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Computer Network Usage and Performance in Teaching, Learning and Administration operations: A case of Tanzanian Universities

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ABSTRACT

The main purpose of this study is to determine how computer networks (CNs) affects teaching and learning (T&L) and administrative operations performance at Tanzanian universities. A questionnaire was used as part of a quantitative methodology to gather data for this study. The response rate was 97.95% out of 342 respondents, including students, academic and non-academic staff. Confirmatory factor analysis (CFA) and the PLS-SEM technique in SPSS version 21 were used to analyze the data. Only two (2) of the twelve (12) hypotheses assessed in this study have demonstrated an insignificant effect on university performance in terms of T&L and administrative operations, as indicated by p-values > 0.01. Correlation of CNs and costs/expenses on performance expectancy, as well as the correlation of CNs and conveniences had a statistically insignificant effect on effort expectancy. The results of this study serve as a wake-up call for education stakeholders to revise the current ICT policy to continue adopting CNs infrastructure for enhancing accessibility in T&L and administrative operations. In terms of measures such as cost/expenses, service delivery speed, service quality, and conveniences that were not fully integrated and addressed in earlier similar studies, these variables were evaluated against T&L and administrative performance.

Keyword: *ICTs; Teaching and Learning; Computer networks; administrative operations; PLS-SEM; University performance; LAN/WAN; Information Technology*

INTRODUCTION

Information and communication technologies (ICTs) have been used more and more in Tanzanian universities in recent years to improve teaching, learning, and research processes. However, the effectiveness of these technologies is largely dependent on the underlying computer network infrastructure. Accessing educational resources, working with faculty and peers, and conducting research all depend on a strong and dependable computer network, but network performance in many Tanzanian universities continues to be a major obstacle to the advancement of academic activities and the full potential of ICT integration (Mwangakala, 2023).

Student learning is among the most important effects of subpar computer network performance. E-books, research papers, and online courses are just a few of the many online services that students use to enhance their education. Additionally, university computer networks provide online contact between students and instructors as well as online access to student results. For instance, it has been observed that frequent network outages and slow Internet speeds make it difficult for students to access these resources, which in turn limits their capacity to study (Semlambo et al., 2022). Furthermore, a dependable computer network is essential for online learning, which has grown in popularity recently. As a result, computer network connectivity is essential for enhancing organizational performance since it facilitates online learning and makes it simple for students to interact with the course materials (Lwoga & Sangeda, 2019).

Mtebe & Raphael (2021) noted that problems with network performance also impact academic personnel. Stable Internet connections are necessary for the proper operation of online teaching resources including virtual classrooms and video conferencing. On the other hand, poor network performance might result in technical issues that interrupt lectures and make it more difficult to

communicate with students effectively. Furthermore, online databases, journals, and collaboration tools are frequently used by researchers in their work. Teaching and learning improvement can be severely impacted by slow Internet speeds and network interruptions, which can limit the caliber and volume of study output (Semlambo et al., 2022). Therefore, research into the adoption and use of computer networks is necessary to enhance university performance in terms of academic and extracurricular activities and operations.

Network effectiveness has an effect on university activities in addition to specific students and teachers. For a variety of administrative functions, such as student enrollment, fee payments, and academic record management, universities depend on network connectivity (Mtebe & Raphael, 2021). Errors, delays, and inefficiencies in these procedures might result from poor network performance. Universities also frequently hold webinars, conferences, and online events to advertise their academic programmes and draw in prospective staff and students. For these events to be successful, dependable network connectivity is essential, necessitating urgent study.

Broadband availability, Internet service providers, network infrastructure effort expectancy, performance expectancy, and network accessibility are some of the characteristics that have been discovered to affect network performance, which in turn affects university performance (Kurose & Ross, 2022). Furthermore, service delivery speed, service quality, and operational cost are specified as measures of university performance in terms of providing academic and non-academic services to students and staff in connection with use of computer networks (Kurose & Ross, 2022). It is maintained that even with the significant organizational performance indicators and the variables affecting computer network usage, the relationship between computer network usage and university success remains elusive and unclear. In order to confirm the occurrence, it is necessary to look into how computer networks affect academic and administrative effectiveness in the context of education service delivery.

Justification for the study

Local area networks (LANs) are crucial in today's digital world, as companies rely heavily on online communication, particularly for user experience and organizational effectiveness (Mtebe & Raphael, 2021). It is argued that a well-performing local area network guarantees smooth data flow, which facilitates customers' access to information, interaction with the services, and timely, frustration-free transaction completion. In addition to client happiness, university operations are impacted by LAN performance, which raises profitability and productivity. Because of its significance, the Tanzanian government, through the Tanzania Communications Regulatory Authority (TCRA), has been working to implement the national undersea cable system in order to support the country's network performance (URT, 2016). Additionally, the current National ICT Policy was created to direct the nation's network implementation (URT, 2023).

The effect of computer networks on university performance remains unclear and elusive in Tanzanian universities, despite the government's efforts and the noteworthy advantages of computer networks (Mtebe & Raphael, 2021). Furthermore, according to the URT (2023), university performance regarding LAN use is woefully inadequate. For example, Semlambo et al. (2022) contend that the pace at which services like file transfers, network printing, and emails are delivered is affected by LAN performance, while Tanenbaum & Wetherall (2020) argued that the use of the Local Area Network affected performance in both the speed and quality of service delivery (Okpeki et al, 2018). Network performance affects the financial budget, administrative costs, and maintenance costs rather than service delivery, speed and quality (Mtebe & Gallagher 2022). According to Mtebe & Raphael (2021), there is no meaningful correlation between university production and LAN performance. Little is known about how LAN performance affects productivity at Tanzanian universities, according to the conflicting evidence from scholars. It is unavoidable to

look into how computer networks affect academic performance given the disagreements among researchers.

The adoption and use of network platforms by Tanzanian institutions to improve administrative and academic operations has advanced significantly. Moodle software has been implemented at Sokoine University of Agriculture (SUA), University of Dar es Salaam (UDSM), and other public higher education institutions in Tanzania. These institutions mainly depend on their network infrastructure to support a variety of digital learning tools, online resources, and collaborative platforms. An e-learning system can be implemented and facilitated using this open-source Learning Management System (LMS). E-learning has also been implemented by Mzumbe University (MU) and Muhimbili University of Health and Allied Science (MUHAS) to help students and facilitators with the research and learning process (Mtebe & Raphael, 2021). Even if there has been progress, there are still issues with LAN performance optimization to satisfy the expanding needs of digital learning and research (Tanenbaum & Wetherall, 2020). As a result, the local area network was implemented in an unsustainable manner, resulting in financial losses and a lack of trust among computer network users. This study investigates the effect of computer networks usage on university performance in Tanzania.

Objectives of the Study

This study is aimed at investigating the effect of computer networks on university performance in Tanzanian universities in accordance with the following specific objectives

- To assess the effect of computer network on service delivery speed in Tanzanian universities.
- To assess the effect of computer network on quality of service (QoS) in Tanzanian universities.
- To assess the effect of computer network on operational costs in Tanzanian Universities.
- To assess the effect of computer network on conveniences in using computer networks in Tanzanian universities.

THEORETICAL AND EMPIRICAL REVIEW

To determine the current knowledge gap, this section examines relevant theories and relevant earlier researches.

Theoretical Review

The application of ICTs and performance enhancement theories are examined in this section One aspect of ICT applications that has received little attention is user acceptance of these technologies. According to Venkatesh et al. (2003), Unified Theory of Acceptance and use of Technology (UTAUT) and subsequently UTAUT2 theoretical models are requirements for information technology adoption theory. UTAUT makes an important contribution to corporate acceptance of computer networks by presenting the concepts of performance expectancy and expected effort. The study intends to prove that university service delivery, and performance expectancy, as outlined by UTAUT, has a significant effect on behavior intention to utilize computer network performance (Mącik & Mącik, 2016). According to the theory, another factor that determines behavior intention to utilize LAN for high-quality service delivery within the universities, is expected effort.

Performance indicators as defined in the context of the valued output of a system in the form of products or services, and measures of quantity, duration, and quality were used to assess the performance of goods and services (Poppendieck & Poppendieck, 2011). Because it specifies

performance as the aim of the study, this definition significantly advances the field. Additionally, it was suggested that improving operations in a company requires more than just customer satisfaction. In this instance, it was found that it was necessary to apply pertinent strategies in order to improve organizational procedures. Based on factors including service quality, service delivery, time convenience, and operational cost, computer network technology has thus been proposed as a viable method for enhancing the performance of organizations, including universities.

Empirical review of related previous studies

Factors of Computer Networks and its effect on performance of T&L administration operations

LAN adoption in service delivery organizations refers to the process of accepting and implementing LAN technology in order to improve organizational performance in terms of service quality, delivery speed, and operating costs/expenses. However, the particular context, possible users, and the nature of the technology all influence how widely LAN technology is utilized or embraced (Njenga, 2010). In terms of performance expectations, expected effort, and accessibility in connection to user/adopter behavior, UTAUT claims that the nature of LAN technology affects organizational performance, as detailed below (Venkantesh et al., 2003).

Performance expectancy: Performance is one of the factors that have a significant effect on LAN utilization in an organization and promote high performance. Performance expectancy is the extent to which people believe that employing technology would increase their performance (Venkantesh et al., 2003). This can also be interpreted as the technology's perceived utility. According to Puspitasari et al. (2019), good indicators of performance expectancy for LAN use that leads to university performance include a technical perspective, increased effectiveness, productivity, and ease of information acquisition. It is expected that when LAN is employed, change performance measurement of service quality would be used (Nzobokela et al., 2024). According to Njoroge (2012), LAN usage is expected to alter people's perceptions of how rapidly services are provided, particularly how quickly infrastructure transforms into suitable and reliable infrastructure. Additionally, LAN infrastructure features significantly reduce operating costs in terms of time and prices since they permit the use of traditional techniques for customer service delivery (Venkatesh et al., 2003). For example, time and money can be saved by using physically transportable vehicles, such as cars and airplanes, to provide services. Thus, it is expected that LAN will provide customers with information on perceived service quality, operational costs, time, and environmental impact (Nzobokela et al, 2024).

Effort expectancy: The degree to which users believe that the technologies are simple to utilize for organizational success is known as effort expectancy. This might also be seen as the perceived utility of the technologies. Puspitasari et al. (2019) described effort expectation as being simple to use, simple to learn, simple to interact with, and simple to become an expert. It is thought that even though a particular technology requires less work to operate, users must work very hard to achieve significant results. In a service company, for example, less labor is needed so that the user can reliably make data remotely accessible for clients to access in a timely and cost-effective manner (Ahlborn et al., 2010). Universities are using LAN more and more to boost productivity, improve decision-making, better understand their clients to provide better customer care, and boost corporate value (Dwivedi et al, 2019). Therefore, users who are comfortable using such technology enhance the performance of the business by increasing staff productivity, saving money and time, and bringing in more money.

Accessibility: Incorporating state-of-the-art technology into service delivery organizations can improve service quality and provide alternative methods for managing client records. This will only be possible if and when such technology is widely available. When it comes to LAN accessibility,

various organizations face numerous challenges, including lack of technical experience, information access concerns, and a lack of data standards that promote LAN data interchange (Kumar & Singh, 2021). Because LANs are difficult to adopt and use, organizations end up installing them as needed without developing the skills and expertise needed to use the technology. Furthermore, the technology might be adopted patchily, which would result in low uptake. As a result, LAN becomes less useful and sometimes increases operating costs by lowering service quality, which leads to poor performance within the organization. LAN availability will make users' and workers' lives easier by anticipating and meeting their demands for notable organizational performance (Kihoro & Ndunguru, 2021).

Measures of University performance

According to Dumitrescu & Popescu (2020), university performance (UP) is the degree to which the university accomplishes its objectives. Every action the company does is evaluated for efficacy and efficiency. Effectiveness is defined as the state in which the organization meets customer needs and aligned objectives. Efficiency, on the other hand, is the utilization of organizational resources to generate anticipated services that satisfy client demands. An overview of how LANs affect organizational performance metrics and indicators is provided below.

The quality of service: According to Nzobokela et al. (2024), quality of service (QoS) is the capacity of a network to offer an application a more appropriate or adequate service. When using LANs to deliver services, QoS is a crucial component. The degree to which the user benefits from the service determines QoS. Therefore, the LAN can be implemented to offer effective service for enhancing organizational performance by considering several QoS factors.

Numerous studies have been carried out to address the challenges of LAN influence on organizational quality of service. For instance, Roy et al. (2018) determined which factors affected QoS in DTNs and found that jitter, congestion, selfishness, fairness, delivery ratio, packet drop, and queuing time all affect QoS management in data transfer networks as LANs. QoS measures for LANs, including data rate transfer and efficiency, bandwidth, loss of packets, delay, and packet delivery ratio, were found by Liu & Zhang (2021). Even though a number of computer network characteristics that affect QoS have been examined in research, these aspects only deal with technological problems; and other significant elements, such as human behaviors as computer network users or adopters, also significantly affect quality of service.

The operational cost: Maintaining the effectiveness of any organization including universities has been found essential for cutting expenses and increasing revenue. The profitability of any business may be significantly impacted by staffing, trash, maintenance, and energy expenses (Nguyen & Hoang, 2020). One effective strategy to cut corporate expenses is to implement and rely on a LAN system. In a large firm, cutting operating costs can be a challenging and drawn-out task. Any big business needs to maximize efficiency and raise earnings in order to stay competitive. According to Patel & Shah (2023), interoperability, as well as effective communication between networked nodes, for instance, lowers response time and the need for resources, boosting efficiency as well as production by reducing operating expenses.

A LAN can assist a business in cutting costs in a number of ways. For instance, LAN uses predictive maintenance concepts to lower maintenance costs in the industrial sector. By decreasing service delivery times, improving efficacy and efficiency, and cutting down on operating time while enhancing income prospects, LAN is said to save expenses in service delivery companies (Cheng & Wang, 2021). Therefore, it is essential to look into how LANs affect operating expenses in order to improve organizational performance in Tanzanian service delivery.

The service delivery speed: Business organizations, education institutions, health centers, manufacturing firms and smart cities are just a few of the application fields where the data gathered by LAN offers an unparalleled chance to address significant issues and provide services (Lee & Lim, 2022). The LAN has developed into a widely dispersed, diverse structure that can now accommodate both individuals' and companies' everyday requirements. The provision of services including learning, communication, and their support can be accelerated by the adoption ICTs technologies including computer network (LAN/WAN) and cloud computing. Because consumer expectations are constantly changing, service delivery is one of the performance metrics that businesses that offer services to clients need to keep a careful eye on.

For instance, businesses are currently addressing the so-called contactless delivery by utilizing cutting-edge technologies like LAN (Hassan & Khan, 2020). Many businesses today claim that contactless service delivery is necessary in order to remain competitive and maintain satisfied and trusting clients. LAN tools are being used by many enterprises to expedite and remotely monitor service delivery to clients (Hassan & Khan's, 2020). For example, Makino makes use of a LAN business connector. In this instance, the business was able to foresee equipment breakdowns with high accuracy and take prompt action .

*Conveniences in T&L and administrative operations***:** In many institutions, the use of computer networks' infrastructure has become crucial for administrative tasks as well as teaching and learning. The ability of students to learn at any time and from any location is one indicator of how well teaching and learning are going when using educational technology, such as e-learning systems (Kisanjara, 2024). For example, e-learning makes it easier to gain knowledge and skills through cooperative and communicative assignments, and teachers can use learning platforms to provide content at any time or location. Additionally, it reduces learning obstacles for students who are foreign-born, disabled, employed, or suffering from long-term illnesses (Basar et al., 2021). For instance, the institution can increase student enrollment by making it simpler for students to access educational resources. Without the assistance of their lecturers, university students can expand their knowledge by picking up practical skills on their own.

Accessible delivery of educational resources therefore influences university performance since computer networks and enabling technology enable more students to enroll. Because they support and enhance learning processes and enable effective information flow, learning management systems (LMS) are generally advantageous to students, employees, administrators, instructors, organizations, and other participants (Liu & Dongmei et al., 2023). By using tools like building modules to organize information and learning resources for mini-courses or networking via chat rooms, forums, and video exchange to provide appropriate training and skill sharing, lecturers or instructors can conveniently deliver educational materials (Kisanjara, 2024). Consequently, computer networks offer a practical means of providing students with access to educational resources so they can learn with confidence and achieve academic success.

The conceptual framework development

The general theory, which was established based on a variety of viewpoints from the literature, is that organization including university performance can be enhanced if it uses a contemporary technology strategy to improve working methods. A research review claims that LAN accessibility, performance expectations, and expected effort as human and technological traits enhance OP by affecting delivery speed, operating cost, and service quality. Operationalization of independent and dependent variables is illustrated in Figure 1, along with the data presented in Table 1.

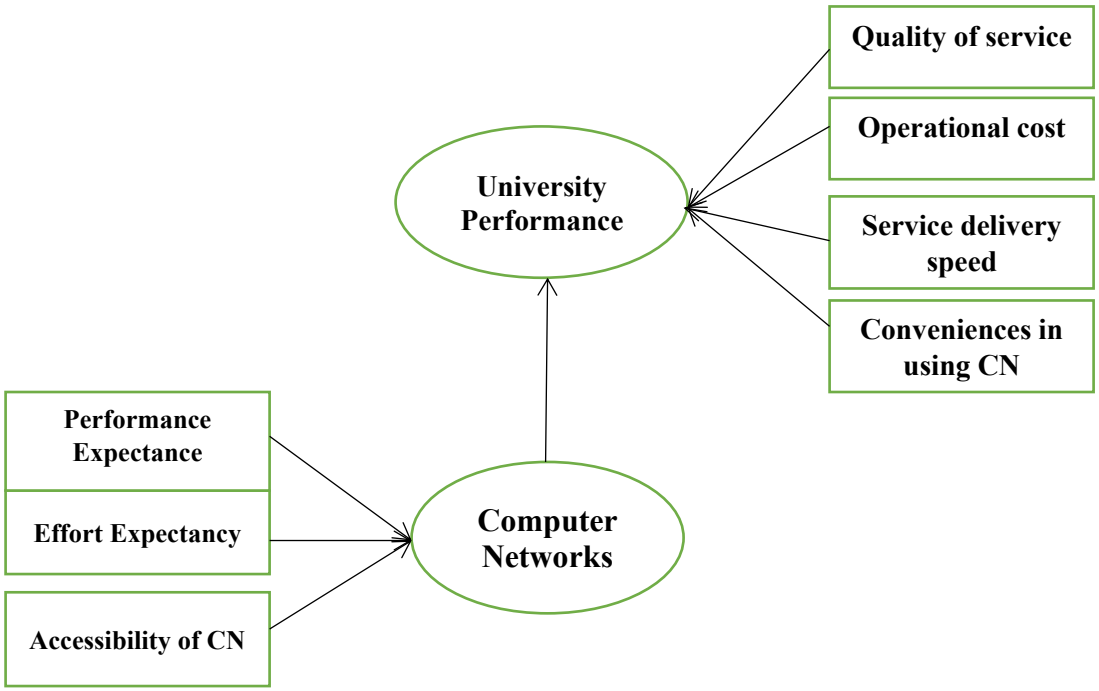

Figure 1: A conceptual framework as per the literature review

Operationalization of variables

Using the conceptual framework shown in Figure 1, all constructs were operationalized. This study found that among Tanzanian bank customers, behavioral intention to use LAN was significantly predicted by effort expectancy, performance expectancy, and accessibility (Nyesiga et al., 2017).

Numerous studies examining the adoption and use of particular technologies, including LANs, smartphones, mobile commerce, and smart homes, have made use of these characteristics (Sail and Danish, 2018; Kurose & Ross, 2022).

Table 1: *Operationalization of variables*

Factor/variable	Explanations
Performance expectancy (TAM and UTAUT)	Performance expectancy is defined in the context of the extent to which the user expects that using the computer network platforms and facilities will enable him or her to accomplish the task and gains job performance. Performance expectancy measures if Local area networks (LAN) or wide area networks (WAN) contributes in performance improvement (Venkatesh et al., 2012; Venkatesh et al., 2003)
Effort expectancy (TAM and UTAUT)	Effort expectancy assess whether LAN/WAN can enhance service delivery with minimal effort and ease of usage (Wu & Wang, 2005). Effort expectancy is defined as extent of ease with which the system can be used. (Palvia et al., 2018).

Accessibility (UTAUT)	Accessibility refers to the degree of availability and usage of platforms or facilities of computer networks at all times when required for its acceptance, adoption, and use to significantly improve the effectiveness and efficient of providing university service (Kisanjara et al., 2020; Smith & Taylor, 2020).

Hypotheses development

In order to guarantee performance in service delivery companies, LAN technology must be accepted and used. According to Wu & Wang (2005), there must be substantial benefits to service delivery organizations' use of technology, especially LAN. As a result, it is critical that employees or users accept and use LAN to its full potential in the organization (via performance expectations, effort expectancy, and accessibility) so that computer networks would increase the level of university performance by affecting operational cost, service delivery speed, and quality of service. As a result, the following explanations and hypotheses are presented:

By improving LAN effectiveness and perceived benefits, utilization perception makes sure that users support and increase its use (Puspitasari et al., 2019). In any technology, users expect benefits from it such as expenses and time savings (Shin, et.al. 2019). According to Eman (2020), performance expectancy in the context of LAN/WAN refers to the extent where users believe that using LAN/WAN technology will enhance their performance and productivity. To put it another way, people will use technology if they think it will help them perform better. Employees and users will thus operate more productively and effectively, reducing operating expenses:

> *H1. There is a considerable association between computer network performance expectancy and university performance in terms of minimizing operational costs.*

According to Wu & Wang (2005) and Puspitasari et al. (2019), LANs are supported by their users and their perceived benefits, which increase their effectiveness. Performance expectancy is a reliable measure of behavioral intention in relation to technology adoption and use (Lee & Shin, 2019). PE is similar to the relative advantage of DOI and the predicted perceived utility of TAM, both of which promote the use of technology. For example, in the LAN scenario, to speed up the delivery of teaching and learning services, for example, university academic staff who instruct students will make use of educational technology M-learning and-learning (Eman, 2020). Thus, in the context of teaching and learning, LAN platforms and facilities will enable students to access services in a very quick and easy manner:

> *H2. When service delivery speed is raised, the relationship between LAN performance expectancy and university performance improves significantly.*
> *H3. There is a considerable association between LAN performance expectancy and university performance, which improves service quality.*

Wu & Wang (2005) and Puspitasarie et al. (2019), argued that LANs are supported by their users and their perceived benefits, which increase their effectiveness. It has been found that behavioral intent to use LAN is significantly predicted by performance expectancy, sometimes referred to as perceived usefulness (Nugroho et al., 2023). Similarly, enhancing service quality increases performance expectancy, which is heavily influenced by characteristics such as perceived utility, motivation, work fit, and the relative benefit of LAN (Onaolapo Sodiq & Olawale, 2018). Through LAN platforms and facilities, users and employees will be engaged, dedicated, and driven to work, giving the university a competitive edge and enabling it to offer students high-quality services:

H4. There is a considerable association between LAN performance expectancy and university success by boosting service quality.

Less work is required since LAN systems are as simple to understand and operate as they are helpful (Venkatesh et al., 2012). By reducing operating expenses, expected effort through LAN usability affects organizational performance. According to Onaolapo Sodiq & Olawale, (2018), there are connections between the conveniences in using the computer network technologies and money spent, the effort LAN users put out at work, the performance they achieve as a result of that effort, and the rewards they receive as a result of that effort. These will have a positive impact on the users' perception and acceptance of the system. If the user dislikes the system, his or her acceptance level will be low, negatively impacting the individual's engagement level and leading to increased cost, including time and operational cost:

H5. There is a strong link between projected effort in using LAN and university success as evaluated by decreased operating costs.

The ability of universities to provide clients with academic and non-academic services is impacted by the adoption and usage of the computer network technologies (LAN/WAN). Students and staff use of LANs is said to be directly correlated with effort expectation of such technologies. This is because students and staff adoption of LAN is likely to be influenced by how simple or complex it is to get pertinent information via LAN to expedite service delivery (Onaolapo Sodiq & Olawale, 2018). For instance, if users believe that LAN systems are easier to understand and use, they will be more efficient and effective, which will lead to faster teaching and learning services delivery (Cheng & Hu, 2021). Therefore, it was confirmed by Venkatesh, & Bala (2020) that the more effort students and staff put into using LAN technology, the less likely they are to utilize and adapt it, which leads to students and other customers receiving learning and administrative services less quickly and conveniently. Consequently, the students and other customers in the universities' happiness rise:

H6. The planned effort to use LAN has a substantial impact on university performance by enhancing service delivery speed.
H7. The expected effort to use LAN has a big impact on university performance because it provides convenience in employing such technologies.

Less work is required since LAN systems are as simple to understand and operate as they are helpful (Venkatesh et al., 2012). These elements promote job satisfaction and enjoyment, which raises staff involvement in delivering high-quality customer service. According to Chipeva et al. (2018), users are more likely to accept technologies that are easy to use and comprehend. The ease of use of computer network technologies, such as WAN/LAN in universities is said to contribute to the provision of high-quality services. Employees and clients, including students, thus understand that WAN/LAN platforms and facilities are very easy to access whenever needed and that there is a good chance of delivering high-quality services, which lowers operating costs compared to physical means (Onaolapo Sodiq & Olawale, 2018). Employees and clients, including students, thus understand that WAN/LAN platforms and facilities are very easy to access it whenever needed and that there is a good chance of delivering high-quality services, compared to physical means (Onaolapo Sodiq & Olawale, 2018)

H8. There is a substantial association between expected LAN effort and university performance, as measured by service quality.

The ease of communication and information access provided by contemporary LAN platforms and facilities plays a significant role in LAN system acceptability, adoption, and use (Venkatesh et al., 2012; Kisanjara et al., 2020). These criteria analyze LAN accessibility and are crucial to its

acceptance and effectiveness in lowering the company's running costs, which eventually leads to profitability. The timely availability and accessibility of LAN platforms and facilities may indicate significant operational advantages, such as fewer superfluous personnel and cheaper operating costs (Stallings, 2017). The level of LAN accessibility has a direct impact on university effectiveness in Tanzanian institutions in terms of operational cost and convenience in accessing computer networks.

> *H9. The accessibility of LAN has a substantial impact on university performance by reducing operating costs.*
> *H10. The accessibility of LAN has a significant effect on university performance by improving conveniences in using such technologies*.

A good indicator of how accessible technology is how easy it is to interact with and retrieve information (Nzobokela et al, 2024). According to Venkatesh et al. (2012) and Kisanjara et al. (2020), these components allow users to embrace, adjust, and utilize LAN systems for the company's success, resulting in high-quality service utilizing the available LAN platforms and facilities. Although LAN platforms and facilities are becoming more accessible, the adoption rate seems to remain low, as noted by Onaolapo Sodiq & Olawale, (2018). Although LAN adoption and accessibility are unrelated, LAN accessibility significantly impacts organizational performance following LAN deployment, resulting in quality service. The organization suffers when technical platforms and facilities are unavailable (Bakar, 2013).

The main goal of the university on adopting the computer networks is to effectively access and use LANs, which would improve the university performance in terms of the caliber of services it provides. Having access to LAN platforms and facilities for information and data sharing implies gaining insights into things and making it easier to give high-quality customer service and product performance in organizational performance (Puspitasari et al., 2019). Access to the LAN and the increasing saturation of its platforms and facilities encourage users to work effectively and efficiently in providing high-quality services, which improves organizational performance by speeding up the delivery of teaching and learning services (Okpeki et al., 2018).

> *H11. By speeding up service delivery, LAN accessibility and university performance are significantly correlated.*
> *H12. By enhancing service quality, LAN accessibility and university performance are significantly correlated.*

MATERIALS AND METHOD

The purpose of this study was to evaluate the effects of computer networks, such as WANs and LANs, on university performance in Tanzania. This section covers the study area, sampling strategy, sample size, and data collection procedure. Other subjects covered include validity and reliability metrics, data analysis techniques, and ethical considerations.

Study Area

The Open University of Tanzania (OUT), Sokoine University of Agriculture (SUA), and Mzumbe University (MU) were the main subjects of this investigation. In contrast to the other Tanzanian universities, these were selected due to their implementation of LANs that support e-learning and learning management systems in the classroom. For instance, in order to improve teaching and learning by reducing delivery costs and expenses, boosting course delivery ease, and enhancing the distribution of high-quality materials, OUT has been utilizing online learning technologies, such as the Moodle Learning Management System (LMS), for open distance learning.

SUA, Mzumbe, and OUT rely heavily on digital platforms to offer services to students and other stakeholders due to the rise in e-learning through the LMS, e-resources, and online classes. In order to support these tools, LANs must be dependable and efficient. As a distance-learning organization, OUT depends heavily on LAN effectiveness and Internet connectivity to link physical hubs and guarantee resource sharing. The LAN is therefore regarded as being extremely crucial and urgently required.

Sampling and Sample Size

A wide sample of students, instructors, administrative personnel, and IT workers who regularly work with LAN systems in Tanzanian universities provided the data for this study. The goal of this study was to gather comprehensive data from a wide range of sources in order to evaluate the impact of computer networks, particularly LANs, on organizational performance in Tanzanian universities.

Another goal of this study was to extrapolate the conclusions to other organizations with comparable traits. In this instance, 342 respondents in total (SUA: 100 participants, Mzumbe: 113 participants, and OUT: 129 participants) received the surveys. First, structural equation modeling (SEM) is the primary analysis method employed in this study. Sample sizes for SEM must be between 100 and 400 (Hair et al., 2014). Further, to be able to generalize the study's findings to other colleges with comparable features is possible because it employed a quantitative approach and a cross-sectional survey methodology (Harwell, 2011).

These factors make a sample size of 342 suitable for this investigation. Heterogeneous sampling methods were used to select the respondents. Since the student list was predetermined before data collection began, 240 students from IT, faculty and administrative staff at the universities were chosen using a straightforward random sample (Neuman, 2019). Using purposive sampling, 102 academic and non-academic staff who regularly get services from IT, faculty, and administrative staff were chosen. Purposive sampling technique was used to select the sample based on the population size, time constraints, and unique characteristics of each sample (Kisanjara et al., 2020). The goal of the maximum like sampling technique is to allow research findings to be broadly applied. Out of the 342 respondents who were selected 97.95% of them responded to the questionnaire.

Data Collection Procedure

The questionnaire tool was created with the demographics of respondents and each of the study's specific research objectives in mind. The study used a cross-sectional survey methodology to concurrently gather data from Tanzanian universities that were geographically dispersed throughout Tanzania (Creswell, 2019). Primary data for this study was gathered from both types of samples using standardized questionnaires. It took into account of every element found in the conceptual framework, that serve as indicators of an organization's effectiveness as follows:

> **Question 1:** The demographic characteristics of the respondents regarding sex, age, education attainment and years of experience in using LAN were considered. It provided a general idea of the research population's suitability. It was also anticipated that a particular type of respondent would have some influence over the adoption and use of LAN technology.
> **Question 2:** Ascertain how improving organizational performance will be impacted by performance requirements for LAN platforms and facilities. The purpose of this section is to shed further light on how operational expenses, service delivery speed, convenience and service quality are impacted by LAN performance standards.
> **Question 3:** assess how the use of LAN platforms and facilities affects the improvement of organizational performance. The effects of effort expectancy as LAN characteristics on

service delivery speed, quality of service, conveniences and operational cost/expenses was covered .

Question 4: assess how LAN platforms and facility accessibility can enhance organizational effectiveness. The effects of accessibility as LAN feature on service delivery speed, quality of service, operational cost and conveniences, and operating expenses wase covered .

Question 5: Examine how indicators, such as operating expenses, service delivery speed, quality of services, and conveniences affect university performance in relation to LAN features including accessibility, performance expectancy, and effort expectancy.

Data Analysis Techniques

SEM, more especially confirmatory factor analysis (CFA) with AMOS 19, was used to evaluate the data in this study. The examination of correlations between latent variables that reflect constructs was made possible by the CFA results. Nonetheless, the primary goal of employing CFA is to assess construct validity and reliability issues in this study, CFA enabled the computation of composite reliability (CR) and AVE values. The SEM test was used to evaluate the direct and indirect effects of independent variables (performance expectation, expected effort, and LAN accessibility) on dependent variables of organizational performance, such as operational cost, service quality, and service delivery speed (Hsu & Lin, 2018). This was accomplished through the use of SEM to test the generated hypotheses (Neuman, 2019; Creswell, 2019).

Ethical Considerations

The research considered research ethics in the following ways: first, the author got approval from the Tanzanian universities where the study was conducted. The Mzumbe University Directorate of Research and Publication sent an introductory letter to the relevant universities because this is academic research. Second, according to the data in the questionnaire, the study respected the confidentiality and privacy of all participants. They voluntarily provided information in order to request participation. Respondents were not under any duress to provide information, and they were free to leave the research at any moment. Additionally, the study's goal was made clear: to encourage respondents to disclose information with confidence, the data is needed for academic objective

PRESENTATION OF RESULTS

In order to assess the effect of computer networks on university performance metrics, the data were clearly analyzed, presented, and interpreted in this area, which was based on the descriptions given in the methodological section. As the prerequisites and presumptions of SEM employing CFA as part of SEM, the analysis was heavily focused on validity and reliability testing. Furthermore, the hypotheses developed for this study were tested using SEM .

Reliability and validity testing using CFA

Table 3 shows the validity and reliability outcomes of the constructs evaluated in the measurement model based on the given criteria. The factor loading values fall between 0.756 to 0.957, which is significantly greater than the 0.7 threshold, as recommended (Chin, 1998). Additionally, each structure's Composite reliability-CR (0.864–0.952) was higher than 0.7. This demonstrates the scale's high level of reliability and internal consistency. The AVE needs to be higher than 0.5 so as to achieve convergent validity (Chin, 1998). The findings of this study indicate that the AVE (0.770–0.898) satisfied the required standards.

Table 3: *Measurement results of validity, reliability and average variance extracted*

Variable Measured	Factor Loading	CR	Alpha α	AVE	VIF	R^2
Performance expectancy in using CN	0.890	0.864	0.922	0.770	3.54	0.613
Effort expectancy in using CN	0.957	0.952	0.817	0.830	3.61	0.643
Accessibility of Computer Networks (CN)	0.756	0.926	0.766	0.898	3.14	0.622

Note. α = Cronbach's alpha, CR = Composite reliabilities; AVE = average variance extracted.

Second, this study evaluated discriminant validity using the Fornell-Larcker criterion (Fornell & Larker, 1981) and the heterotrait-monotrait ratio (Henseler et al., 2015). The data in Table 4 demonstrates that each variable's square root of the AVE is higher than the correlation values of the other constructs. Additionally, Table 4 indicates that the maximum HTMT value is 0.734, which is below the 0.9 threshold as recommended by Fornell and Larker (1981). As a result, every variable possessed discriminant validity. Lastly, before the structural model analysis was conducted, the multicollinearity was assessed. Multicollinearity may arise if the coefficient of magnifying variance (VIF) is greater than 5 or the tolerance is less than 0.20, per Hair et al. (2015). Table 3 shows that the VIF varies from a low of 3.14 to a high of 3.61. Because the VIF was less than 5, this finding generally indicates that multicollinearity was not a concern.

Table 4: *The results of discriminant validity*

Variable Measured	Mean	Std	PE	EE	CN
Performance expectancy (PE) in using CN	3.201	0.921	0.811	0.734	0.215
Effort expectancy (EE) in using CN	3.131	0.830	0.734	0.806	0.453
Accessibility of Computer Networks (CN)	3.421	0.901	0.598	-0.722	0.962

Note: The HTMT values are above the diagonal, the correlation coefficients between construct values are below the diagonal, and the diagonal values represent the square roots of AVEs.

Results of Hypotheses Testing

Performance expectancy in using computer networks and University performance: Operational cost/expenses, service delivery speed, service quality, and conveniences are the measures of university performance in terms of teaching and learning and administrative activities. Table 5 shows that performance expectance in using computer networks have a significant effect on university performance in terms of teaching and learning as well as administrative activities by improving the service delivery speed, quality of service and conveniences to students and staff.

The hypotheses (H2, H3, H4) tested were found to have a p-value < 0.0. However, there is no correlation between university performance and performance expectations since, as H1 shows, it raises operating costs.

Table 5: *Test of Hypotheses*

Hypotheses	Path coefficients	t-values	P-values
H1: Performance expectancy →cost/expense	0.041n.s	1.254	0.115
H2: Performance expectancy →service delivery speed	0.561**	5.671	0.001
H3: Performance expectancy →service quality	0.332**	5.443	0.010
H4: Performance expectancy →conveniences	0.544**	4.982	0.012
H5: Effort expectancy →cost/expense	0.533**	4.221	0.001
H6: Effort expectancy →service delivery speed	0.097*	3.221	0.010
H7: Effort expectancy → conveniences	0.024n.s	1.132	0.213
H8: Effort expectancy → quality of service	0.379**	6.230	0.011
H9: Accessibility →cost/expenses	0.271***	9.354	0.000
H10: Accessibility →conveniences	0.298***	8.710	0.000
H11: Accessibility →service delivery speed	0.398**	3.991	0.002
H12: Accessibility →quality of services	0.674***	10.22	0.000

***p < .01. Note: ns = not significant.

Effort expectancy in using computer networks and University performance: Table 5 further shows that effort expectancy in using computer networks have a significant effect on university performance in teaching and learning as well as administrative activities by improving the service delivery speed, quality of service and conveniences to students and staff. The hypotheses (H5, H6, and H8) tested were found to have a p-value < 0.01. However, there is no association between performance expectancy and university performance because H7 is not supported and does not give convenience.

Accessibility of computer networks and University Performance: Accessibility is another factor of the computer network as tested against performance indicators. The results in Table 5 shows that performance expectance in using computer networks have a significant effect on university performance in terms of teaching and learning as well as administrative activities by improving the service delivery speed, quality of service, convenience and lowering operational cost/expenses to students and staff. The hypotheses (H9, H10, H11 and H12) tested were found to have a p-value < 0.01, which are supported. This implies that accessibility of computer networks is vital for students and staff in increasing university performance.

DISCUSSION OF RESULTS

The primary goal of this study was to assess how computer network usage affects Tanzanian universities' performance in terms of administrative and teaching and learning (T&L) operations. The effect of computer networks on operational costs and expenses, service delivery speed, service quality, and convenience especially in teaching and learning as well as administrative operations in Tanzanian universities were carefully assessed in this study as performance metrics.

Performance Expectancy and University Performance

The links between constructs of computer networks usage have been detailed in a number of prior relevant studies utilizing a variety of theories, such as TAM and UTAUT. Performance expectancy and university performance in terms of T&L and administrative operations are significantly correlated, according to the study's findings, which are displayed in Table 5. For example, by improving service quality, speed, and convenience, performance expectancy in computer networks greatly enhances university performance. There is a significant correlation between computer network usage performance expectancy and improvement of T&L and administrative operations performance by improving service quality speed, quality of service, and the conveniences, in

accordance with the UTAUT theory, which is supported by a p-value < 0.01. By enhancing convenience, service quality, and administrative activities at the university, the results of this study add to the body of research by indicating that performance expectancy significantly improves T&L and administrative operations performance (Liang et al., 2021; Liu & Dongmei, 2023). The results of this study were corroborated by Al-Rahmi et al. (2020), who claimed that students' performance expectations in using computer network resources like e-learning, learning management systems, and emails could help them complete their assignments more quickly and effectively, improving their learning performance and giving them more control over the quality procedures and the learning materials. Thus, by improving the quality of the instructional materials provided to students and other communication with other administrative staff, the use of computer networks platforms in administrative operations improves overall performance (Liu & Dongmei, 2023).

The results in Table 5, above however, showed no correlation between the university's operational cost/expenditure performance and performance expectations when using a computer network. The results of this study run counter to those of other related studies (Ashrafi et al., 2020; Purwono et al., 2023), which claimed that using computer network platforms and facilities to deliver educational materials lowers costs and time compared to face-to-face delivery. These authors go on to add, for instance, that by improving administrative and T&L efficiency while lowering cost/expenses, students and lecturers can spend less time commuting from one place to another for in-person sessions and employ fewer human laborers. The results of this study thus recognize the importance of computer networks and their platforms, such as LANs and WANs, in supporting administrative and T&L activities to enhance performance in Tanzanian universities.

Effort Expectancy and University Performance

This analysis took into account administrative and T&L activities at the university. As suggested by the theory of TAM (Davis, 1989), the results of this study show that effort expectancy in using a computer network is another element that greatly affects the performance of T&L as well as administrative activities in Tanzanian universities. The study's hypotheses, that is, that utilizing computer networks enhances T&L and administrative operations, state that effort expectancy has a substantial impact on reducing operational cost/expense, improving service quality, and speeding up service delivery. The results of this investigation showed a significant correlation, with p <.001 supporting the hypothesis (see Table 5). Similarly, they may be more efficient communication with instructors, students, and other staff members both individually and simultaneously due to the ease of use of message boards, instant messaging, and video conferencing (Al-Rahmi et al, 2020). The results of this study supported the hypothesis that e-learning's simplicity of use significantly improves T&L performance by reducing costs and expenses, as indicated by p <.01 in Table 5. This conclusion is supported by and comparable to the conclusions of Ashrafi et al. (2020), in which the researchers contended that using e-learning platforms to distribute educational resources saves time. It is anticipated that e-learning's simplicity of use has a significant impact on T&L performance by streamlining the provision of teaching and learning resources. The study's results showed that the hypothesis was significant, as indicated by a p-value of less than.001.

Menolli et al. (2020) and Baji et al. (2022) contended, that in contrast to the results of our investigation, that effort expectations when using computer networks have a significant impact on T&L and administrative operations by enhancing conveniences. However, the results of this study are supported by Nikou (2022), who noted that using computer networks, such as e-learning and other platforms with more basic capabilities, provides more convenience for the delivery of instructional materials than complex systems. The discrepant finding can result from variations in the sample size and cultural context of these investigations. Therefore, it makes sense to conclude that the performance criteria have been significantly impacted by the effort expectancy of using computer networks in teaching and learning as administrative activities for lecturers, students and other staff is conveniences.

Accessibility of Computer Networks and University Performance

As this study predicted, the accessibility of computer network services has a major impact on T&L and administrative performance by reducing costs and expenses and improving service delivery, quality, and convenience. As indicated in Table 5, the study's results showed that all of the hypotheses were validated, with p <.001. The results of this study indicate that computer network accessibility has a negative impact on T&L performance by lowering costs and expenses by speeding up service delivery and reducing operating time while improving performance (Hayashi et al., 2020). The UTAUT theory Venkatesh et al. (2003) support the results of this study by asserting that a person's assessment of the accessibility of computer network platforms and facilities for their activities determines their propensity to use them. Therefore, the more easily accessible computer network platforms and facilities are for administrative and T&L operations, the more people will want to use them and the more probable it is that they will be used efficiently, which will increase the quality, speed, and convenience of the delivery of instructional materials. Therefore, it becomes sense to draw the conclusion that administrative performance and T&L are strongly correlated with computer network accessibility.

Zine et al. (2023) and Matete et al. (2023), however, contended differently from the results of this study, arguing that university performance in terms of T&L and administrative operations is not directly correlated with the accessibility of computer networks, a technology utilized in many organizations. Due to cultural differences, specific contextual factors, and potential adopters in the study locations, the results vary. In light of the study's findings, it is important to note that in order to enhance core operations like T&L and administrative operations and raise university performance, it is imperative that the universities use sustainable and accessible computer networks technology such as LAN and WAN.

CONCLUSION

The purpose of this study was to evaluate how computer networks (CNs) use affected university performance at Tanzanian universities with regard to T&L and administrative functions. The T&L and administrative operations have been found to be affected by a number of issues, which has hindered university performance in developing nations. These factors include conveniences, service delivery speed, operational costs/expenses, and service quality. Despite the rapid growth of technology and its widespread acceptance, in the university in particular, underdeveloped nations now face challenges with T&L and administrative operations. Low service performance in T&L and administration activities is one of the challenges, which calls for an urgent fix.

Because the UTAUT, which Venkantesh (2023) developed, was insufficient for evaluating the impact of computer network adoption in T&L and administrative operations in Tanzanian universities, this study adapted it to make the theory relevant by adding a new factor - accessibility. The results of this study theoretically add to the body of literature by showing that the most important factors in assessing the adoption and use of CNs in T&L and administrative operations performance in a university setting are performance expectancy, effort expectancy, and computer network accessibility. It has been discovered that these elements greatly improve performance by speeding up the supply of services, improving the quality of services like teaching materials, and facilitating administrative and T&L processes. Accessibility was deemed to be the most crucial of the three CNs used in this study because, in comparison to other factors, the results showed that it has a significant impact on all performance indicators, including service delivery speed, service quality, operational cost, and conveniences.

It is important to note that computer networks (CNs) have a substantial impact on T&L and administrative performance. As such, stakeholders should pay greater attention to ensuring that CNs are available and accessible beyond their existing state. Universities are encouraged to take

into account the results of this study in order for the platforms and resources of educational technologies (such as blended learning, e-learning, and M-learning) to be embraced and utilized successfully.

IMPLICATIONS, LIMITATION AND RECOMMENDATIONS

Practical Implication

As the study investigated the effect of adopting and using computer networks (CNs) on T&L and administrative operations, the findings of this study suggest that universities should consider restructuring of the infrastructure of CNs using relevant factors. The CNs factors include the performance expectance, effort expectance and accessibility, which were found to have significant effect on T&L and administrative operations performances. Indicators such as operational cost, service delivery speed, quality of service and conveniences, adequately measures performances of T&L and administrative operation in using CNs.

Theoretical Implication

According to previous studies, the influence of CNs usage on university performance in terms of T&L and administrative operations has been understudied in Tanzanian universities. The findings of this study contribute to the body of information about how to improve university performance in Tanzania and other higher learning institutions in terms of teaching and learning and administrative operations. This study's conclusions are focused on CN variables and how they affect university performance in T&L and administrative duties. The study also fills a knowledge gap by offering university performance measures such as operational costs, service quality, service delivery speed, and the convenience of utilizing CNs. These indicators were rarely explored in prior similar studies

Limitation and Recommendations

This study used a quantitative approach to collect and assess the data from respondents. Because it restricts the collection of comprehensive data from various viewpoints, including opinions, rather than just objective data, using only one type of research approach may result in bias. This study used a large sample size, a heterogeneous sample, and heterogeneous sampling techniques to overcome this issue. The results of this study may therefore be helpful for future research on CNs at other Tanzanian higher education institutions that employ a combination of methods to gather complete data from a wide range of perspectives that include both objective and subjective data in order to prevent bias. Additional CNs components and performance indicators are suggested for future research in order to expand understanding.

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