence labor productivity and economic growth. Enhanced labor productivity at the national level often mirrors improvements in organizational processes and efficiency.

ICT Expenditure and Organizational Performance in Nigeria

The Nigerian context provides valuable insights into ICT's role in enhancing organizational performance. Alao-Owunna and Adediwura (2023) analyzed ICT indicators such as mobile subscriptions and internet usage and found a positive link between mobile adoption and economic growth. Although internet usage showed a weaker relationship, the findings suggest that ICT infrastructure is vital to organizational operations.

Abdullahi and Adamu (2023) confirmed through ARDL modeling that ICT investment positively impacts Nigeria's economic growth. Their study implies that firms adopting ICT tools could expect improved operational efficiency, innovation, and competitiveness. Also, Nwala, Abubakar, and Onibiyo (2020) found that investments in ICT hardware and software significantly improved the financial performance of insurance companies in Nigeria, affirming that proactive ICT adoption boosts organizational profitability and operational effectiveness.

Empirical Review

Enomate and Audu (2022) examined the effect of Information and Communication Technology on the financial performance of listed non-financial firms in Nigeria. The study was anchored on the resource-based theory, which also serves as the theoretical foundation for the present study. Data were obtained from twenty (20) non-financial service companies across various sectors listed on the Nigerian Stock Exchange for the period 2016–2020. The analysis employed both descriptive and inferential statistical techniques. The findings revealed that investment in Information and Communication Technology (ICT) infrastructure positively influences the financial performance of listed non-financial firms in Nigeria.

However, investment in ICT personnel was found to have a positive but statistically insignificant effect on the financial performance of these firms.

In 2019, the Organisation for Economic Co-operation and Development conducted an extensive assessment of ICT investment patterns across member and partner economies, highlighting that expenditure on ICT improves productivity and drives modernization, especially through process optimization and the promotion of innovation within organizations.

In the United Arab Emirates, the International Monetary Fund (2023) found that ICT expenditures generated a stronger multiplier effect on non-oil GDP than non-ICT investments. This evidence suggests that ICT investment not only promotes economic diversification but also enhances organizational efficiency and resilience in non-traditional sectors. Similarly, Erman, Rojko, and Lesjak (2020) reported a strong positive association between both conventional and emerging ICT investments and labor productivity across multiple economies, indicating that organizations that invest in modern ICT infrastructure and services achieve higher productivity and operational efficiency.

Focusing on Nigeria, Alao-Owunna and Adediwura (2023) observed that mobile telephone subscriptions positively affected economic growth, suggesting that greater adoption of ICT tools within organizations correlates with enhanced operational efficiency. Also, Abdullahi and Adamu (2023) established that ICT and foreign direct investment jointly drive economic growth in Nigeria, while trade openness had no significant impact. Their findings imply that targeted ICT expenditure is crucial for organizational success in emerging markets.

In the same vein, Nwala, Abubakar, and Onibiyo (2020) provided firm-level evidence from insurance companies, showing that investments in ICT hardware and software significantly boosted financial performance, reaffirming the strategic role of ICT in enhancing organizational outcomes.

Hypothesis Development

Based on the reviewed literature, the following hypotheses were proposed:

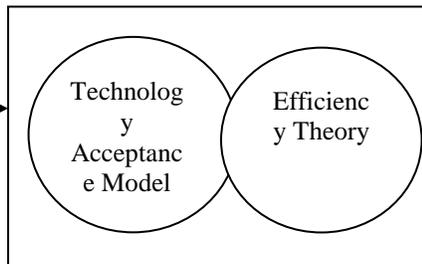
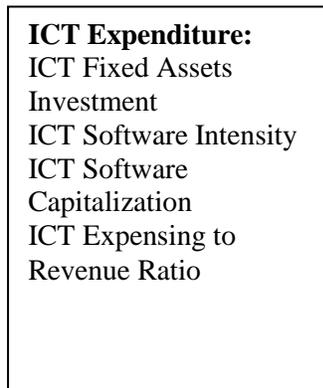
H₀₁: ICT expenditure has a positive effect on organizational efficiency.

H₀₂: ICT investment enhances innovation and competitiveness, contributing to organizational efficiency.

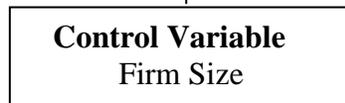
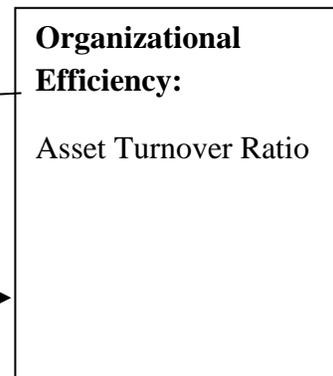
H₀₃: Investments in ICT hardware and software lead to improved financial performance and organizational efficiency.

Conceptual Framework

Independent Variables



Dependent Variable



Source: Author, 2025.

Related theories to this study are:

Technology Acceptance Model (TAM): The Technology Acceptance Model (TAM) was developed by Fred Davis in 1986 as a theoretical framework to explain how users come to accept and use a particular technology. TAM posits that two primary factors influence users' decisions regarding technology adoption: perceived usefulness (PU) and perceived ease of use (PEOU) (Davis, 1986). Perceived usefulness refers to the degree to which a person believes that using a specific technology will enhance their job performance, while perceived ease of use pertains to the extent to which a person believes that using the technology will be free of effort.

These perceptions shape users' attitudes towards the technology, which in turn influence their intention to use it and their actual usage behavior. When employees perceive that a new ICT system is useful and easy to use, they are more likely to develop a positive attitude toward it, intend to use it, and integrate it into their daily work routines.

The model explains how users form attitudes and intentions to use technology, including ICT. The model can be used to understand how ICT expenditure affects organizational efficiency by examining the attitudes and intentions of employees towards ICT adoption.

Efficiency Theory: Efficiency Theory, rooted in economics and management science, asserts that firms strive to maximize efficiency by minimizing waste and optimizing the allocation of resources. According to this theory, organizations continuously seek to produce the highest possible output with the least amount of input, thereby ensuring cost-effectiveness and competitiveness in the market.

Efficiency Theory suggests that investments in information and communication technologies should be strategically directed toward enhancing operational efficiency. ICT systems can automate routine tasks, streamline business processes, facilitate better communication, and enable faster decision-making. As a result, organizations can achieve significant cost reductions, minimize errors, improve productivity, and enhance service delivery

3.0 Methodology

The study employed a quantitative research design, using secondary data from Sub-Saharan African firms, collected data from reputable sources such as the World Bank, International Telecommunication Union (ITU), and national statistical offices.

Data collected were analyzed using descriptive statistics, correlation analysis, and regression analysis to examine the relationship between ICT expenditure and organizational efficiency.

Model Specifications:

$$\text{Model: } OE = \beta_0 + \beta_1 \text{ICT-FAI} + \beta_2 \text{ICT-SI} + \beta_3 \text{ICT-ERR} + \beta_4 \text{ICT-SC} + \text{FS} + U$$

Where:

OE=Organizational Efficiency

ICT-FAI=ICT Fixed Asset Investment

ICT-SI=ICT Software Intensity

ICT-ERR=ICT Expensing to Revenue Ratio

ICT-SC=ICT Software Capitalization

FS=Firm Size

U=Error term

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8$ represent the coefficient of the independent variable

4.0 DATA ANALYSIS AND RESULT

Table 4.1: Descriptive Statistics Result

| Variables | OE | ICT_FAI | ICT_SC | ICT_ERR | ICT_SI | FS |
|-----------|----|---------|--------|---------|--------|----|
|-----------|----|---------|--------|---------|--------|----|

| | | | | | | |
|--------------|----------|----------|----------|----------|-----------|----------|
| Mean | 0.354333 | 0.490083 | 0.101500 | 0.523167 | 0.131167 | 8.008333 |
| Median | 0.284500 | 0.484000 | 0.084000 | 0.453500 | 0.134000 | 7.450000 |
| Maximum | 0.670000 | 0.797000 | 0.199000 | 0.894000 | 0.199000 | 11.81000 |
| Minimum | 0.130000 | 0.206000 | 0.015000 | 0.206000 | 0.041000 | 6.010000 |
| Std. Dev. | 0.181736 | 0.193186 | 0.063695 | 0.233909 | 0.053363 | 1.678917 |
| Skewness | 0.481038 | 0.178416 | 0.256933 | 0.322334 | -0.167926 | 1.001672 |
| Kurtosis | 1.724264 | 1.833110 | 1.683625 | 1.840508 | 1.607978 | 3.011363 |
| Jarque-Bera | 20.42474 | 11.91170 | 15.97521 | 14.08016 | 16.40416 | 32.10811 |
| Probability | 0.000037 | 0.002591 | 0.000340 | 0.000876 | 0.000274 | 0.000000 |
| Observations | 192 | 192 | 192 | 192 | 192 | 192 |

Source: Data Analysis, 2025

The descriptive features of firm size (FS), ICT spending variables, and organizational efficiency (OE) over 192 panel observations are shown in Table 4.1. According to the mean organizational efficiency value (0.354), businesses generally operate at a moderate degree of efficiency throughout the study period. A somewhat steady efficiency pattern among the sampled enterprises is implied by the relatively close median (0.285), which indicates minimal distortion from extreme values. However, there is significant variation in efficiency performance among organizations, as evidenced by the large difference between the minimum (0.130) and maximum (0.670) values.

With a mean of 0.490, ICT Fixed Asset Investment (ICT_FAI) shows that almost half of businesses' ICT spending goes into fixed assets like hardware and infrastructure. The standard deviation (0.193), which represents the dispersion, indicates that enterprises' ICT infrastructure investment choices differ noticeably. ICT Expensing to Revenue Ratio (ICT_ERR) has a higher mean value (0.523), indicating that businesses primarily expense rather than capitalize ICT-related costs, whereas ICT Software Capitalization (ICT_SC) has a relatively low mean (0.102), suggesting limited capitalization of software investments. With a modest mean of 0.131, ICT Software Intensity (ICT_SI) shows comparatively low software utilization intensity in business processes. The sample's mean firm size (FS) is 8.008, indicating a moderate firm scale. The significant Jarque-Bera statistics further support the small deviations from normality indicated by the skewness and kurtosis values across variables. The employment of panel regression techniques instead of straightforward OLS calculations is justified by this non-normal distribution.

Table 4.2: Unit Root Test Result - ADF - Fisher Chi-square Method

| Variables | t-statistics | Probability | Cross-Section | Observation |
|-----------|--------------|-------------|---------------|-------------|
| OE | 85.0819 | 0.0000 | 16 | 192 |
| ICT_FAI | 129.734 | 0.0000 | 16 | 192 |
| ICT_SC | 150.311 | 0.0000 | 16 | 192 |
| ICT_ERR | 40.3374 | 0.0080 | 16 | 192 |
| ICT_SI | 119.599 | 0.0000 | 16 | 192 |
| FS | 119.714 | 0.0000 | 16 | 192 |

Source: Data Analysis, 2025

The ADF–Fisher Chi-square panel unit root test is used to report the stationarity qualities of the variables in Table 4.2. With probability values < 0.05, the results demonstrate that every variable is statistically significant at conventional levels. This suggests that business size, ICT spending variables, and organizational efficiency are all level. The likelihood of erroneous regression findings is decreased because the variables' stationarity suggests that there are no unit root issues. As a result, the variables can be used for panel regression analysis without the necessity for differencing, which improves the validity and dependability of later empirical results.

Table 4.3: Model Selection and Other Diagnostic Tests

| Tests | Statistics | Probability | Decision |
|---|------------|-------------|-----------------------------|
| Breusch-Pagan Test (Pool Least Square Vs Random Effect) | 8.72727 | 0.17313 | Null hypothesis is accepted |
| F-Restricted Test (Pool Least Square Vs Fixed Effect) | 1.33209 | 1.0000 | Null hypothesis is accepted |
| Heteroskedasticity: White's test | 192.000 | 0.743000 | Null hypothesis is accepted |
| Durbin-Watson (DW) stat | 3.077784 | | DW is greater than 2 |

Source: Data Analysis, 2025

The model selection and diagnostic test results are shown in Table 4.3. The null hypotheses are accepted since the Breusch-Pagan and F-restricted tests yield insignificant probability values. These findings support the choice of the fixed effect model by showing that random effects and pooled least squares models are inappropriate for the data format. The negligible probability value from the White heteroskedasticity test further supports the lack of heteroskedasticity. Furthermore, the Durbin-Watson value of 3.078 indicates that the model does not have a significant autocorrelation issue. When taken as a whole, these diagnostic findings confirm the fixed effect regression model's statistical soundness and suitability for inference.

Table 4.4: Fixed Effect Regression Result

| SERIES: OE, ICT_FAI, ICT_SC, ICT_ERR, ICT_SI, FS | | | | |
|--|-------------|------------|-------------|--------|
| Dependent Variable: OE | | | | |
| Method: Fixed Effect Model | | | | |
| Date: 12/13/25 Time: 02:20 | | | | |
| Sample: 2013 2024 | | | | |
| Periods included: 12 | | | | |
| Cross-sections included: 16 | | | | |
| Total panel (balanced) observations: 192 | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| Constant | 0.745745 | 0.096461 | 7.731039 | 0.0000 |
| ICT_FAI | -0.242361 | 0.064348 | -3.766409 | 0.0002 |
| ICT_SC | -0.641326 | 0.200163 | -3.204015 | 0.0016 |
| ICT_ERR | 0.236836 | 0.063265 | 3.743534 | 0.0002 |
| ICT_SI | -1.192837 | 0.226812 | -5.259156 | 0.0000 |
| FS | -0.021850 | 0.007177 | -3.044474 | 0.0027 |
| R-squared | 0.797545 | | | |

| | |
|--------------------|----------|
| Adjusted R-squared | 0.727083 |
| F-statistic | 5.641940 |
| Prob(F-statistic) | 0.000000 |

Source: *Data Analysis, 2025*

The fixed effect regression estimates looking at how ICT spending affects organizational effectiveness are shown in Table 4.4. The negative and statistically significant coefficient of ICT Fixed Asset Investment (ICT_FAI) indicates that excessive investment in ICT infrastructure without matching use may lower organizational efficiency. In a similar vein, ICT Software Capitalization (ICT_SC) exhibits a strong negative impact, suggesting inefficiencies brought on by underutilized or inadequately integrated software assets.

On the other hand, there is a positive and significant correlation between organizational efficiency and the ICT Expensing to Revenue Ratio (ICT_ERR), suggesting that companies that expense ICT costs flexibly may have better operational responsiveness. A large negative coefficient is also recorded by ICT Software Intensity (ICT_SI), indicating inefficiencies associated with an excessive reliance on software without sufficient structural or human support. Efficiency is negatively impacted by firm size (FS), suggesting that larger companies may face coordination issues and bureaucratic rigidities that lower efficiency. The strong R-squared value (0.798) indicates that a significant amount of variance in organizational efficiency can be explained by both company size and ICT expenditure variables.

Discussion of Findings

The results show that investing in ICT does not always improve organizational efficiency. The negative effects of ICT_FAI, ICT_SC, and ICT_SI indicate that inefficiencies occur when ICT investments are not in line with operational needs, despite the theoretical expectation that ICT investments will increase efficiency. This is consistent with earlier research that contends that strategic implementation - rather than the amount of money spent - determines the benefits of ICT. These results are in line with the outcomes of the research conducted by Abdullahi and Adamu (2023): Alao-Owunna and *Adediwura* (2023) among other researchers.

The claim that flexible and adaptive ICT investment increases operational agility is supported by the benefits of ICT expenditures. This result is in line with previous research that highlights the value of flexible ICT investment strategies over strict capitalization techniques. The detrimental impact of company size supports previous research that emphasizes scale-related inefficiencies in big businesses, especially in developing nations. Overall, the results support the Efficiency Theory and the Technology Acceptance Model, which prioritize efficient use, flexibility, and integration over simple technology acquisition.

5.0 Conclusion

The study comes to the conclusion that strategic allocation and efficient use are more important than ICT spending alone, which does not ensure efficiency advantages. By providing firm-level evidence from Sub-Saharan Africa, the findings add to the body of literature on ICT efficiency.

To improve efficiency and competitiveness, managers and policymakers are urged to implement adaptable ICT investment strategies, bolster ICT governance, and match technology investments with organizational procedures. Efficiency issues are made worse by firm size, which suggests that larger firms have structural rigidities.

Contributions to Knowledge

The study extends the body of literature by providing firm-level empirical data on the distinct effects of ICT expenditure components on organizational efficiency. By showing that ICT investment efficacy is more dependent on strategic allocation and use than on investment volume, it extends current knowledge. The study also adds to the body of knowledge on ICT efficiency in the understudied Sub-Saharan African context.

Policy Recommendations

In order to minimize inefficiencies related to over-capitalization, policymakers should encourage firms to adopt flexible ICT expenditure frameworks that prioritize operational adaptability over asset accumulation. Firms should concentrate on aligning ICT investments with organizational processes and employee capabilities. Regulatory bodies may also consider developing guidelines for ICT investment evaluation and management of large firms should adopt decentralization strategies to mitigate scale-related inefficiencies.

REFERENCES

- Abdullahi, A., & Adamu, M. (2023). An assessment of the impact of information and communication technology (ICT) sector on economic growth in Nigeria. Retrieved from https://www.researchgate.net/publication/376957610_An_Assessment_of_the_Impact_of_Information_and_Communication_Technology_ICT_Sector_on_Economic_Growth_in_Nigeria
- Alao-Owunna, F. I., & Adediwura, A. A. (2023). ICT expenditure and economic growth in Nigeria. *Asian Journal of Economics, Business and Accounting*, 23(2), 1-13. <https://journalajeba.com/index.php/AJEBA/article/view/9552>
- Davis, F. D. (1986). A technology acceptance model for empirically testing new end-user information systems: Theory and results (Doctoral dissertation, Massachusetts Institute of Technology).
- Erman, U., Rojko, A., & Lesjak, D. (2020). The impact of ICT investments on labor productivity and GDP growth. *Journal of Computer Information Systems*, 60(5), 1-9. <https://www.tandfonline.com/doi/abs/10.1080/08874417.2020.1830007>
- International Monetary Fund. (2023). United Arab Emirates: Selected issues. IMF Country Report No. 23/224. Retrieved from <https://www.elibrary.imf.org/view/journals/002/2023/224/article-A003-en.xml>
- Nwala, A., Abubakar, A., & Onibiyo, T. (2020). ICT investment and financial performance of listed insurance firms in Nigeria. *Journal of Economics and Economic Research*, 6(2), 103-117. <https://jearecons.com/index.php/jearecons/article/view/168>
- Organisation for Economic Co-operation and Development. (2019). ICT investments in OECD countries and partner economies. Retrieved from https://www.oecd.org/en/publications/ict-investments-in-oecd-countries-and-partner-economies_bcb82cff-en.html
- Enomate, B., and Audu I. O., (2022) Effect of Information and Communication Technology on Financial Performance of Listed Non-Financial Firms in Nigeria. *Bingham International Journal of Accounting and Finance* 2(2), 2735 – 9