Technological, Organizational, and Supporting Factors Influencing Geospatial Information Technology Systems in Tanzania

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Published in IJIRMPS (E-ISSN: 2349-7300), Volume 11, Issue 2, March-April 2023

Abstract

The study sought to examine the technological, organizational, and supporting factors influencing Geospatial Information Technology Systems in Ilala and Kinondoni Councils. This study used a quantitative approach and a case study design was used as the research design. A simple random sampling method was used in this research to guarantee fair representation and widespread results for the general population. Primary data for this research was collected using a questionnaire involving taxpayers. Data analysis was done using inferential statistics for the statistical data with the aid of SPSS version 26. Data was analyzed and presented in tables and figures. The study revealed that technological factors, organizational factors, and support factors, have a positive relationship with GITS Performance. The model constructed in this study showed that Technological Factors, Organizational Factors, and Support Factors, (TOS) account for 94.6% of the GITS Performance. Therefore, TOS (Technological Factors, Organizational Factors, and Support Factors) might be employed to make better use of the GITSs that have been put in place to increase revenue collection by Tanzanian local government authorities. Future studies should take into account all other kinds of own sources of revenue that are gathered utilizing the GITS as this research only looked at the business license as the primary OSR to analyze factors affecting the GITS performance. To facilitate effective data collection, storage, sharing, regular data updates, and system integration among LGA systems and other stakeholders, the study advises LGAs to develop, introduce, operationalize, and update policies, rules, and procedures that govern GITS's applications in revenue collection.

Keywords: GITS Performance, Technological, Organizational, Support Factors

1. Introduction

Local governments have greater autonomy and are more attentive to the needs and objectives of their residents when they have robust local revenue-collecting systems. Tanzanian local governments have decided to invest in information technology to boost tax collection. This is so that local government performance and the standard of public service delivery may be improved by using information technology (Dwivedi et al., 2015; Arpaci, Yardimci, Ozkan, & Turetken, 2012; Mandal & Gunasekaran,

2003; Poon & Wagner, 2000). Tanzania LGAs created a range of Geospatial Information Technology Systems (GITSs) as an innovative strategy and a method to enhance revenue collection and administration to meet the current issues (McCluskey, Kabinga, Franzsen, & Kasese, 2018; McCluskey, Bank, & Dc, 2019; Namangaya, 2018; Manwaring, 2017; Collin, Nascimento, Lopez Caramazana, & François Habeau, 2016; WorldBank, 2015). Numerous parts of the GITS are primarily employed during data collection, mapping, and information retrieval to support decision-making by diverse stakeholders, including individuals and organizations. In particular, these systems employ a range of modern, integrated technologies, such as geospatial technology, global positioning systems, remote sensing, geographic information systems, and mobile mapping technologies (Ngereja, Liwa, & Buberwa, 2018; Scott, 2018; NBS, 2012). It is unclear how much investments in GITSs have improved revenue collection given the quick and significant changes in technology, rules, regulations, and operational practices. This is because LGAs have not yet been successful in collecting all of the money they had hoped to. The majority of LGs in Tanzania meet 50% to 70% of their collection goals, and there are signs of non-compliance with tax laws.

By managing taxpayer information, managing and maintaining accurate information, keeping track of the exact location of revenue sources and facilitating easy collection, preventing revenue loss, and having a solid foundation for revenue projection, LGAs can adopt a more strategic stance, strengthening their financial capacity (Ali, Soar, & Yong, 2016; Mtalo, 2016; Kaongo, 2015; WorldBank, 2015; Mkalawa, 2014; Ridhima, 2012; Gondo & Zibabgwe, 2010; Henrik, 2006; UN-Habitat, 2002). Effective revenue collection and well-informed decision-making are made possible by the implementation of smart technologies and big data analytics technologies in well-designed GITS with well-structured data that are governed by policy, rules, and processes (Collin et al., 2016; Mtalo, 2016).

Mtalo (2016) claims that there isn't much data on GITS' effectiveness in Tanzanian LGAs, although it has gained popularity as a method for effective revenue collection operations and competitive advantage. LGAs are aware of how GITS enhances revenue-collecting procedures. Due to this, GITS are becoming more adaptable to LGAs, although it is uncertain how to measure their performance (Haneem & Kama, 2018; Namangaya, 2018; Zabadi, 2016). LGAs must defend this promise given the effort and cost involved in the GITS rollout.

Previous research showed that the usage of CSFs, which influence the functioning of GITS, is necessary for both individual and organizational success (Haneem & Kama, 2018; Namangaya, 2018; Amade, Painho, & Oliveira, 2017; Zabadi, 2016). This necessitates the integration of all GITS performance-enhancing components. These elements include web mapping, remote sensing, GPS, IT, GIS, and IS. But none of these components have ever been merged into the GITSs that are accessible in LGAs. Additionally, over the past 30 years, LGAs have implemented GITS programs, such as Free Open Sources Software for Geospatial (FOSS4G), trained staff on how to use them, provided them with GIS hardware, and developed GIS strategies, none of which have improved GITS' performance in terms of revenue collection. Therefore, it is important to examine technological, organizational, and supporting factors influencing geospatial information technology systems in Tanzania particularly Ilala and Kinondoni Councils, Dar es Salaam.

1.1. Need for the Study

German and British colonialism, as well as other European cultures, affected Tanzania's history of geospatial technology and remote sensing (Liwa, 2013). The usage of GIS at Kinondoni Municipal Council (KMC) began in June 2006 with a project intended to effectively identify and collect data on property taxpayers and utilize the revenue collection from property taxes (KMC, 2018). Ilala and Temeke MC adopted the MRECOM system in 2008 after being drawn in by KMC's success in leveraging information technology for revenue collection (IMC, 2019). The MRECOM system included a business licensing module by the year 2010. A revenue collection information system (LGRCIS) was created by the PO-RALG in 2012 with the help of TSCP and Day One Softcom. In 2014, the system was introduced to Tanga, Arusha, and Mtwara Mikindani City Councils as part of a piloting program (McCluskey & Huang, 2019; McCluskey et al., 2018; Pérez-Mira et al., 2017). The performance of geospatial information technology systems in Tanzania is influenced by many elements, but little is known about these aspects, which leaves a significant knowledge vacuum in the research on these factors in the Tanzanian councils of Ilala and Kinondoni. Therefore, it is crucial to examine the technological, organizational, and supporting factors influencing Geospatial Information Technology Systems in Tanzania particularly Ilala and Kinondoni Councils, Dar es Salaam to provide the body of knowledge.

2. Objectives of the Study

The general objective of this study was to examine the technological, organizational, and supporting factors influencing Geospatial Information Technology Systems in Tanzania particularly Ilala and Kinondoni Councils, Dar es Salaam. The specific objectives of this study were:

(a) To ascertain the technological factors influencing Geospatial Information Technology Systems in Tanzania.

(b) To investigate the organizational factors influencing Geospatial Information Technology Systems in Tanzania.

(c) To determine the supporting factors influencing Geospatial Information Technology Systems in Tanzania.

3. Literature Review

This part provides a survey of the relevant literature from different studies to pinpoint the ideas that guided the inquiry.

3.1. Technological, Organizational, and Environment (TOE) Framework

A framework called TOE was created by Tornatzky, Fleischer, and Chakrabarti in 1990 and incorporates three factors that have an impact on how GITS is used inside an organization. The technical aspect in the TOE framework refers to both internal and external technology that is accessible within the company. This framework examines the current technologies, both internal and external to the business, that have an impact on how GITS is used. The organizational variables explain how organizational traits affect how GITS is used. Examples of organizational characteristics include company size, level of formalization, degree of centralization, the complexity of management structure, level of human resource quality, and quantity of internal spare resources. The setting in which a corporation operates, including its industry, rivals, rules, and interactions with the government, makes up the external environment determinant (Tornatzky, Fleischer, & Chakrabarti, 1990). The TOE framework's characteristics of company size, rules, and human resource quality have been incorporated in this study.

GITS scholars have had success utilizing the TOE framework viewpoint to comprehend important contextual factors that affect the organization's adoption of new GITS (Tornatzky et al., 1990). Numerous IT settings, such as HRIS, KMS, Mobile Commerce, E-Commerce, ERP, Electronic Data Exchange (EDI) (Lu, 2010), E-Services (Kaelan, Lazovi, Urikovi, and Biljana, 2018), E-Learning (Alone, 2017), and E-Procurement, have all undergone TOE theory testing (Suleiman, 2015). Research on technology and innovation has shown that, in addition to Rogers' (2003) GITS characteristics, the organizational context and external environment should also be considered (Shim, Han, & Ha, 2021; Zhu, Nakata, Sivakumar, & Grewal, 2007).

The inability of the TOE framework to measure technological features, the disregard for individual support for GITS adoption, and the absence of external components in the environmental context required to forecast innovation application in an organization constitute its weaknesses (Evwiekpaefe, Chiemeke, & Haruna, 2018). These flaws led to the TOE framework's combination with institutional theory, which included external pressure from rules, laws, and policies to explain the application of GITS in companies.

3.2. Institutional Theory

The institutional theory examines how diverse networks and interactions have a significant impact on people's ideas, attitudes, norms, cultures, and behaviors in both individuals and organizations (Scott, 2001). The institutional theory discusses the function of institutions, and it is important to include organizational decisions as well as social and cultural aspects. The institutional theory expands on the external environment context of the TOE framework's external environment by including external pressures such as regulations, laws, and policies to better explain the application of GITS in companies. Rules, laws, and policies are crucial for the effective application of GITS because they offer the necessary legal tools to govern its application and enforcement. Concerning the CSFs of the GITS, individual and organizational external variables have an impact on how well the GITS perform and are used. These factors either support or prevent the use of GITS in LGAs; for example, GITS utilization is typically hampered by government rules and prohibitions. Institutional theory is flawed in that it only applies at the organizational level, not the personal level. Using the Institution idea, e-learning has been investigated as a method to enhance training and educational performance. Numerous studies combine institutional theory with the TOE framework (Soares-Aguiar & Palma-Dos-Reis, 2008; Gibbs & Kraema, 2004). Li (2008) explained how businesses implement electronic procurement systems by combining the TOE framework with the institutional and DOI theories. Using DOI Institutional theories and the TOE Framework, the study by Amade, Painho, and Oliveira (2018) highlighted the key drivers and applications of GITS in enterprises in developing nations. The institutional external elements that affect the GITS performance in LGAs revenue collection have been taken into account in this study.

4. Methodology

To evaluate the technological, organizational, and supporting factors that affect GITS performance, a case study approach was adopted in this study (Kothari, 2004). A quantitative method was used to conduct the study in the councils of Ilala and Kinondoni. To evaluate and offer a quantitative overview of the study's principles and the methods utilized to gather, analyze, present, and publish research findings, quantitative methodologies were applied. This study employed a case study methodology based on the research of Yin (2003) and Shoaib & Mujtaba (2016).

Both primary and secondary data were used to compile the study's data. To collect primary data, a self-administered questionnaire was made accessible to a sample of individuals from the Ilala and Kinondoni Council. Closed-ended questions were utilized in the survey. To gather secondary data for this investigation, published publications and studies done by other researchers were examined.

Both primary and secondary data were analyzed using descriptive and inferential statistics. The Social Science Statistical Package (SPSS) version 26 was used for the analysis, which allows for the collection, processing, and analysis of data. Descriptive statistics demonstrate the effects of technology, organization, and support on GITS performance. The performance of GITS was evaluated and analyzed using inferential analysis in connection to technological, organizational, and support factors.

5. Analysis and Interpretation

The results of the study explored the relationship between the technological, organizational, support factors and GITS performance. The outcome was as follows:

Table 1: Correlations

		Technological _Factors	Organization _Factors	Support_ Factors
GITS Performance	Pearson Correlation	.344	.2455	.187
	Sig. (2-tailed)	.006	.002	.008
	N	243	243	243

Data from the aforementioned sources indicate a strong correlation between technological factors and GITS performance (r = 0.344, N = 243). Organizational factors and GITS Performance had a positive correlation (r = .2455, N = 243). The results show a strong connection (r = .187 N = 243) between Support Factors and GITS Performance.

A linear regression analysis was conducted on technological, organizational, and supporting factors influencing Geospatial Information Technology Systems in Tanzania. The results of the model summary are shown in Table 7 below, indicating the percentage of variance in the dependent variable (GITS performance) that was explained by the independent variable (technological, organizational, and supporting factors).

Table 2: Model Summary

Model			R	0.868
			R Square	0.636
			Adjusted R Square	0.611
ANOVA			F	5.610
			Sig.	0.000
Coefficients	**Unstandardized Coefficients**	**B**	(Constant)	0.036
			Technological_Factors	0.207
			Organizational_Factors	0.120

			Support_Factors	0.167
	Sig		(Constant)	0.047
			Technological_Factors	0.000
			Organizational_Factors	0.041
			Support_Factors	0.016

Dependent Variable: GITS Performance

In the model summary, the coefficient of determination (r2) explains 63.6% of the independent variables. This suggests that only 63.6% of the factors impacting GITS performance can be explained by independent variables under the technological, organizational, and supporting factors. The coefficient of determination is noteworthy since attributes not included in the independent variables account for 36.4% of variances. An ANOVA test was created to determine the significance and validity of the regression model that was fitted to the data. The regression model was determined to be statistically significant based on the findings, as shown by $p < .05$.

Using the results above, we have the regression equation as

$$Y = \beta 0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \alpha$$

$$Y = 0.036 + 0.0207 X_1 + 0.120 X_2 + 0.167 X_{3+} \alpha$$

Whereby

Y = GITS Performance
X1 = Technological Factors
X2 = Organizational Factors
X3 = Support Factors

Under the proven equation for regression, taking all other independent variables at zero, Technological Factors increase GITS Performance by 0.207. While Organizational Factors will result in a 0.120 increase in GITS performance and Support Factors will result in a 0.167 increase in GITS performance. Therefore, this implies that Technological Factors, Organizational Factors, and Support Factors have a positive relationship with GITS performance at Ilala and Kinondoni Councils.

6. Results and Discussion

According to the study, technological factors and GITS Performance are positively correlated. To ensure the success of the produced GITS, LGAs should have a proper strategy in place for choosing GITS hardware and software. Furthermore, choosing and developing robust digital hardware and software will guarantee the GITS's implementation. The GITS planned functions can only be successfully carried out with the development and careful selection of new software. Likewise, the study of Mumtaz Abdul Hameed & Arachchilage, (2020) and Sayginer & Ercan, (2020) found that when the technological factor is compatible with existing business processes, the organization and individuals would like to use and integrate it within the organization.

Additionally, the study demonstrated a favorable association between organizational factors and GITS Performance. This suggests that LGA should provide employees with the training and tools they need to utilize the GITS effectively, as well as the appropriate funds, time, and resources. Before system implementation, fix inefficiencies and make sure that staff is well-trained and motivated. It is strongly recommended that LGAs set aside adequate money, time, and other resources to provide ongoing training and education for the personnel since it is essential to the success of GITS. According to Barbara Kitchenham & Charters' (2007), research, organizational factors in the organization have a significant impact on how successfully local governments use GITS and enable enterprise application integration because they are skilled at implementing organizational change and overcoming resistance to it.

The findings revealed a significant relationship between the GITS Performance and the Support Factors. This suggests that LGA should encourage taxpayers to utilize the GITS by providing sufficient funding for training and education, as well as by offering support and any necessary help. This is because adequate financial assistance makes it easier for organizations to implement the GITS successfully by streamlining the process of acquiring necessary levels of software and hardware and performing end-user training. The results are in line with research by Salahshour Rad et al. (2018), which revealed that the deployment of e-services and cloud computing is significantly influenced by financial support.

7. Conclusion

This study concluded that technological, and organizational factors are imperative to the GITS performance in Ilala and Kinondoni Councils. The accessibility and prompt use of enhanced GITSs are crucial for the efficacy and efficiency of tax collection and LGA operations. However, the value of the GITSs can only be realized when the right technology is chosen, the organizational context for the deployment of the technology is established, and when there is a good supportive environment. To facilitate effective data collection, storage, sharing, data interoperability, and system integration across LGA systems and other stakeholders, LGAs must establish, implement, operationalize, and update the policies, rules, and procedures that govern GITS's applications for revenue collection. This is because several LGA departments employ numerous distinct systems, each with a different data format. These systems demand ongoing assistance and user education since they are challenging to learn, manage, and integrate. The study's findings only reflect a small sample of the nation's two LGAs. Therefore, to enable the research to reach a more specific conclusion, a study should be conducted using the same variables within a larger geographical context and a sample of LGAs in Tanzania to ascertain whether the research on CSFs impacts the effectiveness of the Geospatial Information Technology System in LGA revenue collection. To analyze the factors that influence how well GITSs perform in collecting revenue, the research solely employed a business license as the principal OSR. The study's scope does not encompass all OSR types that are gathered via GITS as a result. Therefore, to contribute to the body of knowledge, future studies should take into account other OSR categories that are obtained utilizing the GITS.

Abbreviations and Acronyms

ANOVA - Analysis of Variance
GIS - Geographical Information System
GIT - Geospatial Information Technologies
KMC - Kinondoni Municipal Council
LGAs - Local Government Authorities

MRECOM - Municipal Revenue Collection Manager
SPSS - Statistical Package for Social Science
TOE - Technological Organizational and Environmental

Acknowledgment

I want to express my gratitude to God in particular for providing me the fortitude, health, and courage to overcome challenges to complete this endeavor. I also want to thank everyone who in some way assisted me in completing this research paper.

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