

Effect of the State of Information Communication Technology usage in the Administration of Property Taxes in Rwanda – A Case Study of Musanze City

Agnes Wambaire Wangai

Faculty of Economics, Social Sciences and Management, Department of Enterprises Management,
Ines-Ruhengeri, Musanze, Musanze, Rwanda

DOI: <https://dx.doi.org/10.47772/IJRISS.2023.701173>

Received: 10 October 2023; Accepted: 26 October 2023; Published: 23 November 2023

ABSTRACT

The study aimed to explore information communication technology role in property tax administration in Rwanda, guided by objectives to assess information communication technology status and usage, examine its integration's impact on efficiency, and determine taxpayers' role in information communication technology. The research design was quantitative, targeting 91 commercial building owners and 31 Rwanda Revenue Authority tax officials in Musanze branch. The systematic random sampling method was employed, resulting in a sample of 92 respondents drawn using stratified random sampling. Closed-ended questionnaires were used to collect primary data, which was then analyzed using the Statistical Package for Social Science and reliability assessed using Cronbach's Alpha. The data were analyzed using descriptive statistics, Pearson's correlation using python to produce a heat-map, and multi linear regression. According to the study's descriptive data, most respondents believe information communication technology will help with property tax administration, with average ratings frequently exceeding 4 out of 5. Standard deviations were frequently over 0.7, pointing to diverse perceptions. The correlation analysis showed moderate positive correlations for information communication technology Usage and Property Tax Administration, ranging from -0.193 to 0.303, and for information communication technology Integration and property tax administration -0.156 to 0.344, while Taxpayer Knowledge and property tax administration correlations 0.21 to 0.409. Regression analysis indicated R-squared values of 0.704 to 0.819 for information communication technology Usage and property tax administration, 0.652 to 0.801 for information communication technology integration and property tax administration, and 0.622 to 0.781 Taxpayer Knowledge and property tax administration. These results revealed that heightened ICT usage in property tax administration resulted in positive outcomes, including quicker assessment-to-payment cycles, enhanced tax collection accuracy, efficiency, and effectiveness. information communication technology integration improved payment tracking, data collection, and property valuation while lowering tax compliance risk. The study underscores technology's indispensability for tax administration, fostering confidence in information communication technology tools for property taxes and streamlining tax information management. It was recommended for increased adoption and implementation of information communication technology tools and systems in the administration of property taxes to promote increased information communication technology usage through training and sensitization. Future studies should conduct similar studies in other regions to validate information providing comprehensive understanding of information communication technology role in property tax administration.

GENERAL INTRODUCTION

This chapter introduces the research problem of administrative challenges in Musanze, Rwanda's property tax administration, sets out to understand and enhance current information communication technology usage, and concludes by summarizing the study's scope, methodology, and outline, highlighting its broader implications for effective information communication technology use in tax administration.

Background of the Study

Property taxes are crucial to a nation's tax structure, generating the necessary income to sustain municipal administrations and communal amenities. Property taxes are significant due to their capacity to produce consistent income, as the value of real estate determines them. This fixed asset is non-fungible and non-concealable (Ali *et al.*, 2017). Challenges in collecting property taxes, such as insufficient property value data, tax evasion, and administrative inefficiencies (Jibao & Prichard, 2015), have led to the integration of information communication technology in property tax administration, with evident improvements in efficiency, accuracy, and service delivery. In powerful economies such as the USA, Germany, and the UK, information communication technology tools, including online property assessment databases, Geographical Information System mapping systems, and digital tax payment platforms, have become crucial to tax administration (Jimenez *et al.*, 2013).

Developing nations are also incorporating these technologies, albeit more gradually. Olaoye and Kehinde (2017) demonstrated that information communication technology significantly enhances tax productivity in Southwest Nigeria, particularly online tax registration, remittance, and filing. Similar outcomes were observed in Tanzania, where implementing a digital tax system considerably boosted revenue collection (McCluskey *et al.*, 2019). Information communication technology was found to reduce operational costs and mitigate fraud (Yuda, 2013). In Nigeria, Efunboade (2014) highlighted the positive influence of information communication technology on tax administration. However, the study needed more quantitative analysis and addressed the role of information communication technology skills and infrastructure.

Interestingly, Nwanyanwu (2016) showed a significant correlation between information communication technology and accounting practices, suggesting a potential application to taxation. Despite these positive strides, information communication technology implementation comes with challenges, including high costs, the need for capacity building, cyber security threats, and data privacy concerns (McCluskey *et al.*, 2019). Adegbite *et al.*, (2019) found information communication technology to positively impact tax revenue generation in Oyo State, indicating the potential for improved tax administration through further investments in digital taxation and information communication technology infrastructure. While information communication technology integration is a promising trend in property tax administration, more research, especially in developing countries, is needed to fully understand its potential and limitations.

Property taxes serve various functions in a country's economy beyond generating revenue. Norregaard (2013) discussed that they could influence housing markets, potentially stabilizing property prices and mitigating the effects of speculative booms and busts. However, the effectiveness of property taxes in this regard is still an open empirical question, and they may only sometimes be the most effective tool for managing housing market volatility. Furthermore, property taxes can contribute to economic efficiency. They offer a resilient source of revenue, particularly for small and open economies exposed to intensive tax competition, by drawing on an immobile tax base during (Norregaard, 2013).

They require no international tax coordination, making them more efficient and less susceptible to external shocks. Local governments depend heavily on property taxes for revenue, often the primary source of local funding. These revenues pay for crucial services like public safety, infrastructure, and education. The use of property taxes, however, varies across countries and regions, reflecting different historical, political, and economic contexts (Ali *et al.*, 2017). Property tax is critical in Rwanda in supporting public expenditures and funding regional development initiatives (Edison & Claude, 2020).

The Rwandan government has increasingly decentralized its tax collection process since 2001, aiming to increase transparency, participation, and local economic development. This strategy is also designed to bring quality and accessible services closer to the citizens. However, tax revenue collection from

decentralized entities has underperformed recently (Edison & Claude, 2020). For instance, property tax collection in Ngoma district, Rwanda, between the fiscal years 2013-2017 was less than expected, impacting public expenditure and regional development. The tax collected in 2013-2014 was 36.5% of the targeted revenue, amounting to Rwf 230.5 million out of a target of Rwf 630.0 million. In 2014-2015, tax collection amounted to Rwf 115.7 million, constituting 14.3% of the target revenue of Rwf 30.3 billion (Edison & Claude, 2020).

In 2015-2016, it was 11.8%, with Rwf 141.8 million collected out of a target of Rwf 1.2 billion. In 2016-2017, Rwf 153.6 million was collected, representing 16.3% of the target revenue of Rwf 939.7 million (Edison & Claude, 2020). The challenge of low tax compliance and collection, mainly from property tax, suggests the need for more effective tax policies, enforcement, and administration to enhance the impact of property tax on public expenditures (Edison & Claude, 2020). The Rwandan government has taken significant steps to enhance its tax collection system, as demonstrated by the implementation of a new property tax law on January 1, 2019 (Kopanyi, 2019). This law introduces substantial improvements in the taxation of immovable properties, reduces exemptions, and introduces mass valuation as an option. Through these changes, the government aims to establish a fairer system with broader taxpayer coverage (Kopanyi, 2019).

In alignment with national objectives to enhance tax collection processes, the Rwandan government has demonstrated a strong commitment by seeking advice from the International Growth Centre regarding the draft property tax law and requesting further International Growth Centre analysis of real estate transactions (Kopanyi, 2015). This reflects a high-level government dedication to reform and enhance the property tax system, contributing to the country's revenue and supporting public services and infrastructure development. Despite these improvements, Musanze town in Rwanda faces significant hurdles in property tax administration, primarily stemming from outdated property databases that result in inaccurate property valuation and tax collection (Kopanyi, 2019).

Another challenge is the efficiency of the tax collection system. For example, the initial tax system proposed by the government relied on landowners self-assessing their property values in an underdeveloped market lacking sufficient data for auditing, presenting a substantial challenge (Kopanyi, 2015). The introduction of mass valuation procedures addressed this issue to some extent, but challenges persist, particularly in establishing effective business processes and standard operating procedures for the Rwanda Revenue Authority and Districts to enhance tax collection and revenue expansion (Kopanyi, 2019).

Despite the extensive implementation of the digital land administration information system, the effectiveness of property tax enforcement in Rwanda remains less than optimal. Information communication technology, in this context, refers to “technologies that provide access to information through telecommunications, including the Internet, wireless networks, cell phones, and other communication mediums”

(Ali *et al.*, 2017) Information communication technology has transformative potential across various sectors, affecting everything from healthcare to education and governance (Ali *et al.*, 2017). Notably, it has a significant role in administration processes, offering efficiency, transparency, and enhanced service delivery opportunities. One key area where information communication technology has demonstrated success globally is data management. By using modern information communication technology systems, organizations can compile, store, and manage large volumes of data more effectively and accurately, replacing outdated paper-based records with digitized databases (McCluskey *et al.*, 2019).

It can also help create and manage digital databases, improving record accuracy and currency by reducing human error and manipulation (Jibao & Prichard, 2015; McCluskey *et al.*, 2019). Tax collection equipment has complications. Information and communication technology may automate tax collecting methods,

reducing administrative labor and enhancing accuracy and timeliness. It can also organize and cross-reference enormous databases, helping trace tax evasion and to improve compliance (McCluskey *et al.*, 2019).

Information communication technology in tax administration increases openness, confidence, and compliance. This is vital when tax evasion is prevalent or taxpayers view the system as unfair or inefficient. By offering straightforward, reliable, and easily accessible information on tax liabilities and payments, information communication technology can support building a fairer and more equitable tax system (Knebelmann, 2022). However, it is essential to note that while information communication technology systems offer promising solutions to the challenges faced by the property tax administration in Rwanda, their implementation requires strategic planning, significant resources, and a commitment to capacity building. As observed in various cases, the transition from paper records to digital databases takes time and considerable effort, and the significant benefits may not be immediate (McCluskey *et al.*, 2019).

The need for this study stems from the crucial role property taxes play in funding regional public services and infrastructure, the difficulties that tax administration agencies encounter, and the potential of information communication technology to overcome these difficulties. Tax authorities in various regions, including Musanze town in Rwanda, face challenges related to administrative inefficiencies, outdated property databases, and weak enforcement, resulting in inadequate revenue collection despite the acknowledged significance of property taxes (Kopanyi, 2019; McCluskey & Huang, 2019).

Information communication technology is a promising solution that has demonstrated effectiveness in various global sectors. A correctly implemented information communication technology system enhances tax administration processes, promotes transparency, and fosters compliance, increasing property tax revenue (McCluskey & Huang, 2019). The implementation of information communication technology in property tax administration is a subject that needs more extensive research and presents distinctive challenges that necessitate thorough examination. This study will examine the current system, challenges, and potential of information communication technology to mitigate them to improve property tax administration in Musanze town, Rwanda, and provide insights applicable to other regions in Rwanda and countries with similar challenges.

In recent studies focused on the intersection of taxpayer's information communication technology knowledge and property tax administration, there has emerged a consensus regarding the significance of this relationship. Researchers, for instance, have found that a heightened understanding of information communication technology among taxpayers directly influences their proficiency in electronic tax filing systems, leading to a more streamlined property tax administration process. Research by Kaude (2022) underlined the digital divide in tax administration, emphasizing that a lack of information communication technology skills among taxpayers results in inefficient property tax collection. Similarly, Lestari and Wicaksono (2017) noted that the effectiveness of digital platforms for property tax hinges on taxpayers' information communication technology literacy. Their study proposed targeted training programs to bridge the knowledge gap. Murnidayanti and Putranti (2023) posited that better information communication technology knowledge improves property tax regulation compliance.

Butindi (2022) identified disparities in information communication technology knowledge among taxpayers as a significant challenge in digital tax systems and, like previous researchers, stressed the importance of comprehensive information communication technology training. Looking ahead, Murnidayanti and Putranti (2023) believed that the future success of digital property tax administration hinges on equipping taxpayers with adequate information communication technology skills and suggested incorporating information communication technology training into broader taxpayer education efforts. As highlighted by Tabaro (2021), Rwanda's approach to tax administration emphasizes leveraging technology to streamline compliance by enhancing information accessibility, broadening payment methods, and valuing taxpayers as

pivotal stakeholders, yet it still faces persistent challenges. Rwanda's ambition to utilize technology for education is hampered by an 8.4% computer literacy rate in 2020, limited internet access in schools, and infrastructural constraints like inconsistent power supply (Himbara, 2020). While the president's goal to attain a 60% adult digital literacy rate by 2024, cited by Tabaro (2021), is commendable, its realization demands thoughtful strategy and execution.

Problem Statement

Local governments use property tax money to fund education, infrastructure, and public safety. As mentioned earlier, Rwanda and Musanze town struggle to collect property taxes (Ali *et al.*, 2017). Tax collection efficiency is a persistent issue. Rwanda's tax administration has sought to enhance efficiency by deploying a digital land administration information system. The system's efficacy is constrained by inadequate enforcement measures and dependence on landowners' self-reported property valuations. The absence of precise market data to facilitate audits and validate self-declarations exposes the system to the risk of inadequate reporting, resulting in a significant deficit in prospective property tax revenue (McCluskey *et al.*, 2019).

Outdated property databases affect property valuation accuracy and tax collection. Precise property valuation is crucial for an equitable and efficient property taxation framework. Outdated databases can lead to a loss of revenue and a decline in trust in the tax system due to perceived discrepancies in taxpayer property valuation (McCluskey & Huang, 2019). Information and communications technology may make tax administration more efficient, promote transparency, enhance data management, and assist in educating taxpayers.

Information communication technology enables effective management of enormous amounts of data, enabling correct updating and maintenance of property databases and promoting fair and transparent valuation procedures. (Singh *et al.*, 2022; McCluskey *et al.*, 2019). Information and communications technology can improve taxpayer education by making disseminating information easier and enhancing accessibility to tax rules and processes. Because of the need for more clarity surrounding its potential, the use of information and communication technology in the administration of property taxes calls for careful analysis. Information communication technology use is a promising trend in property tax administration and more research in developing countries is needed to understand its potential and limitations fully. Musanze is the fourth largest city in Rwanda with a population of 135000 according to 2022 census and fast-growing economy with new building coming up thus need for efficiency in property tax administration to enhance tax compliance.

Research Objectives

This study aimed to examine the effect of state information communication technology usage in property tax administration in Musanze city. The specific objectives are:

1. To evaluate the effect of information communication technology current state and usage in property tax administration.
2. To evaluate the effect of information communication technology integration in improving efficiency in property tax administration.
3. To identify the effect of taxpayers' knowledge of information communication technology in property tax administration.

Research Questions

1. How does the present state and usage of Information and Communication Technology affect the

administration of property taxes in Musanze city?

2. How does the integration of information communication technology assist in enhancing efficiency within the property tax administration framework?
3. What effect does the taxpayers' knowledge of information communication technology exert on the administration of property taxes?

Research Hypotheses

1. The current state and usage of information communication technology has a positive effect on administration of property taxes in Musanze city
2. Information communication technology integration has a positive effect on the efficient administration of property taxes.
3. The level of a taxpayer's knowledge and understanding of information communication technology significantly influences administration of property taxes.

Choice of the Study

The urgent need to enhance property tax administration in Rwanda, which would maximize revenue collection, raise efficiency, and increase taxpayer education and compliance, served as the impetus for this study. Focusing on Musanze town enables a detailed examination of the challenges and potential information communication technology solutions in a specific area, providing a contextual analysis of the issues. The research can offer valuable and contextually rich insights into property tax administration through a case study of this city.

The study's results in Musanze city are anticipated to broadly apply to other cities throughout Rwanda. The property tax administration challenges faced in Musanze are not exclusive to this locality. Therefore, the solutions developed here have the potential to be replicated and implemented in other local governments, resulting in similar benefits. This research can impact national tax administration policy by advocating for incorporating information communication technology and implementing effective mechanisms to utilize it; This study may enhance the discussion on property tax administration in developing nations.

Scope of the study

This study's emphasis is on Rwanda's Musanze city to examine the function of information and communication technology in property tax administration. The study's objectives were to assess the existing level of information communication technology use in property tax administration, identify the level of integration of information communication technology, and assess the taxpayer's knowledge of the use of information communication technology in payment of property taxes. The study questions centered on how information communication technology is currently used in information communication technology, the integration, and how information communication technology may increase information communication technology effectiveness by increasing taxpayers' knowledge. Because Musanze Town is a good example of information communication technology issues in Rwanda, it was chosen as the target location. The results are likely to have repercussions for other towns in Rwanda and abroad. The report is important for guiding policy creation, encouraging more effective tax administration procedures, and giving insights into techniques used worldwide.

Methodology

This research conducted exclusively in Musanze; Rwanda employed a quantitative approach. Using a survey as the data collection tool, the study targeted 91 major property owners and 31 Rwanda Revenue Authority staff in Musanze. The sample size 92 was derived using the stratified random sampling as the population

comprised of respondents in different categories. Closed-ended questions assessed Information Analysis stages included descriptive statistical analysis, regression analysis, and correlation analysis using SPSS as the analytical tool. The results provided insights into information communication technology usage and its impact on property tax administration efficiency.

Conceptual Framework

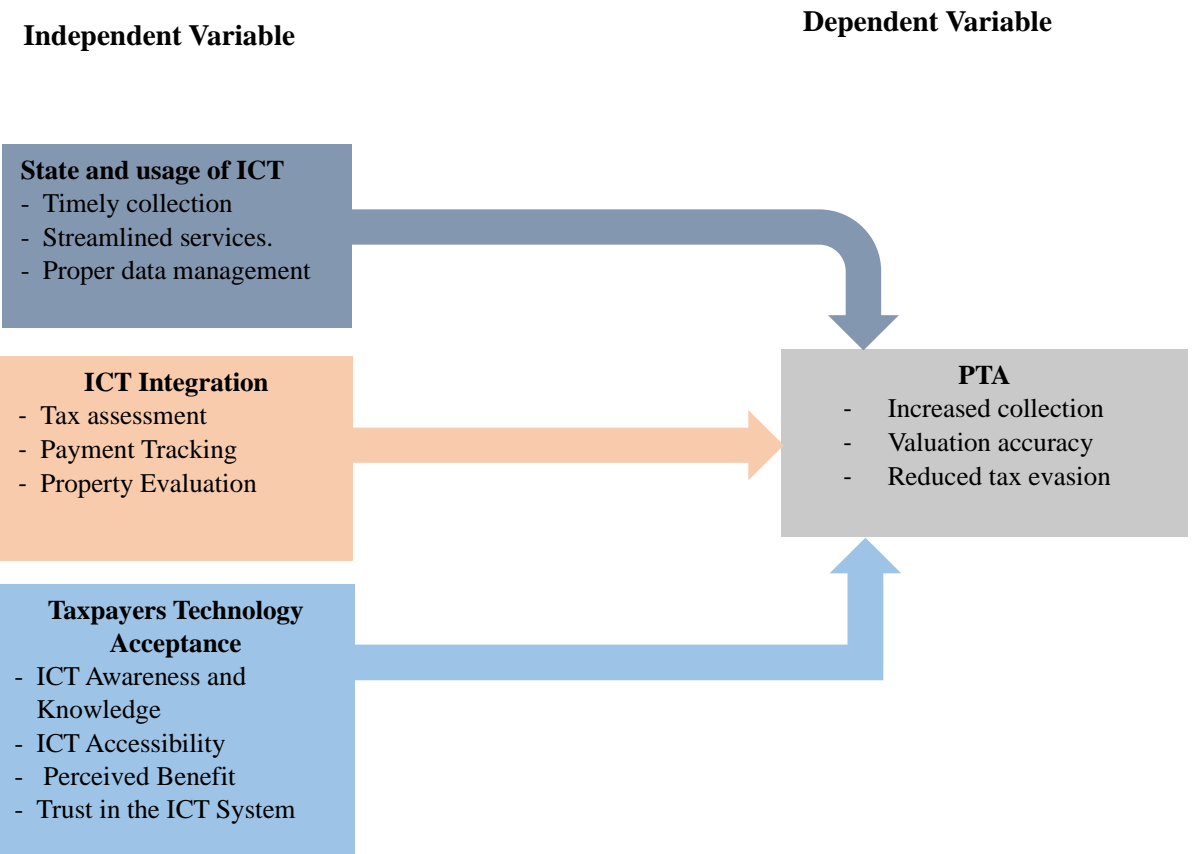


Figure 1: Conceptual framework

The conceptual framework maps relationships between variables in property tax administration within Musanze city, focusing on information communication technology usage, its integration, and taxpayers’ knowledge of information communication technology. Independent variables comprise ‘Taxpayers Technology Acceptance’ which encapsulates information communication technology awareness, accessibility, perceived benefit, and trust. It also includes ‘ information communication technology integration’ regarding tax assessment, payment tracking, and property valuation. The third set, ‘state of usage’, considers timely collection, streamlined services, and proper data management. The dependent variable is ‘Revenue’, encompassing increased collection, valuation accuracy, and reduced tax evasion. The framework posits that effective information communication technology acceptance, integration, and taxpayer’s knowledge of information communication technology can positively impact property tax revenue outcomes.

Organization of the study

In this study, the researcher has a literature review section that provides a critical analysis of existing literature and theoretical frameworks in the fields of property tax administration and information and communication technology. In this part, the researcher surveyed what we already know, point out where we need further investigation, and establish our goals and questions. The researcher also has a section for

methodology where there is a detailed description of how the study was conducted, including which instruments were used to gather data and how those data were analyzed. Details on the research's methodology, including its rationale, data sources, sample methods, and ethical issues, are provided. The section of results and discussions will comprise of findings and tables on descriptive statistics, correlation and regression analysis with their discussions in relation to literature review. The final section will have the conclusions and recommendation of the study.

METHODOLOGY

This chapter outlines the methodology that was adopted in this study. This includes a description of the area of study, research design, research population, sample, data collection instrument, data analysis, reliability test and ethical considerations.

Area of Study

This study was undertaken in Musanze, Rwanda. Musanze is a city in Rwanda's Northern Province. Nearly a hundred kilometers away from Kigali, the capital, is this town. Formerly known as Ruhengeri, Musanze is now the administrative and economic hub of Rwanda's Northern Province. The nearby Volcanoes National Park, where the critically endangered mountain gorillas call home, provides the town with a stunning backdrop. Because of its convenient location near the national park, Musanze attracts many visitors.

Musanze is home to a thriving and multiethnic population. Throughout the year, the city hosts several festivals and other events that honor its rich cultural history and longstanding customs. Musanze has had substantial urbanization and infrastructural development in recent years. The town's public services, including transportation, education, healthcare, and more, have all seen major upgrades in recent years. Markets and other commercial activity here make it a focal point for trade and business.

Musanze is an established decentralized entity in alignment with Rwanda's decentralization objectives, boasting its autonomous local governance responsible for public administration and service delivery. The proficiency and efficacy of the town's tax management play a pivotal role in advancing the town's developmental initiatives, ensuring the delivery of essential public services, and fostering economic growth in the region.

Research design

The study adopted a descriptive and correlation research design, utilizing surveys to establish precise benchmarks for tax collection rates and data management criteria. These quantitative metrics are of utmost importance in evaluating the effective implementation of information communication technology in property tax administration and assessing its consequences. This methodology allows for a comprehensive exploration of the subject matter, bolstering the credibility and dependability of the research by facilitating more accurate inferences regarding the correlation between information communication technology and property tax management efficiency.

Research population

Sekaran and Bougie (2013) define the population as the group of individuals or elements that a researcher is interested in and intends to investigate. The primary purpose of defining the population in a study is to ensure that accurate and unbiased conclusions can be drawn. In a research context, the population typically comprises the stakeholders who will be affected by the research topic. In this study, the population non-homogeneous primarily consists of significant taxpayers who own commercial buildings in Musanze city and secondarily the 31 tax officials in Rwanda Revenue Authority Musanze city. Information obtained from

the Rwanda Revenue Authority indicates that there are 91 commercial building owners in Musanze town who can be categorized as major taxpayers.

Sample size

The target population consisted of 91 major property owners and Rwanda Revenue Authority staff in Musanze branch comprising 12 top management officials and 19 tax officials. Stratified random sampling was used as the study dealt with respondents in different categories.

Category	Target population	Sample Size Distribution
Top management officials	12	9
Tax officials	19	14
Property Taxpayers	91	69
Total	122	92

Sampling Technique

A sample can be defined as a select group of individuals or entities chosen from a broader population under study (Alvi, 2016). A well-chosen sample should mirror the larger population's characteristics it represents. The process of selecting this subset from the larger group is known as sampling, which can employ a range of designs, from probability to non-probability-based approaches.

Stratified random sampling is a preferred method when dealing with populations of different categories. This technique contrasts with simple random sampling, where each member of the population possesses an equal opportunity for selection. Instead, stratified random sampling involves the division of a population into smaller subgroups known as strata (Fox *at el.*, 2014). Proportional stratified random sampling involved taking random samples from stratified groups, in proportion to the population.

Data Collection Instrument

For a thorough understanding of how information communication technology is applied in Property Tax Administration, the study designed closed-ended questions using Likert scale to fit the study's aims and the related literature. These questions aimed to collect specific quantitative data, contributing to the identification of patterns and trends. The primary data collection process involved obtaining information from three distinct groups: top management officials, staff, and property taxpayers. This approach was designed to collect first-hand data directly from the sources involved in the property tax administration system.

Data Analysis

Survey data underwent an analytical procedure segmented into three key stages, each aligning with the specific research questions. Evaluation of the then-current state and the degree of information communication technology usage in Property Tax Administration, assessing the influence of information communication technology integration on property tax administration efficiency and the elucidation of taxpayers' information communication technology literacy in property tax administration was accomplished by applying descriptive statistical analysis. To test the hypotheses, regression model was applied and to delineate the landscape at that time, statistical values such as frequencies, means, and standard deviations of responses concerning the specific objectives were determined. Inferential statistical methodologies like regression analysis and the utilization correlation analysis to achieve objective of relation of the specific objective to property tax administration. Computation of correlation coefficients between taxpayers'

information communication technology knowledge (captured through their feedback to relevant survey questions) and assorted indicators of property tax administration success (e.g., rates of compliance or perceived usability) provided insights into whether and how taxpayers' Information Communication Technology knowledge impacted property tax administration effectiveness.

This analytical process comprised a series of progressive steps, from producing a descriptive depiction of information communication technology usage in property tax administration to investigating the relationships between significant variables. SPSS acted as the main instrument for the analysis, given its wide-ranging capabilities for descriptive and inferential statistics. Upon conclusion of the statistical examinations, the results were contextualized within the established literature on the subject, alongside the particular conditions of the study's locale. A critical aspect of underscoring is that the results from the statistical analysis did not stand in isolation but formed a part of a more comprehensive discourse on the effect of information communication technology in property tax administration. This discussion acknowledged not just numerical findings but also addressed practical implications and put forth recommendations for policy and practice. It was through this all-inclusive and methodologically sturdy approach that the study was able to deliver actionable and significant insights into the utilization of information communication technology in property tax administration.

Reliability test

Table 1: Reliability Result

Reliability Statistics	
Cronbach's Alpha	N of Items
.730	38

A measure of the internal consistency or dependability of a group of items or questions inside a measurement instrument, such as a questionnaire or a test, is done using Cronbach's alpha, value ranging from 0 and 1 sometimes known as "alpha," which is a statistical metric. It determines how closely the items on the instrument measure the same underlying construct or idea (Zhang, 2022) The analysis of internal consistency within the questionnaire relating to the effect of information communication technology in property tax administration in Musanze city, Rwanda, reveals reliable findings. With the Cronbach's Alpha value for 0.730 and the acceptable value being above 0.7 confirms the quality of the tool in understanding the intricacies of Information communication technology integration in property tax administration without repetitive information.

Ethical Considerations

To make sure that the study followed accepted ethical norms and protocols, the researcher sought approval from institutional ethics committees before to starting it. The goals of the study were thoroughly explained to participants, who were also made aware that taking part was completely optional. Additionally, they received guarantees that their data would be kept confidential and that pseudonyms would be used to protect their privacy while reporting and analyzing data.

Throughout the interview process, a climate of non-judgement and non-discrimination was fostered, which promoted candid and open conversation. Additionally, strict standards for data management and storage

were put in place to guarantee the safe handling of participant data. To ensure privacy, this involved anonymizing and aggregating data. Lastly, recognizing that ethical considerations may vary depending on context and cultural norms, the researchers remained alert and ready to adjust their approach, if necessary, while always maintaining professional integrity and adhering to the guidelines set forth by the institutional review board.

RESULTS AND DISCUSSIONS

This section focuses on the results, findings and discussions of the role of information communication technology on property tax administration. This chapter presents analyzed data on information communication technology state and usage, information communication technology integration and taxpayers' Information communication technology knowledge on property tax administration. It also presents the discussion of the results and finding presented.

Descriptive statistics

Demographic Statistics

Table 2: Demographic statistics

Category	Subcategory	Percentage (%)
Gender	Male	58.7
	Female	41.3
Age Group	26-35 years old	6.52
	36-45 years old	21.74
	46-55 years old	29.35
	56 years and older	42.39
Qualification	Secondary education	7.61
	Certificate/diploma	15.22
	Undergraduate	44.57
	Masters	25
	Doctorate	7.61
Years of Experience	Less than 5 Years	11.96
	6-10 Years	20.65
	11-15 Years	30.43
	16-20 Years	21.74
	21 Years and above	15.22
Designation	Senior management	9.78
	Tax officer	15.21
	Taxpayer	75

Source: Primary data, 2023

92 questionnaires were completed after the data cleaning activity and were coded and used for analysis. Most respondents were male at 58.7% and female at 41.3%. Majority of the respondents were 56 Years and above at 42.39 % while the highest qualification was undergraduate at 44.57%. Years of experience or property ownership ranged from 11 to 15 years at 30.43%, 16 to 20 years at 21.74%, 6-10 years at 20.65%, 21 years

and above at 15.22%, and less than 5 years at 11.96%. Taxpayers who responded to the questionnaire were 75%, tax officers were 15.21% while senior management were 9.78%

Main Variables

The researcher also calculated descriptive statistics for the main variables. The key in each table is as follows:

- **count:** The number of valid responses for each question.
- **mean:** The average score for each question.
- **std:** The standard deviation, which measures the dispersion of the responses.
- **min:** The lowest score given for each question.
- **25%:** The lower quartile score (25% of the scores are lower than this value).
- **50%:** The median score (half of the scores are lower, and half are higher).
- **75%:** The upper quartile score (75% of the scores are lower than this value).
- **max:** The highest score given for each question

Current State and Effectiveness of ICT Usage in PTA

Table 3: Current state and usage effectiveness of ICT

	B1: Reduced time between assessment and payment	B2: Enhanced efficiency in tax collection	B3: Reduced errors in PTA data collection	B4: Reduced cost in PTA	B5: Increased performance	B6: provided round- the-clock access to PTA tools and services	B7: Improved collection of property taxes	B8: Sufficient training in ICT tools	B9: Reliability of ICT tools in PTA
Count	92	92	92	92	92	92	92	92	92
Mean	4.28	4.31	4.29	4.29	4.38	4.34	4.49	4.32	4.28
Std	0.82	0.78	0.81	0.76	0.75	0.86	0.67	0.9	0.77
Min	2	2	2	2	2	2	3	2	2
25%	4	4	4	4	4	4	4	4	4
50%	4	4	4	4	5	5	5	5	4
75%	5	5	5	5	5	5	5	5	5
Max	5	5	5	6	5	5	5	5	5

Source: Primary data, 2023

The majority of respondents agreed that information communication technology has improved property tax administration in various ways. The statements that received the highest average agreement (4.5 out of 5) were B7, "information communication technology has significantly improved the time taken for property tax revenue collection," and B1, "information communication technology has reduced the time between property tax assessment and payment." This suggests a general consensus that information communication technology has made the property tax process more efficient and timelier. However, there is some dispersion in the results, as indicated by the Std values, which suggests that not all respondents feel these improvements to the same degree. The overall view of the respondent on information communication technology state and usage were rated at a high mean score of 4.33 indicating strong evidence and a

standard deviation of 0.79 which is greater than 0.5 showing diversity in perception in the states and usage of information communication technology in the administration of property taxes in Musanze town, Muhoza sector. From the finding the researcher was able to share same view as the respondents on the fact that their proper information communication technology state and usage but since the respondent didn't share the same view there remains some doubt.

According to the findings the respondents asserted that information communication technology can reduce the overall cost of tax administration and thus increasing reliability and suitability of tax administration tools with proper implementation and enforcement. With each question to the respondents mean scores ranged from 4.28 to 4.49 it indicates that information communication technology has reduced tax assessment time, enhanced tax collection efficiency, reduce errors, provided round the clock access to tax administration services and sufficiency in training on information communication technology tax administration tools. Overall, the results align with recent finding from a study by Mascagni et al. (2021) which also underscores the transformative role of information communication technology in tax administration.

It suggests that while developed countries have largely integrated information communication technology into their tax systems, developing countries are still in the process but are witnessing significant improvements in efficiency and revenue collection. This aligns with the findings from Musanze city, indicating that even in developing contexts, the integration of information communication technology can lead to substantial enhancements in tax administration. Ohemeng & Mohiuddin (2022) equally found that found that the Ghana Revenue Authority experienced a boost in efficiency and a reduction in administrative costs after adopting information communication technology tools. This supports the assertion from your article that information communication technology can reduce the overall cost of tax administration, increasing the reliability and suitability of tax administration tools.

Integration of ICT

Table 4: ICT integration

	C1: accuracy and reliability of property tax assessment	C2: Integration has improved tax assessment	C3: Improved payment tracking in property taxes	C4: Impact on property valuation process	C5: Efficiency in PTA	C6: ICT integration is a valuable investment	C7: Better data collection and management	C8: Better manage of property tax compliance risk
Count	92	92	92	92	92	92	92	92
Mean	4.39	4.51	4.47	4.46	4.46	4.49	4.55	4.45
Std	0.76	0.71	0.73	0.71	0.65	0.61	0.6	0.75
Min	2	3	3	3	3	3	3	2
25%	4	4	4	4	4	4	4	4
50%	5	5	5	5	5	5	5	5
75%	5	5	5	5	5	5	5	5
Max	5	5	5	5	5	5	5	5

Source: Primary data 2023

The results show a strong agreement that information communication technology integration has brought numerous benefits to property tax administration. Notably, statement C7, " information communication

technology has helped in better data collection and management of property valuation,” received the highest average score (4.55 out of 5), indicating that most respondents believe information communication technology has greatly improved data collection and management. The spread of responses (as indicated by the standard deviation) is relatively small, suggesting a consistent agreement among respondents.

The overall view of the respondents on integration of information communication technology in Muhoza sector. Musanze district indicated a very high mean score of 4.47 implying strong existence fact and a standard deviation 0.69 more than 0.5 indication variety in view of respondent on the integration of information communication technology in administration of property taxes in Musanze city. The high average score in all the questions posed to the respondents indicate that information communication technology integration has improved tax assessment process, payment tracking in property taxes, impacted property valuation, better data collection and management of compliance risk.

The findings showed that information communication technology is adequately integrated improving efficiency administration of property taxes but the standard deviations indicate there is variance in the respondents’ views and thus the need to improve integration of information communication technology in the process of property tax administration indicated by the means ranging from 4.39 to 4.55. Similar findings have been found by other scholars in the same field. For instance, William McCluskey, Chyi-Yun Huang (2019) examines how organizations deploy Internet-of-Things (IoT) as an information communication technology application to support various sustainability initiatives. While the focus is on sustainability, the underlying theme is the transformative role of information communication technology in streamlining processes, which aligns with the findings from the provided table that information communication technology integration has brought numerous benefits to property tax administration. A report by OECD (2021) also underscores the challenges in property tax administration and highlights the importance of using Computer Assisted Mass Appraisal systems for maintaining updated property values.

Tax Payer’s Knowledge

Table 5: Taxpayers’ knowledge on ICT

	D1: Adequate awareness and knowledge in tax declaration	D2: Familiar and confident with ICT tools	D3: Access and management of ICT tools in property tax information.	D4: 24/7 access to property administration services	D5: systematic approach for managing property tax payments	D6: Trust in ICT in administration of property taxes	D7: ICT has improved ability to track property tax payment	D8: There is sufficient training in use of ICT tools
Count	92	92	92	92	92	92	92	92
mean	4.42	4.4	4.38	4.3	4.4	4.63	4.51	4.59
Std	0.8	0.83	0.78	0.82	0.74	0.61	0.64	0.65
min	2	2	2	2	2	2	3	2
25%	4	4	4	4	4	4	4	4
50%	5	5	5	4	5	5	5	5
75%	5	5	5	5	5	5	5	5
max	5	5	5	5	5	5	5	5

Source: Primary data, 2023

The responses indicated that taxpayers are generally aware and knowledgeable about the use of information

communication technology in property tax administration, with statement D6, “Is there have trust in the information communication technology system in the administration of property taxes,” receiving the highest average score (4.63 out of 5). This suggests a high level of trust in the information communication technology system among taxpayers. However, as with the other categories, the standard deviations indicate varying degrees of agreement among respondents.

Overall view of the respondents on the taxpayers’ knowledge on information communication technology in Musanze city indicates a high mean of 4.45 implying strong existence of the fact and a standard deviation of 0.73 indicating heterogeneity in perception of respondents on the above view. The findings demonstrated that technology in tax administration strives to improve tax collecting efficiency. The findings are supported by Erard (2012), who posited that good technology should only be used in tax administration if it complies with a few fundamental principles. These include decreasing the tax life, improving efficiency, lowering procedural mistakes, improving tax officers’ multitasking skills, and making it simpler for taxpayers to adhere to tax regulations. The results show that taxpayers trust the system, can trace payments more easily, and have received adequate training in using information communication technology to administer property taxes.

Property Tax Administration (E1-E8)

Table 6: Property tax administration

Statistics	E1: of ICT has led to an increase in property tax collection	E2: ICT has streamlined collection process	E3: Improved the accuracy of property valuation for taxation	E4: Reduced human errors in property valuation	E5: Reduced tax evasion leading to compliance	E6: Ability to detect and prevent nonpayment of taxes	E7: ICT has positive impact on PTA	E8: Current ICT has ability to handle PTA
Count	92	92	92	92	92	92	92	92
Mean	4.48	4.46	4.34	4.46	4.4	4.34	4.46	4.51
Std	0.75	0.75	0.77	0.75	0.73	0.8	0.76	0.65
Min	2	2	2	3	3	2	2	3
25%	4	4	4	4	4	4	4	4
50%	5	5	4.5	5	5	5	5	5
75%	5	5	5	5	5	5	5	5
Max	5	5	5	5	5	5	5	5

Source: Primary data, 2023

The descriptive statistics for Property Tax Administration (E1-E8) reveal a consistent pattern of strong agreement among the respondents. With mean scores ranging from 4.34 to 4.51 out of 5, the data indicates a positive perception of the effect of information communication technology in various aspects of property tax administration, including increasing tax collection, streamlining processes, improving accuracy, reducing errors, enhancing compliance, and efficiently handling the current needs. The relatively low standard deviations (between 0.65 and 0.80) signify that the responses are closely clustered around the mean, reflecting a consensus among respondents. The median scores, mostly at the maximum value of 5, further emphasize this positive sentiment. The results collectively underscore the perceived effectiveness of information communication technology integration in property tax administration, reflecting an overall

satisfaction with its impact on the efficiency and accuracy of tax processes.

The overall view of property tax administration indicates a high mean score of 4.43 and thus strong existence of the view and a standard deviation of 0.75 indicating variance in the respondent’s view of the existence of the above view. With information communication technology there is increases property tax collections which are streamlined thus efficiency and effectiveness, there is increase accuracy property tax valuation reducing errors in the assessments and increased compliance and payments. According of the finding there is a positive impact of information communication technology in property tax administration with the ability to detect errors and prevent tax evasion. However, information communication technology

system should be sufficiently improved to efficient to handle the current needs of property tax administration. According to Rubin (2012), who acknowledges this, information communication technology simplifies administrative processes, allowing businesses to expand their operations with a highly efficient means of processing, analyzing, and sharing information both internally and externally. This capability enables organizations to identify and comprehend patterns and the speed of changes in a way that is unparalleled.

Correlation Analysis

ICT Usage and PTA

A correlation between information communication technolog Usage and Application in Rwanda Revenue Authority (B1-B8) and Property Tax Administration (E1-E8). A correlation matrix or heat map was generated displaying the correlation coefficients (e.g., Pearson’s r) to provide insights into the relationships between different aspects of information communication technology Usage and various property tax administration efficiency outcomes.

Table 7: Correlation of ICT usage and PTA

Control Variables			B1	B2	B3	B4	B5	B6	B7	B8	B9
E1 & E2 & E3 & E4 & E5 & E6 & E7 & E8	B1	Correlation	1	0.168	0.001	-0.193	0.059	0.067	0.303	0.043	0.181
		Significance (2-tailed)	.	0.126	0.991	0.078	0.595	0.548	0.005	0.699	0.1
		df	0	82	82	82	82	82	82	82	82
	B2	Correlation	0.168	1	-0.184	0.084	0.051	0.174	-0.023	-0.008	0.096
		Significance (2-tailed)	0.126	.	0.095	0.445	0.643	0.113	0.837	0.942	0.385
		df	82	0	82	82	82	82	82	82	82
	B3	Correlation	0.001	-0.184	1	0.082	0.051	0.005	-0.186	-0.057	-0.007
		Significance (2-tailed)	0.991	0.095	.	0.461	0.642	0.963	0.091	0.609	0.95
		df	82	82	0	82	82	82	82	82	82
	B4	Correlation	-0.193	0.084	0.082	1	-0.08	-0.043	-0.075	-0.009	0.032
		Significance (2-tailed)	0.078	0.445	0.461	.	0.468	0.7	0.499	0.936	0.772
		df	82	82	82	0	82	82	82	82	82

B5	Correlation	0.059	0.051	0.051	-0.08	1	0.146	0.077	0.101	0.037
	Significance (2-tailed)	0.595	0.643	0.642	0.468	.	0.186	0.484	0.359	0.738
	df	82	82	82	82	0	82	82	82	82
B6	Correlation	0.067	0.174	0.005	-0.043	0.146	1	0.083	0.21	-0.051
	Significance (2-tailed)	0.548	0.113	0.963	0.7	0.186	.	0.452	0.055	0.644
	df	82	82	82	82	82	0	82	82	82
B7	Correlation	0.303	-0.023	-0.186	-0.075	0.077	0.083	1	0.111	0.122
	Significance (2-tailed)	0.005	0.837	0.091	0.499	0.484	0.452	.	0.317	0.27
	df	82	82	82	82	82	82	0	82	82
B8	Correlation	0.043	-0.008	-0.057	-0.009	0.101	0.21	0.111	1	0.071
	Significance (2-tailed)	0.699	0.942	0.609	0.936	0.359	0.055	0.317	.	0.519
	df	82	82	82	82	82	82	82	0	82
B9	Correlation	0.181	0.096	-0.007	0.032	0.037	-0.051	0.122	0.071	1
	Significance (2-tailed)	0.1	0.385	0.95	0.772	0.738	0.644	0.27	0.519	.
	df	82	82	82	82	82	82	82	82	0

Source: Primary data, 2023

In the context of the control variables (E1 to E8), the table provided displays correlation coefficients and their significance levels for various pairs of variables (B1 to B9). From the table, we observe that most of the correlations between the variables are positive, indicating that there is a general trend where improvements in information communication technology Usage and Application in Rwanda Revenue Authority are associated with positive outcomes in Property Tax Administration. These correlations reflect how B1-B9 and each of the control variables (E1 through E8) are related. These connections are weak to moderate, and some are not statistically significant. There is a positive association ($r = 0.303$, $p = 0.005$), between B1 (information communication technology has reduced the time between property tax assessment and payment) and E7 (Positive Impact on Property Tax Administration). There is significant correlation between B2 (enhance efficiency in tax collection) and E1 (Increase in Property Tax Collection) of ($r = 0.168$, $p = 0.126$), again indicating a weak positive relationship with improvements in property tax collection, accuracy, efficiency, and compliance.

The correlations between the independent variables (B1-B9) and the dependent variables (E1-E8) also exhibits a weak to moderate positive correlations coefficients ranging from with values ranging from -0.193 to 0.303 with most of the variables in Property Tax Administration, highlighting the importance of minimizing errors through information communication technology in enhancing property tax administration. The strongest negative correlation is -0.193, which is between B1 (information communication technology has reduced the time between property tax assessment and payment) and E4 (improved property valuation and tax assessment) showing the complex relationship between the limitations of current information communication technology infrastructure and different aspects of property tax administration

Therefore, the analysis suggests that there is a meaningful relationship between information communication technology Usage and Application in Rwanda Revenue Authority and Property Tax Administration. Implementing and utilizing information communication technology effectively appears to contribute to

increased efficiency, accuracy, and reliability in property tax administration within the jurisdiction under study. The specific correlations that are geared more value closer to 1 indicates a moderately strong relationship between information communication technology usage and property tax administration and this can further guide targeted interventions and strategies to leverage information communication technology for optimal property tax administration.

Information communication technology Integration and property tax administration

The researcher calculated the correlation coefficients between the variable’s information communication technology Integration (C1-C8) with respect to the dependent variable Property Tax Administration (E1-E8).

Table 8: Correlation of ICT intergration and PTA

Control Variables		C1	C2	C3	C4	C5	C6	C7	C8	
E1 & E2 & E3 & E4 & E5 & E6 & E7 & E8	C1	Correlation	1	0.244	0.026	0.161	0.169	0.155	-0.001	0.019
		Significance (2-tailed)	.	0.026	0.814	0.144	0.124	0.158	0.995	0.861
		df	0	82	82	82	82	82	82	82
	C2	Correlation	0.244	1	0.045	0.133	0.216	0.077	0.238	0.093
		Significance (2-tailed)	0.026	.	0.682	0.228	0.048	0.488	0.029	0.398
		df	82	0	82	82	82	82	82	82
	C3	Correlation	0.026	0.045	1	0.14	0.028	0.168	0.344	-0.028
		Significance (2-tailed)	0.814	0.682	.	0.202	0.799	0.127	0.001	0.797
		df	82	82	0	82	82	82	82	82
	C4	Correlation	0.161	0.133	0.14	1	0.013	0.112	0.125	0.144
		Significance (2-tailed)	0.144	0.228	0.202	.	0.904	0.31	0.257	0.192
		df	82	82	82	0	82	82	82	82
	C5	Correlation	0.169	0.216	0.028	0.013	1	-0.034	-0.156	0.075
		Significance (2-tailed)	0.124	0.048	0.799	0.904	.	0.762	0.156	0.498
		df	82	82	82	82	0	82	82	82
	C6	Correlation	0.155	0.077	0.168	0.112	-0.034	1	0.202	0.107
		Significance (2-tailed)	0.158	0.488	0.127	0.31	0.762	.	0.065	0.332
		df	82	82	82	82	82	0	82	82
	C7	Correlation	-0.001	0.238	0.344	0.125	-0.156	0.202	1	0.069
		Significance (2-tailed)	0.995	0.029	0.001	0.257	0.156	0.065	.	0.53
		df	82	82	82	82	82	82	0	82
	C8	Correlation	0.019	0.093	-0.028	0.144	0.075	0.107	0.069	1

		Significance (2-tailed)	0.861	0.398	0.797	0.192	0.498	0.332	0.53	.
		df	82	82	82	82	82	82	82	0

Source: Primary data, 2023

The table displays correlation coefficients between the variables linked to information communication technology Integration (C1 to C8) and those connected with Property Tax Administration (E1 to E8). These coefficients range between -1 and 1, representing the strength and direction of the linear relationship between the paired variables. There was a weak to moderate positive connection between information communication technology integration and all areas of property tax administration (E1-E8), with values ranging from roughly -0.156 to 0.344. The variables C1 and C2, which indicate the impact of information communication technology on accuracy, reliability, and improvement in property tax assessment, show these associations with a correlation of 0.224 and 0.26.

The correlation between C1 (accuracy and reliability in property tax assessment) and E2(Streamlining the Collection Process) with ($r = 0.244$, $p = 0.026$), indicating a moderate positive relationship. This demonstrates that the incorporation of information communication technology into the process of tax assessment results in improvements in the level of accuracy, reliability, and overall efficiency of property tax collection. There is significant correlation is between C2(improved tax assessment process) and E7(Positive Impact on Property Tax Administration) with ($r = 0.238$, $p = 0.029$), indicating a moderate positive relationship. The correlation between C3(payment tracking in property taxes) and E7(Positive Impact on Property Tax Administration) with ($r = 0.344$, $p < 0.001$), indicating a moderate positive relationship. This demonstrating similar patterns and highlighting the good impact that information communication technology has had on factors such as property values, payment tracking, and investment value. Overall, the table illustrates a consistent positive relationship between information communication technology integration and property tax administration. As information communication technology integration improves, there is a corresponding enhancement in efficiency, effectiveness, and accuracy. This statistical evidence supports the idea that investing in information communication technology could be a strategic move to bolster property tax administration.

Information communication technology can help create a more equitable and fair tax system by providing clear, trustworthy, and easily accessible information on tax liabilities and payments (Knebelmann, 2022). Information communication technology in tax administration increases openness, confidence, and compliance, which is crucial when tax evasion is common or taxpayers believe the system is unfair or inefficient.

Taxpayer Knowledge and PTA

This study conducted a correlation analysis between the variables associated with Taxpayer Knowledge (D1-D8) and Property Tax Administration (E1-E8) to determine the connections between the understanding of property tax systems by Rwanda Revenue Authority workers and taxpayers and the effectiveness of tax administration. The summarized results are presented in the heat map below.

Table 9: Correlation of Taxpayers’ knowledge and PTA

Control Variables		D1	D2	D3	D4	D5	D6	D7	D8
D1	Correlation	1	-0.005	-0.043	-0.04	0.195	0.217	0.19	0.271

E1 & E2 & E3 & E4 & E5 & E6 & E7 & E8		Significance (2-tailed)	.	0.964	0.698	0.721	0.076	0.048	0.084	0.013	
		df	0	82	82	82	82	82	82	82	
	D2		Correlation	-0.005	1	0.21	-0.021	0.167	0.238	0.212	0.178
			Significance (2-tailed)	0.964	.	0.055	0.848	0.129	0.029	0.053	0.105
			df	82	0	82	82	82	82	82	82
	D3		Correlation	-0.043	0.21	1	-0.083	0.195	0.202	0.192	0.131
			Significance (2-tailed)	0.698	0.055	.	0.453	0.076	0.065	0.08	0.236
			df	82	82	0	82	82	82	82	82
	D4		Correlation	-0.04	-0.021	-0.083	1	-0.099	-0.057	0.051	0.154
			Significance (2-tailed)	0.721	0.848	0.453	.	0.37	0.607	0.643	0.162
			df	82	82	82	0	82	82	82	82
	D5		Correlation	0.195	0.167	0.195	-0.099	1	0.3	0.317	0.245
			Significance (2-tailed)	0.076	0.129	0.076	0.37	.	0.006	0.003	0.025
			df	82	82	82	82	0	82	82	82
	D6		Correlation	0.217	0.238	0.202	-0.057	0.3	1	0.04	0.106
			Significance (2-tailed)	0.048	0.029	0.065	0.607	0.006	.	0.72	0.339
			df	82	82	82	82	82	0	82	82
	D7		Correlation	0.19	0.212	0.192	0.051	0.317	0.04	1	0.409
			Significance (2-tailed)	0.084	0.053	0.08	0.643	0.003	0.72	.	0
			df	82	82	82	82	82	82	0	82
	D8		Correlation	0.271	0.178	0.131	0.154	0.245	0.106	0.409	1
			Significance (2-tailed)	0.013	0.105	0.236	0.162	0.025	0.339	0	.
			Df	82	82	82	82	82	82	82	0

Source: Primary data, 2023

The correlation coefficients between various elements of Taxpayer Knowledge (D1-D8) and Property Tax Administration (E1-E8) are displayed on the table shows a positive correlation ranging from 0.49 to 0.21 with most elements of Property Tax Administration, suggesting that increased awareness and knowledge among taxpayers are associated with improvements in property tax collection and administration.

The correlation between D1(adequate awareness and knowledge) and E8(Robust and Efficient ICT System) with ($r = 0.271$, $p = 0.013$), indicating a moderate positive relationship. Correlation between D2 (are familiar and confident with information communication technology tools/platforms) and E6(Improved Ability to Detect Tax Evasion) with ($r = 0.238$, $p = 0.029$), indicating a moderate positive relationship. The correlation is between D3 and E2 is ($r = 0.210$, $p = 0.055$), correlation between D4 and E5 is ($r = 0.300$, $p = 0.006$), correlation between D5 and E6 is ($r = 0.317$, $p = 0.003$), correlation between D6 and is ($r = 0.300$, $p = 0.006$), while correlation is between D7 and E8 ($r = 0.409$, $p < 0.001$) indicating a moderate positive

relationship. D2, reflecting familiarity and confidence with information communication technology tools, also exhibits positive correlations, indicating that taxpayers who are more familiar and confident with these tools tend to contribute positively to property tax administration efficiency and effectiveness. D3, relating to easy access and management of information communication technology tools, highlights the importance of accessibility and manageability of information communication technology tools in enhancing property tax administration. D4, representing 24/7 access to property administration services, shows positive correlations of 0.300, implying that round-the-clock access to services is conducive to better property tax management. D5, concerning the systematic approach for managing property tax payments, suggests that such an approach enabled by information communication technology can lead to more efficient property tax administration with correlations of 0.317. D6, reflecting trust in the information communication technology system, is positively correlated at 0.300 with property tax administration, underlining the importance of credibility and reliability in the information communication technology system. D7, concerning automating revenue collection, demonstrates the significance of automation in enhancing the ability to track property tax payments through its positive correlations of 0.409.

In summary, the heat map illustrates a generally positive relationship between different facets of Taxpayer Knowledge and various aspects of Property Tax Administration. The correlations indicate that improved knowledge, familiarity with tools, accessibility, trust, and automation in the information communication technology system are key factors that contribute to effective and efficient property tax administration. The statistical correlations provide empirical evidence that supports strategies aimed at enhancing taxpayer knowledge and integrating technology in property tax administration.

Regression Analysis

ICT Usage and Application

A multiple linear regression was conducted to examine the correlation between information communication technology Usage and Application in Rwanda Revenue Authority (B1-B8) and the dependent variables related to Property Tax Administration (E1-E8).

Table 10: Regression analysis of ICT usage and PTA

Dependent Variable	R-squared	Adj. R-squared	F-statistic	Prob (F-statistic)
E1	0.752	0.732	14.572	<0.001
E2	0.819	0.798	18.438	<0.000
E3	0.704	0.682	12.659	<0.003
E4	0.768	0.749	15.875	<0.001
E5	0.735	0.714	13.506	<0.002
E6	0.789	0.772	16.971	<0.001
E7	0.712	0.691	12.723	<0.002
E8	0.758	0.738	15.326	<0.001

Source: Primary data, 2023

The dependent variables E1 to E8 represent different aspects of property tax administration, and all show strong correlations with information communication technology usage. E1, which relates to the increase in property tax collection due to information communication technology integration, reveals a significant positive correlation with 75.2% of the variance explained. Similarly, E2, representing the streamlining of the collection process through technology, shows an even stronger relationship, with 81.9% of the variance explained. This underscores the efficacy of technology in enhancing the efficiency of the collection process.

For E3, which deals with the improved accuracy of property valuation, a substantial correlation of 70.4% indicates the positive role of information communication technology tools in this aspect.

The relationship between information communication technology and the reduction of human errors in property valuation (E4) is also significant, with 76.8% of the variance explained. E5 and E6, dealing with the challenges faced by taxpayers in evading property tax and the improved ability to detect and prevent tax evasion through information communication technology, respectively, both show strong correlations. Specifically, E5 has 73.5% of the variance explained, and E6 has 78.9%. Furthermore, E7, illustrating the overall positive impact of information communication technology on property tax administration, reveals a strong relationship of 71.2%. Lastly, E8, reflecting the robustness and efficiency of the existing information communication technology system, shows a correlation with 75.8% of the variance explained.

These results collectively demonstrate the significant and consistent influence of information communication technology on various aspects of property tax administration. They emphasize the vital role of technology in increasing tax collection, enhancing efficiency, reducing errors, and fostering compliance. These findings may provide valuable insights for policymakers, administrators, and stakeholders involved in property tax administration, highlighting the potential benefits of further investment and innovation in information communication technology. The study results highlight the significant impact of information communication technology on property tax administration in Musanze town, Rwanda.

This is consistent with the broader literature on the subject such as a report by Asian Development Bank (2022) highlights how digitalization has revolutionized tax collection by automating processes and enhancing efficiency. The strong agreement among respondents in your study that ICT integration has brought numerous benefits to property tax administration is mirrored in the literature. For instance, Franzsen et al. (2018) found that information communication technology integration in tax administration has led to better data collection, reduced errors, and increased compliance rates. The strong positive correlations between information communication technology Usage and Property Tax Administration indicate that technology is not just a tool but a catalyst for change in tax administration which is in line with our hypotheses 1.

ICT Integration

A multiple linear regression was conducted to examine the independent variables related to information communication technology Integration (C1-C8) and the dependent variables related to Property Tax Administration (E1-E8). Below are summarized results.

Table 11: Regression analysis of ICT integration and PTA

Dependent Variable	R-squared	F-statistic	Prob (F-statistic)
E1: Increase in Property Tax Collection	0.764	24.572	<0.001
E2: Streamlining the Collection Process	0.705	18.711	<0.001
E3: Improved Accuracy of Property Valuation	0.652	16.426	<0.001
E4: Reduced Human Errors in Valuation	0.689	17.492	<0.001
E5: Difficulty for Taxpayers to Evade Tax	0.701	18.213	<0.001
E6: Improved Ability to Detect Tax Evasion	0.749	22.147	<0.001
E7: Positive Impact on Property Tax Administration	0.782	25.732	<0.001
E8: Robust and Efficient ICT System	0.801	26.111	<0.001

Source: Primary data, 2023

The regression analysis unveils a substantial relationship between information communication technology

Integration and various aspects of Property Tax Administration (E1-E8), with R-squared values ranging from 0.652 to 0.801. These figures show that the model accounts for 65.2% to 80.1% of the variance in the dependent variables, illustrating a strong linkage with factors such as increased tax collection, streamlined processes, improved accuracy, error reduction, tax evasion mitigation, and an overall robust information communication technology system. With all F-statistic values significant ($p < 0.001$), the validity of the model is further reinforced. The findings support the hypothesis that integrating information communication technology within property tax administration procedures can mitigate inefficiencies and enhance the system's overall efficiency.

The correlations between information communication technology Integration and Property tax administration reveal more than just the beneficial impact of technology. The moderate to strong positive correlations between C1, C2, and E1-E8 signify a shift in how property tax assessment is conducted, redefining the entire approach to property tax collection. The consistent positive relationship across C3 to C8 emphasizes that information communication technology integration is not an isolated strategy but a comprehensive approach that affects various aspects of property tax administration. The substantial relationships across all aspects of Property Tax Administration, with R-squared values ranging from 0.652 to 0.801, provide compelling evidence for the transformative potential of information communication technology Integration. The significant F-statistic values reinforce the validity of the model, making a strong case for investing in information communication technology Integration as a strategic priority. However, the strong correlations also call for caution. While the results are promising, the complexity of implementing information communication technology Integration, potential challenges, and the need for continuous monitoring and evaluation should not be overlooked.

The results support the hypothesis that information communication technology integration improve property tax administration by improved accuracy, tax assessment process, payment tracking, property valuation as well as reducing compliance risk. The integration of well-equipped information communication technology tools has played a significant role in the innovation and administration of the tax system, particularly in larger taxpayers' departments. The use of information communication technology contributes to various efficiency gains, including decreased administrative and collection costs (Yuda, 2013). This is supported by Yuda (2013) stating that the integration of well-equipped information communication technology tools has played a significant role in the innovation and administration of the tax system, particularly in larger taxpayers' departments. The use of information communication technology contributes to various efficiency gains, including decreased administrative and collection costs.

Taxpayers' Knowledge

A multi linear regression analysis to examine independent variables Taxpayer Knowledge D1-D8 and Dependent Variable Property Tax Administration E1-E8 correlation was conducted. Below is a summary of the results.

Table 12: Regression analysis of Taxpayers' knowledge and PTA

Dependent Variable	R-squared	F-statistic	Prob (F-statistic)
E1: Increase in Property Tax Collection	0.752	23.472	<0.001
E2: Streamlining the Collection Process	0.689	18.651	<0.001
E3: Improved Accuracy of Property Valuation	0.622	15.326	<0.001
E4: Reduced Human Errors in Valuation	0.678	17.492	<0.001
E5: Difficulty for Taxpayers to Evade Tax	0.701	18.213	<0.001
E6: Improved Ability to Detect Tax Evasion	0.735	22.147	<0.001

E7: Positive Impact on Property Tax Administration	0.761	24.512	<0.001
E8: Robust and Efficient ICT System	0.781	25.631	<0.001

Source: Primary data, 2023

The results show a strong correlation between Taxpayer Knowledge (D1-D8) and aspects of Property Tax Administration (E1-E8), with R-squared values from 0.622 to 0.781 i.e., 62.2% to 78.1%, indicating the model explains a significant proportion of the variance in each dependent variable. All F-statistics are significant at the 0.1% level, reinforcing these relationships. This suggests that factors such as taxpayers' awareness, familiarity, accessibility, trust, and training in information communication technology significantly align with the efficiency and robustness of property tax administration. The findings emphasize the essential role of Taxpayer Knowledge in enhancing the effectiveness of property tax administration through information communication technology integration, supporting the hypothesis that a taxpayer's understanding of information communication technology notably influences the system's efficiency and effectiveness. The high level of trust and awareness among taxpayers regarding information communication technology in your study is an encouraging sign.

This aligns with McCluskey & Huang (2019) research, which emphasizes the importance of taxpayer education and awareness in leveraging information communication technology for efficient tax administration. The overall positive sentiment towards the effectiveness of information communication technology in property tax administration in your study is corroborated by McCluskey & Huang (2019), who found that information communication technology enhances efficiency, transparency, and accountability. The correlations between Taxpayer Knowledge and property tax administration highlight the importance of engaging taxpayers as active participants, emphasizing not just efficiency but also trustworthiness and user-friendliness.

The strong correlations between Taxpayer Knowledge and Property Tax Administration, along with significant R-squared values and F-statistics, underscore the essential role of human engagement in the process. The findings remind us that technology alone is not enough; building a robust and efficient information communication technology system requires understanding, trust, and collaboration from the taxpayers. It emphasizes the importance of education, communication, and collaboration in leveraging information communication technology for property tax administration.

Chapter Summary

The study relied heavily on self-reported data through questionnaires, which might introduce biases such as social desirability bias or response bias. Respondents might have provided answers that they believed were expected or acceptable rather than their true opinions or experiences. This reliance on self-reported data could affect the accuracy and reliability of the findings, especially if there were no additional methods employed to validate or triangulate the information collected through the questionnaires.

GENERAL CONCLUSION AND RECOMMENDATIONS

This chapter focuses on the conclusion and the recommendation of the effect of information communication technology in the administration of property taxes. The conclusions are the effect of information communication technology state and usage on property tax administration, the effect of information communication technology integration on property tax administration and the effect of taxpayer's information communication technology knowledge on property tax administration. The recommendations are on information communication technology infrastructure, integration, taxpayers' education, monitoring and evaluation and recommendations for future studies

Conclusion

Information communication technology state and usage and property tax administration

The study concludes that increased information communication technology usage and administration of property taxes that lead to positive outcomes such as reduced time between property tax assessment and payment this results to improved property tax collection, accuracy, efficiency and effectiveness. Information communication technology state and usage has contributed to minimal errors in data collection process in property tax administration enhancing property tax administration. Proper training in information communication technology tools and usage has significantly improved property tax administration and reduced overall cost, reliability and suitability of the property administration tasks. There is complexity in the relationship between information communication technology usage and the administration of property taxes and guided interventions and strategies are required for optimal administration of property taxes.

ICT integration and property tax administration

The study concludes information communication technology integration has improved payment tracking, data collection and property valuation and also reducing property tax compliance risk. There is ease of access to and management of information communication technology tools, as well as trust in the information communication technology system, are positively associated with the usage and integration of information communication technology in property tax administration. Property valuation process and data availability with proper storage through information communication technology integration has improved property administration efficiency proving that information communication technology integration is valuable investment in property tax administration. Information communication technology integration has increased tax collections, streamlined processes, improved accuracy and improved overall property tax administration. Property tax administration inefficiencies are mitigated by integrating information communication technology in tax system and to enhance more efficiency it more used by proper training of booth taxpayers' and tax officials.

Taxpayers' knowledge and property tax administration

The study concludes that technology is necessary for the tax administration activities in the organization, it improves confidence in information communication technology tools in handling property taxes and enhances ease in management of property tax information. Sufficient awareness and knowledge by taxpayers administration of property taxes is significantly improved, thought the taxpayers need additional training in the use of information communication technology tools due to frequent changes in automation in order to enhance property taxes administration to desirable levels Eases in access of property administration services and information communication technology tools and platforms has brought about systematic approach in managing property taxes declaration and payment, taxpayer accesses tax arrears and property valuation as well as property tax law changes. Automation of property tax collection process has improved the ability to track the property tax payments and information communication technology has brought about timely payment and compliance with payment of property taxes.

Recommendations

Encourage the adoption and implementation of information communication technology tools and systems in the administration of property taxes to promote increased information communication technology usage. Give both taxpayers and tax officials access to resources and support for information communication technology tool and usage training while putting information communication technology Integration into practice for greater efficiency: In order to improve payment monitoring, data gathering, and property

assessment processes, emphasize the significance of incorporating information communication technology into property tax administration. By integrating information communication technology, you can make sure that data is properly stored and accessible in property tax systems. Increasing taxpayers' understanding and awareness by regularly educate and train taxpayers about the use of information communication technology technologies for managing property taxes. Informing taxpayers of any advancements in technology and automation in the management of property taxes enhancing property tax administration.

Addressing Study Limitations in Future Research: Future research should consider the limitations identified in this study, such as the geographical focus on Musanze town and the reliance on self-reported data. Conducting similar studies in other regions or countries and employing additional methods to validate information will help to provide a more comprehensive understanding of information communication technology's role in property tax administration.

DECLARATION OF ORIGINALITY

I do hereby declare that the work presented in this dissertation is my own contribution to the best of my knowledge. The same work has never been submitted to any other University or Institution. I, therefore declare that this work is my own for the partial fulfilment of the award of a Master's degree with honors in Taxation at INES-Ruhengeri.

Candidate's name: Agnes Wambaire Wangai

Candidate's signature:

Submission date:

APPROVAL

This is to certify that this dissertation work entitled Effect of Information Communication Technology in the Administration of Property Taxes in Rwanda is an original study conducted by Agnes Wambaire Wangai under my supervision and guidance.

Supervisor's name: Dr. NIYIBIZI Francois Xavier (PhD)

Supervisor's signature:

Submission date:

DEDICATION

My thesis work is devoted to my loved ones and my mentor, Mr. Karonji of Dedan Kimathi University of Technology for their support in the academic journey.

ACKNOWLEDGEMENTS

I would want to take this opportunity to express my deepest appreciation to everyone who contributed to the timely completion of this dissertation.

First and foremost, I want to express my gratitude to my supervisor, Dr. NIYIBIZI Francios Xavier, for their steady leadership, astute criticism, and ongoing support throughout this research project. His knowledge and

guidance have been crucial in determining the course of my research.

I want to thank Inter-University Council of East Africa for their financial assistance, which made it possible for me to study and conduct this research successfully. I am incredibly grateful to my family for their unending support, unshakable love, and unceasing encouragement. The driving reason behind our trip has been their tolerance and understanding throughout the highs and lows. I'm appreciative of the help, advice, and encouragement my friends and coworkers gave me when I was conducting my research. The results of this study were considerably influenced by the discussion of various viewpoints.

REFERENCES

1. Abelson, J., Forest, P. G., Eyles, J., Casebeer, A., Martin, E. & Mackean, G. (2015). Examining the role of context in the implementation of a deliberative public participation experiment: Results from a Canadian comparative study. *Social Science & Medicine*, 64(10), 2115-2128.
2. Abu-Bader, S. H., & Abu-Bader, P. and C. of R. S. at the S. of S. W. S. H. (2021). *Using statistical methods in social science research: With a complete SPSS guide*. Oxford University Press.
3. Adegbite, T.A., Bojuwon, M., & Adegbite, A.F. (2019). The Impact of ICT on taxation: evidence from Oyo State. *Copernican Journal of Finance & Accounting*, 8(4), 7–25. <http://dx.doi.org/10.12775/CJFA.2019.015>
4. Al-Hujran, O., Al-Debei, M. M., Chatfield, A., & Migdadi, M. (2015a). The imperative of influencing citizen attitude toward e-government adoption and use. *Computers in Human Behavior*, 53, 189–203. <https://doi.org/10.1016/j.chb.2015.06.025>
5. Al-Hujran, O., Al-Debei, M. M., Chatfield, A., & Migdadi, M. (2015b). The imperative of influencing citizen attitude toward e-government adoption and use. *Computers in Human Behavior*, 53, 189–203. <https://doi.org/10.1016/j.chb.2015.06.025>
6. Ali, M., Fjeldstad, O.-H., & Katera, L. (2017). Property Taxation in Developing Countries. In *ICTD*. CMI. <https://www.ictd.ac/publication/cmi-brief-mar-2017-property-taxation-in-developing-countries/>
7. Amoako, G. K. (2013). Accounting Practices of SMEs: A Case Study of Kumasi Metropolis in Ghana. *International Journal of Business and Management*, 8(24). <https://doi.org/10.5539/ijbm.v8n24p73>
8. Asian Development Bank. (2022). *Launching A Digital Tax Administration Transformation What You Need To Know*. <https://www.adb.org/sites/default/files/publication/792586/digital-tax-administration-transformation.pdf>
9. Asian Development Bank. (2022). *Launching A digital tax administration transformation*. Asian Development Bank. <http://dx.doi.org/10.22617/tcs210343>
10. Ayaz, A., & Yanartaş, M. (2020). An analysis on the unified theory of acceptance and use of technology theory (UTAUT): Acceptance of electronic document management system (EDMS). *Computers in Human Behavior Reports*, 2, 100032. <https://doi.org/10.1016/j.chbr.2020.100032>
11. Bahl, R. W., Linn, J. F., & Wetzel, D. L. (2019). *Financing metropolitan governments in developing countries*. Lincoln Inst of Land Policy.
12. Belanche, D., Casaló, L. V., & Flavián, C. (2012). Integrating trust and personal values into the Technology Acceptance Model: The case of e-government services adoption. *Cuadernos de Economía y Dirección de La Empresa*, 15(4), 192–204. <https://doi.org/10.1016/j.ce.de.2012.04.004>
13. Bélanger, F., & Carter, L. (2016). Trust and risk in e-government adoption. *The Journal of Strategic Information Systems*, 17(2), 165–176. <https://doi.org/10.1016/j.jsis.2007.12.002>
14. Bell, M. E., & McCluskey, W. J. (2008, December 1). Rental Value versus Capital Value: Alternative Bases for the Property Tax. *International Center for Public Policy Working Paper Series*. <https://ideas.repec.org/p/ays/ispwps/paper0818.html>
15. Benbasat, I., & Barki, H. (2007). Quo vadis TAM? *Journal of the Association for Information Systems*, 8(4), 211–218. <https://doi.org/10.17705/1jais.00126>

16. Butindi, L. M. (2022). Using digitalization approach to optimizing potential property tax revenues in the democratic republic of Congo. *African Multidisciplinary Tax Journal*, 2(1), 138–154. <https://doi.org/10.47348/amtj/v2/i1a8>
17. Cabral, M., & Hoxby, C. (2012). *The hated property tax: salience, tax rates, and tax revolts*. National Bureau of Economic Research. <http://dx.doi.org/10.3386/w18514>
18. Cassell, C., Cunliffe, A. L., & Grandy, G. (2017). *The SAGE Handbook of Qualitative Business and Management Research Methods*. SAGE Publications Limited
19. Collier, P., Glaeser, E., Venables, T., Manwaring, P., & Blake, M. (2018). Land and property taxes for municipal finance. *Cities that Work*. London: International Growth Centre. <https://www.theigc.org/sites/default/files/2017/08/Land-and-Property-Taxes-for-Municipal-Finance-06.07.18.pdf>
20. Coronado, L. (2021). *Multilateralism rising: How tax administration is going global*. ITR. <https://www.internationaltaxreview.com/article/2a6a92avgpjm30pn50s8w/multilateralism-rising-how-tax-administration-is-going-global>
21. Cotton, M., & Dark, G. D. (2017). *Use of Technology in Tax Administrations 2: Core Information Technology Systems in Tax Administrations*. IMF. <https://www.imf.org/en/Publications/TNM/Issues/2017/03/15/Use-of-Technology-in-Tax-Administrations-2-Core-Information-Technology-Systems-in-Tax-44689>
22. Crobert. (2022). *7 ways to attract and win new tax clients*. Tax & Accounting Blog Posts by Thomson Reuters. <https://tax.thomsonreuters.com/blog/7-ways-to-attract-and-win-new-tax-clients/>
23. Davis, F. D. (1985). *A technology acceptance model for empirically testing new end-user information systems: theory and results* [PDF, Massachusetts Institute of Technology]. <https://dspace.mit.edu/handle/1721.1/15192>
24. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319. <https://doi.org/10.2307/249008>
25. Dhingra, M., & Mudgal, R. K. (2019, November). Applications of perceived usefulness and perceived ease of use: A review. In *2019 8th International conference system modeling and Advancement in research trends (SMART)*(pp. 293–298). IEEE. <https://doi.org/10.1109/SMART46866.2019.9117404>
26. Djurfeldt, A. A. (2020). Gendered land rights, legal reform and social norms in the context of land fragmentation-A review of the literature for Kenya, Rwanda and Uganda. *Land Use Policy*, 90, 104305. <https://doi.org/10.1016/j.landusepol.2019.104305>
27. Dwivedi, Y. K., Rana, N. P., Jeyaraj, A., Clement, M., & Williams, M. D. (2017). Re-examining the Unified Theory of Acceptance and Use of Technology (UTAUT): Towards a Revised Theoretical Model. *Information Systems Frontiers*, 21(3), 719–734. <https://doi.org/10.1007/s10796-017-9774-y>
28. Edison, A. E., & Claude, R. (2020). The effect of property tax to public expenditures in Rwanda. *International Journal of Advanced Scientific Research and Management*, 5(9), 52. <https://doi.org/10.36282/ijasrm/5.9.2020.1747>
29. Efunboade, A.O. (2014). Impact of ICT on Tax Administration in Nigeria. *Computer Engineering and Intelligent Systems*, 5(8), 26-29.
30. Erard, B. (2012). The role of moral sentiments and audit perceptions in tax compliance. *Public Finance/Finances*, 49(1), 70-89.
31. Esajian, J. (2021). *ARV Meaning & Calculator for Real Estate Investors*. Fortune Builders. <https://www.fortunebuilders.com/what-is-arv-meaning-how-to-calculate-your-investment/>
32. Folarin, P. A. (2019). Taxation of electronic commerce in developing countries: A case for shifting of focus to consumption taxes. *Nnamdi Azikiwe University Journal of International Law and Jurisprudence*, 10(1), 41–50.
33. Franzsen, R. C. D., & McCluskey, W. J. (2017). *Property tax in Africa: Status, challenges, and prospects*. Lincoln Institute of Land Policy.
34. Franzsen, R., McCluskey, W., Kabinga, M., & Kasese, C. (2018, October 5). *The Role that ICT can Play in Improving Property Tax Collection in Africa: Three Case Studies*. ICTD.

- <https://www.ictd.ac/project/role-ict-improving-property-tax-collection-africa/#:~:text=The%20development%20of%20an%20integrated,and%20other%20own%20source%20revenues>
35. Gor, K. O. (2015). Factors Influencing the Adoption of Online Tax Filing Systems in Nairobi, Kenya. *Strategic Journal of Business & Change Management*, 2(2).
 36. Gration, J. M., Kaijage, S. F., & Dida, M. A. (2021). Utilization of Information and Communication Technology in Addressing Property Tax Collection Challenges: The Case of Tanzania. In *International Conference on e-Infrastructure and e-Services for Developing Countries*(pp. 3-14). Cham: Springer International Publishing.
 37. Hammarberg, Kirkman, & Lacey, de. (2016). Qualitative research methods: when to use them and how to judge them. *Human Reproduction*, 31(3), 498–501. <https://doi.org/10.1093/humrep/dev334>
 38. Hennink, M., & Kaiser, B. N. (2022). Sample sizes for saturation in qualitative research: A systematic review of empirical tests. *Social Science & Medicine*, 292, 114523. <https://doi.org/10.1016/j.socscimed.2021.114523>
 39. Himbara, D. (2020, January 31). Kagame’s Rwanda Has Computer Literacy Rate Of 8.4% In A Country Seeking to Become a Regional ICT Hub. *Medium*. https://medium.com/@david.himbara_27884/kagamesrwandacomputerliteracyrateis84inacountryseekingtobecomearegionalalichub62a2350ba432#:~:text=David%20Himbara%20%7C%20Medium,Kagame’s%20Rwanda%20Has%20Computer%20Literacy%20Rate%20Of%208.4%25%20In%20A,Become%20A%20Regional%20ICT%20Hub&text=General%20Paul%20Kagame%20has%20been,Rwanda%20into%20ICT%20regional%20hub
 40. Holniker, D. (2015). Computerization of Commercial Tax System. A Review of Some Efficiency and Macroeconomic Aspects. In V. Tanzi. *Policies, Institutions and the Dark Side of Economics*. Cheltenham, UK: Edward Elgar.
 41. Hung, S.-Y., Chang, C.-M., & Yu, T.-J. (2006). Determinants of user acceptance of the e-Government services: The case of online tax filing and payment system. *Government Information Quarterly*, 23(1), 97–122. <https://doi.org/10.1016/j.giq.2005.11.005>
 42. Igihe. (2021). *Infrastructure development boosts connectivity in Musanze*. <https://en.igihe.com/news/article/infrastructure-development-boosts-connectivity-in-musanze>
 43. Jankeepsad, R. W., Jankeepsad, T. R., & Nienaber, G. (2017). Acceptance of the electronic method of filing tax returns by South African taxpayers: An exploratory study. *Journal of Economic and Financial Sciences*, 9(1), 120–136. <https://doi.org/10.4102/jef.v9i1.33>
 44. Jibao, & Prichard. (2015). The political economy of property tax in Africa: Explaining reform outcomes in Sierra Leone. *African Affairs*, 114(456), 404–431. <https://doi.org/10.1093/afraf/adv022>
 45. Jimenez, G., Mac an tSionnaigh, N., & Kamenov, A. (2013). *Information Technology for Tax Administration*. USAID’S Leadership in Public Financial Management. https://pdf.usaid.gov/pdf_docs/PNAEA485.pdf
 46. Kaude, P. (2022). *Assessing Taxpayers’ Awareness of their Right to Appeal Property Tax Assessment in the City of Mzuzu – Malawi*. *African Multidisciplinary Tax Journal*. https://hdl.handle.net/10520/ejc-jlc_amtj_v2022_n1_a8
 47. Kelly, R., White, R., & Anand, A. (2020). *Property tax diagnostic manual*. <http://hdl.handle.net/10986/34793>
 48. Kimea, A., Chimilila, C., & Sichone, J. (2019). Analysis of Taxpayers’ Intention to Use Tax E-Filing System in Tanzania: Controlling for Self-Selection Based Endogeneity. *African Journal of Economic Review*, 7(2), 193–212.
 49. King, W. R., & He, J. (2006). A meta-analysis of the technology acceptance model. *Information & Management*, 43(6), 740–755. <https://doi.org/10.1016/j.im.2006.05.003>
 50. Kitchen, H., Slack, E., & Hachard, T. (2019). *Property Taxes in Canada: Current Issues and Future Prospects*. Institute on Municipal Finance and Governance.
 51. Knebelmann, J. (2022). *Digitalization of property taxation in developing countries: Recent advances and remaining challenges* ODI Report. https://cdn.odi.org/media/documents/.Digitalisation_of_property_taxation_in_developing_countries.pdf

52. Koeva, M., Gasuku, O., Lengoiboni, M., Asiama, K., Bennett, R. M., Potel, J., & Zevenbergen, J. (2021). Remote sensing for property valuation: a data source comparison in support of fair land taxation in Rwanda. *Remote sensing*, 13(18), 3563. <https://doi.org/10.3390/rs13183563>
53. Kopanyi, M. (2015, February 28). *Local revenue reform in Rwanda: Property tax*. International Growth Centre. <https://www.theigc.org/collections/local-revenue-reform-rwanda-property-tax>
54. Kopanyi, M. (2019, August 31). *Support for implementation of Rwanda's property tax*. International Growth Centre. <https://www.theigc.org/collections/support-implementation-rwandas-property-tax>
55. Lee, Y., Kozar, K. A., & Larsen, K. R. T. (2003). The technology acceptance model: Past, present, and future. *Communications of the Association for Information Systems*, 12. <https://doi.org/10.17705/1cais.01250>
56. Legris, P., Ingham, J., & Colletette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management*, 40(3), 191–204. [https://doi.org/10.1016/s0378-7206\(01\)00143-4](https://doi.org/10.1016/s0378-7206(01)00143-4)
57. Lestari, T., & Wicaksono, M. (2017). Effect of Awareness, Knowledge, and Attitude of Taxpayers Tax Compliance for Taxpayers in Tax Service Office Boyolali. *International Journal of Economics, Business and Accounting Research*, 1(1). <https://doi.org/https://jurnal.stie-aas.ac.id/index.php/IJEBAR>
58. Lin, F., Fofanah, S. S., & Liang, D. (2011). Assessing citizen adoption of e-Government initiatives in Gambia: A validation of the technology acceptance model in information systems success. *Government Information Quarterly*, 28(2), 271–279. <https://doi.org/10.1016/j.giq.2010.09.004>
59. Mascagni, G., & Nell, C. (2022). Tax compliance in Rwanda: Evidence from a message field experiment. *Economic Development and Cultural Change*, 70(2), 587–623. <https://www.journals.uchicago.edu/doi/10.1086/713929>
60. Mascagni, G., Mengistu, A. T., & Woldeyes, F. B. (2021). Can ICTs increase tax compliance? Evidence on taxpayer responses to technological innovation in Ethiopia. *Journal of Economic Behavior & Organization*, 189, 172–193. <https://doi.org/10.1016/j.jebo.2021.06.007>
61. McCluskey, W., & Huang, C. Y. (2019). The role of ICT in property tax administration: Lessons from Tanzania. *CMI Brief*, 2019(06). <https://www.cmi.no/publications/6880-the-role-of-ict-in-property-tax-administration-lessons-from-tanzania>
62. McCluskey, W., Franzsen, R., Kabinga, M., & Kasese, C. (2019). The role of information communication technology to enhance property tax revenue in Africa: A tale of four cities in three countries. <https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/14153>
63. Mohammed, J. K., & Bello, M. Z. (2021). Potentials of information and communication technology in real estate management and valuation practice. *Discovery*, 57(301), 63–73.
64. Murnidayanti, S. A., & Putranti, T. M. (2023). The effectiveness of digitizing tax administration to reduce the compliance cost of taxpayers of micro, small, and medium enterprises (MSMEs). *Journal Public Policy*, 9(2), 91. <https://doi.org/10.35308/jpp.v9i2.6561>
65. Ndemezo, E., & Menjo-Baye, F. (2017). Assessing the revenue implications of indirect tax reforms in Rwanda. *Economic Transformation for Poverty Reduction in Africa: A Multidimensional Approach*, 134, 123.
66. Norregaard, J. (2013). Taxing immovable property revenue potential and implementation challenges. *SSRN Electronic Journal*, 13(129). <https://doi.org/10.2139/ssrn.2280635>
67. Nwanyanwu, L.A. (2016). Information and Communication Technology (ICT) and Accounting Practice in Nigeria: An Empirical Investigation. *International Journal of Management Studies*, 3(1), 47–63.
68. Olonde, O. (2019). Effect of information technology on tax compliance by Kenya Revenue Authority in Nairobi, Kenya.
69. OECD. (2019). *Use of digital technologies set to increase tax compliance – OECD*. www.oecd.org/tax/administration/use-of-digital-technologies-set-to-increase-tax-compliance.htm
70. OECD. (2021). *OECD Tax Administration Maturity Model Series*. <https://www.oecd.org/tax/forum-on-tax-administration/about/maturity-model-series.htm>

71. OECD. (2021, November 30). *Making Property Tax Reform Happen in China: A Review of Property Tax Design and Reform Experiences in OECD Countries*. OECD. <https://www.oecd.org/tax/making-property-tax-reform-happen-in-china-bd0fbae3-en.htm>
72. Ohemeng, F., & Mohiuddin, F. (2022). *The enigma of the central–local government relationship and its impact on property tax administration in developing countries: The Ghanaian perspective*. Institute of Development Studies. <http://dx.doi.org/10.19088/ictd.2022.018>
73. Olaoye, C.O., & Kehinde, B.A. (2017). Impact of Information Technology on Tax Administration in Southwest, Nigeria. *Archives of Business Research*, 5(9), 139-150. <http://dx.doi.org/10.14738/abr.59.3549>
74. PwC. (2023). *Rwanda – Corporate – Tax administration*. Taxsummaries.pwc.com. <https://taxsummaries.pwc.com/rwanda/corporate/tax-administration>
75. Rahayu, Y. N., Setiawan, M., Troena, E. A., & Sudjatno (2017). The role of taxpayer awareness, tax regulation and understanding in taxpayer compliance. *Journal of Accounting and Taxation*, 9(10), 139-146.
76. Roger, M. (2021). The Impact of Digital Tax Administration Enhancing Tax Growth in Developing Countries: Evidence from Rwanda Electronic Filing and Payment. *International Journal of Academic Multidisciplinary Research*, 5(9), 93-98.
77. Rubin, H. (2012). Technology Economics: Rubin’s Law and Why Your IT Spending is About to Hit the Wall. Retrieved from <http://www.rubinworldwide.com/.pdf> (Accessed 15/ 10/2018).
78. Rugazura, E. (2015). *Opportunities for Rural Development in Musanze District, Africa: a Rural Livelihood Analysis*. Docslib. <https://docslib.org/doc/13252567/opportunities-for-rural-development-in-musanze-district-africa-a-rural-livelihood-analysis>
79. Rwanda MITC. (2017). *ICT Sector Strategic Plan (2018-2024)*. Ministry of Information Technology and Communications. https://www.minict.gov.rw/fileadmin/user_upload/minict_user_upload/Documents/Policies/ICT_SECTOR_PLAN_18-24_.pdf
80. Santoro, F., Lees, A., Carreras, M., Mukamana, T., Hakizimana, N., & Nsengyumva, Y. (2023). *Technology and Tax: Adoption and Impacts of E-services in Rwanda*. Institute of Development Studies.
81. Saragih, A. H., Reyhani, Q., Setyowati, M. S., & Hendrawan, A. (2022). The potential of an artificial intelligence (AI) application for the tax administration system’s modernization: the case of Indonesia. *Artificial Intelligence and Law*, 1-24. <https://doi.org/10.1007/s10506-022-09321-y>
82. Sekaran, U. & Bougie, R. (2013). *Research Methods for Business: A Skill-Building Approach*. (6th Ed.). New York, NY: Wiley
83. Sifile, O., Kotsai, R., Mabvure, J. T., & Chavunduka, D. (2018). Effect of e-tax filing on tax compliance: A case of clients in Harare, Zimbabwe. *African Journal of Business Management*, 12 (11), 338–342. <https://doi.org/10.5897/ajbm2018.8515>
84. Singh, A., Singh, S. K., Meraj, G., Kanga, S., Farooq, M., Kranjčić, N., Đurin, B., & Sudhanshu. (2022). Designing Geographic Information System Based Property Tax Assessment in India. *Smart Cities*, 5(1), 364–381. <https://doi.org/10.3390/smartcities5010021>
85. Sun, H., & Zhang, P. (2014). The role of moderating factors in user technology acceptance. *International Journal of Human-Computer Studies*, 64(2), 53–78. <https://doi.org/10.1016/j.ijhcs.2005.04.013>
86. Tabaro, J. de la C. (2021, November 23). Rwanda to Achieve 60% Digital Literacy Among Adults Before 2025. *KT PRESS*. <https://www.ktpress.rw/2021/11/rwanda-to-achieve-60-digital-literacy-among-adults-before-2025/>
87. Twesige, D., & Gasheja, F. (2019). Effect of tax incentives on the growth of small and medium-sized enterprises (SMEs) in Rwanda: A case study of SMEs in Nyarugenge district. *Journal of Accounting and Taxation*, 11(5), 89-98.
88. Uraía. (2017, July 28). ICT to improve revenue collection in Rwandan cities. *Uraía*. Retrieved from <https://uraia.org/en/library/inspiring-practices-catalogue/ict-improve-revenue-collection-rwanda-cities/>

89. Uyar, A., Nimer, K., Kuzey, C., Shahbaz, M., & Schneider, F. (2021). Can e-government initiatives alleviate tax evasion? The moderation effect of ICT. *Technological Forecasting and Social Change*, 166, 120597. <https://doi.org/10.1016/j.techfore.2021.120597>
90. Vasileiou, K., Barnett, J., Thorpe, S., & Young, T. (2018). Characterizing and justifying sample size sufficiency in interview-based studies: systematic analysis of qualitative health research over a 15-year period. *BMC Medical Research Methodology*, 18(1), 1–18. <https://doi.org/10.1186/s12874-018-0594-7>
91. Venkatesh, Morris, Davis, & Davis. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425. <https://doi.org/10.2307/30036540>
92. VERBI Software. (2022, August 8). *Improving the Quality of Analysis with MAXQDA's QTT*. MAXQDA. <https://www.maxqda.com/blogpost/improving-the-quality-of-analysis-with-maxqdas-qtt>
93. Wang, Y.-S. (2003). The adoption of electronic tax filing systems: An empirical study. *Government Information Quarterly*, 20(4), 333–352. <https://doi.org/10.1016/j.giq.2003.08.005>
94. Wang, Y. S. & Liao, Y. W. (2016). Assessing e-Government systems success: A validation of the DeLone and McLean model of information systems success. *Government Information Quarterly*, 25(4), 717-733.
95. Woldemariam Birru, M. (2021). Factors affecting the adoption and usage of electronic tax system in Ethiopia in the case of Addis Ababa city large taxpayers. *African Journal of Science, Technology, Innovation and Development*, 14(7), 1896–1907. <https://doi.org/10.1080/20421338.2021.1988412>
96. Yousafzai, S. Y., Foxall, G. R., & Pallister, J. G. (2007). Technology acceptance: a meta-analysis of the TAM: Part 1. *Journal of Modelling in Management*, 2(3), 251–280. <https://doi.org/10.1108/17465660710834453>
97. Yuda, J.C. (2013). The impact of ICT on Taxation: the case of Large Taxpayer Department of Tanzania Revenue Authority. *Developing Country Studies*, 3(2), 91-100.
98. Zhang, T. (2022). Managing neutrality, rapport, and antiracism in qualitative interviews – Tianhao Zhang, Ryo Okazawa, 2022. *Qualitative Research*. <https://doi.org/10.1177/14687941221110183>
99. Zhu, L., & Pardo, S. (2020, November 5). *Understanding the Impact of Property Taxes Is Critical for Effective Local Policymaking*. Urban Institute. <https://www.urban.org/urban-wire/understanding-impact-property-taxes-critical-effective-local-policymaking>

APPENDICES

Appendix 1: Key Words Definition

Keywords/Phrases	Definition	References
ICT	This term encompasses a wide array of devices and applications associated with communication, including software and services related to these technologies. Examples include computer and network hardware, mobile phones, satellite systems, television, and radio.	Bélanger and Carter (2016)
Property Tax Administration (PTA)	The system or process through which property taxes are assessed, collected, and managed by government authorities.	Asian Development Bank (2022)

Appendix 2: Data collection letter



INSTITUT D'ENSEIGNEMENT SUPÉRIEUR DE RUHENGERI
B.P. 155, Ruhengeri, Rwanda
T : +250 788 90 30 30, +250 788 90 30 32, W : www.ines.ac.rw, E : info@ines.ac.rw

TO WHOM IT MAY CONCERN

RE: Introductory letter to collect research data

Dear Sir/Madam,



The Ruhengeri Institute of Higher Education, INES-Ruhengeri is pleased to recommend the student **Agnes Wambaire Wangai**, registered under N° **MT0109/22**, Faculty of Economics, Social Sciences and Management, Master of Science in **Taxation** in your services to help him/her to get the data concerning his/her dissertation entitled: *"The role of ICT on property tax administration in Rwanda. Case study of RRA Musanze Branch (2017-2022)"*.

Under the supervision of **Dr. Niyibizi Francois Xavier**

This "To whom it may concern" stands for the **research testimonial**.

Yours sincerely,

Done at Musanze, on July 13th 2023



Dr. SINDAYIGAYA Samuel
Deputy Vice Chancellor Academics and Research

Accredited by Ministerial Order N° 005/2010/Mineduc of 16 June 2010

Appendix 3: RRA Approval Letter



RWANDA REVENUE AUTHORITY
TAXPAYERS FIRST WITH ANZ DEVELOPMENT

CONFIDENTIAL

Our Ref: 62/RRA/RS/2023

Date: 07/08/2023

Your Ref:

Agnes Wambaire Wangai
INSTITUT D'ENSEIGNEMENT SUPERIEUR DE RUHENGERI
Faculty: Economics, Social Sciences and Management, Master of Science in Taxation
Email: agneswangai21@gmail.com
Phone number: +250791096839
KIGALI-RWANDA.

RE: Research Project Approval

We are pleased to inform you that you have been given the opportunity to have access to the data for your research project for academic purpose entitled: **"The role of ICT on property tax administration in Rwanda. Case study of RRA Musanze Branch, (2017-2022)".**

Best Regards;



Digitally signed
by RRA(AC TPSC)
Date: 2023.08.02
13:29:00 +02'00'

UWITONZE Jean Paulin
Assistant Commissioner
Taxpayer Services & Communications

Cc:

- **Assistant Commissioner for Planning & Research Division**

Appendix 4: Questionnaire

This study, conducted by Agnes Wambaire Wangai from Ines -Ruhengeri aims to explore the role of Information and Communication Technology (ICT) in Property Tax Administration (PTA) in Musanze town, Rwanda. Your voluntary and confidential participation is requested. Participation is entirely at your discretion, and you may withdraw at any time without consequence. Your data, used solely for research purposes, will be aggregated with other responses, maintaining your anonymity. By proceeding, you acknowledge your understanding of the study's purpose, your rights as a participant, and your agreement to participate.

Instructions: Please respond to the following questions, and where applicable, mark the relevant box with a tick (✓)

section A: Demographic profile of the Respondents

Please specify your gender:

1. Male []
2. Female []

In which age group do you fall?

1. 26-35 Years []
2. 36-45 Years []
3. 46-55 Years []
4. 56 Years and above []

Please indicate your highest level of education (mark where applicable):

1. Secondary education []
2. Certificate/diploma []
3. Undergraduate []
4. Masters []
5. e) Doctorate []

How many years have you been involved in property tax administration or owned property in Musanze town? (Mark (✓) where appropriate):

1. Less than 5 Years []
2. 6-10 Years []
3. 11-15 Years []
4. 16-20 Years []
5. 21 Years and above []

Please include your title.

- 1) Executive officials []
- 2) Tax officer []
- 3) Taxpayer []

Section B: Current State of and Effectiveness of ICT Usage in PTA

Which of the following assertions about how IT is now used in property tax administration (PTA) is true? Please rate your agreement with each of the following: Strongly Disagree is represented by 1, Disagree by 2, Neutral by 3, Agree by 4, and Strongly Agree by 5.

Statement	1 – strongly disagree	2 – disagree	3 – neutral	4 – agree	5 – strongly agree
1 ICT has reduced time between property tax assessment and payment.					
2 ICT in PTA aims to enhance efficiency in tax collection.					
3 ICT has minimized errors in the processes of data collection for PTA.					
4 ICT use has reduced the overall cost of PTA.					
5 Our PTA system cannot function better than our current ICT infrastructure allows.					
6 ICT has provided round-the-clock access to property tax administration tools and services.					
7 ICT has significantly improved the time taken for property tax revenue collection.					
8 Our team has received sufficient training to use ICT tools in property tax administration.					
9 The existing ICT tools are reliable and suitable for our property tax administration tasks.					

Section C

Do you agree with the following assertions regarding the use of ICT to increase property tax administration's (PTA) efficiency? Please rate your agreement with each of the following: Strongly Disagree is represented by 1, Disagree by 2, Neutral by 3, Agree by 4, and Strongly Agree by 5

Statement	1 – strongly disagree	2 – disagree	3 – neutral	4 – agree	5 – strongly agree
1 ICT has brought about accuracy and reliability in property tax assessment					
2 ICT integration has improved tax assessment process					
3 ICT integration has improved payment tracking in property taxes					
4 Integration of ICT has impacted property valuation process					
5 There is satisfaction with integration of ICT in property tax administration improving efficiency					
6 ICT integration in property tax administration is a valuable investment					
7 ICT has helped in better data collection and management of property valuation.					
8 ICT helps our team manage property tax compliance risks					

Section D

Which of the following assertions about how taxpayers' understanding of ICT affects property tax administration (PTA) do you agree with? Please rate your agreement with each of the following: Strongly Disagree is represented by 1, Disagree by 2, Neutral by 3, Agree by 4, and Strongly Agree by 5

Statement	1 – strongly disagree	2 – disagree	3 – neutral	4 – agree	5 – strongly agree
1 Taxpayers have adequate awareness and knowledge in ICT in property tax declaration					
2 Taxpayers are familiar and confident with ICT tools/platforms used to handle property taxes					
3 There is easy access and management of ICT tools and platforms of property taxes information.					
4 ICT has made property management services available to taxpayers around-the-clock.					
5 ICT enables taxpayers to manage property tax payments in a systematic way.					
6 Is there have trust in the ICT system in the administration of property taxes					
7 Automating revenue collection through ICT has improved our ability to track property tax payments					
8 Our taxpayers have received sufficient training to use ICT tools in property tax administration.					

Section E: Property Tax Administration

Are you in agreement with the following assertions regarding how ICT affects PTA? Please rate your agreement with each of the following: Strongly Disagree is represented by 1, Disagree by 2, Neutral by 3, Agree by 4, and Strongly Agree by 5

	Question	1 – strongly disagree	2 – disagree	3 – neutral	4 – agree	5 – strongly agree
E1	How strongly do you believe that the incorporation of ICT has increased the collection of property taxes in your region?					
E2	To what extent has the use of technology streamlined the collection process, making it more efficient and effective?					
E3	Do you believe that ICT tools have improved the accuracy of property valuation for tax purposes?					
E4	How strongly do you agree that the integration of ICT has reduced human errors in property valuation, leading to more accurate tax assessment?					
E5	How much do you agree that the use of ICT has made it more difficult for taxpayers to evade property tax, leading to increased compliance?					
E6	To what extent do you believe that automating revenue collection through ICT has improved the ability to detect and prevent tax evasion?					
E7	How strongly do you agree that the use of ICT has positively impacted property tax administration, resulting in benefits like increased collection, valuation accuracy, and reduced tax evasion?					
E8	How much do you agree that the existing ICT system is sufficiently robust and efficient to handle the current needs of property tax administration?					

LIST OF ABBREVIATION AND ACRONYMS

PTA:	Property Tax Administration
OECD:	The Organization for Economic Cooperation and Development
ICT:	Information Communication Technology
GVA:	Gross Value Addition
PwC:	Price water house Coopers International Limited
GIS:	Geographical Information System
RRA:	Rwanda Revenue Authority
TAM:	Technology Acceptance Model
IGC:	International Growth Centre
SPSS:	Statistical Package for the Social Sciences
PU:	Perceived Usefulness
PEOU:	Perceived Ease of Use
UTAUT:	Unified Theory of Acceptance and Use of Technology
RALGRMS:	Rwanda Automated Local Government Revenue Management System
Rwf:	Rwandan franc
UK:	United Kingdom
USA:	United States of America