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THE EFFECT OF DIGITALIZATION ON PUBLIC REVENUE COLLECTION IN RWANDA: A CASE OF RWANDA REVENUE AUTHORITY

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ABSTRACT

In recent years, there has been significant growth in the use of technology in all industries across the world. The adoption of modern technologies has propelled the governments not only to improve service delivery, but also tap in the growing source of revenue as a result of digital transformation. This research investigated the effect of digitalization on the public revenue collection, taking a case of Rwanda Revenue Authority (RRA). The specific objectives included to investigate the effect of electronic filing system on the public revenue collection in Rwanda; to investigate the effect of the electronic billing system on the public revenue collection in Rwanda and to investigate the effect of integrated information systems on the public revenue collection in Rwanda. Three theories were found to be relevant to this study, namely, technological acceptance theory, theory of economic efficiency and theory of productivity. Descriptive and analytical research designs were used for data analysis in this research. Primary data were collected from a sample of 200 selected using stratified random sampling technique from a total of 400 employees from RRA. SPSS version 23 was used to analyse and present the data. The data were presented and analysed using descriptive statistics, frequency tables, mean, standard deviation, Pearson correlation and regression analysis. The findings on first objective showed that a total of 98.5% of the participants were in agreement that RRA has put in place a user-friendly online platform. An average of 4.46(std=0.54) was obtained which implied that the responses were homogenous and in agreement that the online tax payment provided by RRA is easy to use for the taxpayers. 57% of the participants strongly agreed and 41% agreed with the statement that Rwanda Revenue has also undertaken mobile technologies in its effort to increase public revenue collection. The correlation analysis results showed that online tax collection, online tax payment services and m-declaration services were significantly related to public revenue collection since their respective p-values were less than 5%. The findings on the second objective revealed that the use of EBM has reduced tax evasion, increased tax compliance and therefore increased revenue collection, a mean score of 4.59(std=0.52) obtained, showing high level of agreement. A mean score of 4.41(std=0.58) was obtained on whether the public revenue collected through the irembo has being increasing for the last three years. The correlation analysis between the use of electronic billing system and public revenue collection in Rwanda was conducted using Pearson coefficient correlation which showed that all the three indicators were positive and statistically significant. The findings on the third objective showed 97% of the participants agreed that the system integration has eased RRA reports on revenue collection from all other government agencies. On whether the use of the e-single window is needed for collection of revenues from the importation, a mean score obtained was 4.57. The Pearson correlation analysis between system integration and public revenue collection showed that all the three indicator variables used to measure the integration of the information system were positive and significant at 5% since their p-values were less than 5%. The regression model (F=633.173, p=0.000) was significant since the p-value was less than 5%, giving an R^2=0.906, which indicated that 90.6% of the changes in public revenue in Rwanda Revenue Authority can be attributed to the use of digital technologies. The study recommends that the Government of Rwanda should continue in its trajectory in digital transformation. Despite these positive benefits, the government must be vigilant to monitor its systems to avoid system failures.

Key words: Digitalization, electronic filing system, electronic billing system, information systems and public revenue collection

INTRODUCTION

The modern-day business environment and globalization have compelled businesses to adopt digital technologies in order to remain competitive. This adoption of technologies has improved business operations and increased their profitability. In the same breath, governments across the globe have been obliged to follow suit in order to meet the demand for government services by the growing population and the businesses. In this way, the adoption of modern technologies has propelled the governments not only to improve service delivery, but also tap in the growing source of revenue as a result of digital transformation. The recent experiences of Covid-19 is a point in case where the use of digital payment services have proved to be a necessity. The government of Rwanda has advocated for a cashless economy through various policy pronouncements. For instance, online payments services for all government levies and fees are done through *irembo* which is a government to citizen e-service portal. This portal facilitates the citizen and residents to submit application and make payments for various services provided by government institutions (Twizeyimana, *et al*., 2018; MINICT, 2021).

Despite the success stories behind digital transformation and cashless payment systems in Rwanda, there have been challenges cited across the country. For instance, cited extra charges are incurred in the use of the online payment services. In addition, internet connectivity are challenges that have affected many taxpayers in regards to timely tax declaration and filing. This in turn has reduced the compliance issues especially in regards to the use of electronic billing machine (EBM). As evidenced by Steenbergen (2017), the introduction of EBM was quickly introduced such that within one year more than half of the registered VAT taxpayers installed the EBM. Unfortunately, this did not automatically translate to increased compliance since it only increased VAT revenue by 5.4%. This is an indication that adoption of new technologies does not necessary lead to increased revenue collection. It requires significant inputs from the government and constructive collaboration between the government and the private sector to make the digitalization increase revenue collection in Rwanda. In addition, the adoption of digital technologies brings with it associated risks like online scams, sophisticated spyware and cyber insecurity issues (Mutimukwe, Kolkowska & Grönlund, 2019). It is therefore imperative that movement towards digitalization is efficiently carried out and that the system is water tight to protect personal data and secure the system from fraud and misuse. Despite increasing trends of revenue collection from 2016-2021 as reported by RRA (2021), there is still a fiscal deficit of 8.7% which has widened over the same time period (World Bank, 2019). This clearly shows that the public revenue collection is insufficient to cover the growing government spending. The adoption of digital technologies may help the government to increase the revenue collection. This research therefore sought to investigate the effect of digitalization on revenue collection in Rwanda, taking a case of Rwanda Revenue Authority (RRA).

Objectives of the Study

This research was made up of two set of objectives, namely, the general objective and the specific objectives.

General Objective

The general objective of this research was to investigate the effect of digitalization on public revenue collection in Rwanda, taking a case of Rwanda Revenue Authority (RRA).

Specific Objectives

The research was guided by the following specific objectives:

i). To investigate the effect of electronic filing system on the public revenue collection in Rwanda.

ii). To investigate the effect of the electronic billing system on the public revenue collection in Rwanda.

iii). To investigate the effect of integrated information systems on the public revenue collection in Rwanda.

Research Hypotheses

H_{01}: There is no significant effect of electronic filing system on the public revenue collection in Rwanda.

H_{A1}: There is a significant effect of electronic filing system on the public revenue collection in Rwanda.

H_{02}: There is no significant effect of the electronic billing system on the public revenue collection in Rwanda.

H_{A2}: There is a significant effect of the electronic billing system on the public revenue collection in Rwanda.

H_{03}: There is no significant effect of integrated information systems on the public revenue collection in Rwanda.

H_{A3}: There is a significant effect of integrated information systems on the public revenue collection in Rwanda.

LITERATURE REVIEW

This chapter presents the relevant literature that the author has used. It includes conceptual review, empirical literature, the theoretical review and conceptual framework.

Conceptual Review

Digitalization

Digitalization refers to the transformation of data, processes and procedures in to the digital format that is readable by the computer. Analog data are transformed in to digital data through digitization, Digitalization goes further and involves the ability to use modern technologies for data collection, trend analysis, comparative analysis and constructive interpretations. Digitalization is the use of digital technologies that transform the processes in order to make the business operations more cost effective, improve business performance and increase system automation in an organization (Schallmo & Tidd, 2021). In this regards, digitalization is used to mean the initiative and the use of technologies by the government in order to increase the quality of service delivery. In addition, the use of digital technologies can be used in order to increase public revenue collection.

Public Revenue

Public (or government) revenue refers to the income that a government collects or generate from various sources. The main source of public revenues is classified in to two, the tax revenues and the non-tax revenues. Under the non-tax revenues different sources of revenues can be identified, namely, revenue streams from government investments and borrowings, fees charged on various government services, fines and penalties, revenue streams from use or sale of natural resources, revenues from disposal of public assets, among others. The tax revenue includes the revenue streams from direct taxes imposed on personal income, business income, investment income, and other incomes. It also includes incomes collected through indirect taxes like value added tax (VAT), excise tax, import duty and other forms of consumption taxes. In most jurisdiction, the tax revenue is recognized as the main source of public revenue having a sizeable share in the budget. Public revenue is a source of finance for government to support the government spending (Joshua, 2020).

Public Revenue Collection

Public revenue collection is the process through which governments collect income from different source including from taxes and non-tax sources. Through the collection of revenue, the government is able to get sufficient funds to run the government. In this case, a single government agent/institution is given the mandate to collect and administer the public revenues. For instance, Rwanda Revenue Authority is the main revenue collector in Rwanda (Joshua, 2020).

Empirical Literature

An empirical study by Adu *et al*., (2020) carried in Ghana focused on the digitization of local revenue collection at the local government level. The authors used mixed research method and collected data using primary data obtained through interview and secondary data obtained through review of annual reports and budgets in the periods 2011 to 2017. The results have indicated that there is improved revenue collection through the adoption of Point of Sales (PoS) terminal which enable the system to capture the taxpayers' record, sales transactions and inventory management. In addition, the system has enabled the government to increase its level of accountability in revenue collection. Ayakwah, Damoah and Osabutey (2021) on their part investigated the effect of digitalization on quality service delivery and revenue mobilization in Africa, focusing on Ghana as case study. Their research showed that digitalization of government services tend to increase revenue generation while at the same time improves service delivery and accountability. However, weak infrastructure, inadequate human capital and lack of adequate political willpower are hindrances towards efficient digitalized systems.

Gitaru (2017) conducted a research investigating the impact of system automation on revenue collection in Kenya. The researcher use SIMBA (System of Information Management and Banking) as the case study investigating how the system has influenced the public revenue collection. Using descriptive and regression analysis, secondary data was analysed and presented. The results revealed that revenue collection increased at increasing rate since the use of SIMBA which improved the coordination of declaration of custom values in a centralized system. The system also enabled Document Processing Centre (DPC) leading to an increase in transaction processed within a month. The regression results further showed that 81.82% of revenue collection was an improvement owing to the use of automation system in Kenya.

Gnangnon and Brun (2018) while covering 164 countries including developed and developing countries investigated the impact of use of internet on public revenue mobilization. The research covered a period of nineteen years from 1995-2013. The authors used Generalized Methods of Moments (GMM) approach and found that increase the use of internet benefit the least developed countries more than the developed countries in increasing public revenue. Audu and Ishola (2021) in their research investigated the effect of digital economy and tax administration in Nigeria. The authors used quantitative research method factor analysis covering data from 2010 to 2017. Using linear regression, the results showed that the use of ICT did not have significant effect on revenue generated from taxation. Similarly, use of ICT was not significantly related to tax evasion. This is because the adjusted R square was -0.028 and p-value of 0.406 which was greater than 0.05.

Uyar, *et al*. (2021) revealed that modernization of government services has positive effect on alleviating tax evasion. The authors analysed data covering 1677 country-year observations from 2006-2017. Digitalization of government services has a long term effect on tax compliance and thereby increases public revenues generated by deterring tax evasion. In their research, Kitsios, Jalles and Verdier (2022), were interested on finding out how governments can reduce fraud on cross-border taxation and increase revenue through use of digital technologies. Using data covering different countries, the authors revealed that the use of digital platforms can significantly reduce cross-border tax fraud and thereby increase public revenue. For low income countries, the use of digital technologies could increase the public revenues by over 1.5% of their GDP.

In Rwanda, Bonhomme, Sandor and Chika (2018) investigated the effect of data analytics on improving public service delivery. The research was more focused on quality service delivery by government and government institutions through the use of digital platforms. Twizeyimana, *et al*. (2018) investigated the use of *irembo* government online platform and the challenges encountered in the implementation. The authors used interpretive case study and collected data using interview and participatory observation. The results showed that challenges in the implementation of the e-government platform do exist and should be addressed adequately in order to make the digitalization of government services more effective.

Theoretical Framework

Technological Acceptance Theory (TAC)

According to Katua (2019) Technological Acceptance Theory (TAC) also known as Technological Acceptance Model (TAM) was first advanced by David in 1986. This theory proposes that adoption of technological advancement depends mostly on the user's perceived benefits accruing from the use of such technologies. Therefore, new technologies are adopted and applied by different people based on their perceptions on the use and effectiveness of such technology. It further suggest that the extent to which consumers accept a given technology is influenced by the perception on the ease of use of the said technology. Therefore the two most important factors that influence the acceptance of technology are perceived ease of use and perceived usefulness.

Marangunic and Granic (2015) further discusses the use of TAC in explaining the adoption and implementation of modern technology. As suggested by the authors, TAC proposes that digital transformation can be significantly influenced in an environment where the acceptance level of the user improved. In this regards, the management should be in the forefront to ensure that the users acknowledge the new technologies. This would ensure that the users are familiar with the new technologies and find the technology easy to use. In this regards, the TAC provides the general framework and consistence for use in the adoption of the technologies. Rahmi, *et al*, (2015) further argues that the technological acceptance model intends to influence the behaviour of the users of technology. In a way, the adoption of the new technology opt to be influenced through the user approach. In this approach, the model proposes that the adoption of new technologies should be done in such a way that it is client oriented.

This theory is relevant in this research because it proposes that adoption of new technologies should be done in a way that it incorporates the needs of the users. In this way, the theory is used in this research to propose that the use of digital platforms by governments should be such that the users' attitudes and behaviour are taken care of. In this regard, digitalization of government services should not be seen to increase the costs of compliance on the side of the public. Further, government online and other digital platforms should be much friendly and economic to use for all the people. Without having these factors feature in, the acceptance level of the digital systems would go down, thereby reducing the expected accruing benefits of the usage of the platforms.

Theory of Economic Efficiency

The Theory of Economic Efficiency (ToEE) was first proposed by Adam Smith in his famous book "The wealth of the nations" in 1776 (Adam, 2016). This theory proposes that the costs associated to collecting and administration of public revenue collection should be as minimum as possible. In other words, governments should not incur huge costs to collect and administer public funds. Otherwise, this would be counterproductive since the sourced funds would only be used to cover the costs of obtaining them. This would mean that the government would only be left with very little funds to use or may be left with a deficit. Hence, the ToEE is an important theory in public finance and administration because it acts as a guide on the importance to have efficient approaches and methods for revenue collection. In this regard, the use of internet, digital platforms and other online services can be seen to align with this theory since their use significantly reduce the costs of public revenue collection (Andreoni, Noman & Stiglitz, 2016).

Further ToEE proposes that any government initiative or approach in collecting public revenue should be avoided altogether if it leads involves high costs in administration and brings more complications in the system. The source and the collection of the public revenue should be such that it does not bring unnecessary delays in assessments and collection. In fact, citizens and other contributing persons to such revenues would be tired if the process are complicated, are ambiguous and are costly on their side. Therefore, the theory is seen to promulgate efficient methods and approaches which should be abandoned if they cannot be economically viable and the outcomes are leading to negatives. Since taxation is part of the main source of revenue, the theory holds that the collection of the taxes should be economically viable in a way that they are cost effective in collecting and administration (Andreoni, Noman & Stiglitz, 2016).

The theory of economic efficiency is applicable in this research and resonates well with the arguments held in the current research. The current research proposes that there exists a

relationship between digitalization and public revenue collection in Rwanda. This proposition further propels that the use of digital platforms would tend to increase public revenue collected, reduce the costs associated in collecting the revenues and increase compliance levels. It further holds that by use of digital platforms, governments can be able to tap in more taxes and other levies more efficiently and in a timely manner as compare to manual system. It is therefore easy to see that the theory of economic efficiency would be met if governments are to adopt digital technologies, digitalize their services and use the same to increase revenue collection.

Theory of Productivity

The theory of productivity (ToP) can be traced back to Charles F. Basatable (1855-1945) who was a classical economist in the field of public finance (Bastable, 1891; Boylan & Maloney, 2013). The theory holds that any government initiative to raise public funds should be productive enough to bring in sufficient amount of money to the government. In a more particular sense, taxation, which is one of the main source of public revenue for most governments should be capable to bring in sizeable amount of revenue to the government. In fact, the theory is proposing the expected outcome of any source of public revenue. It would insignificant to talk of source of public revenue if the amount of money attributed to such source is insignificant to the government budgeting. Concomitantly, there would be no economic benefit for a government to spend administrative costs towards a source of revenue that is bringing in insufficient funds.

Further, as discussed by Dabla-Norris, *et al*. (2019), ToP proposes the revenue yield should be substantial enough to allow the government to incorporate it administration in its budget. In addition, only those sources of public revenue should be imposed that do not hamper the overall production in the economy. If a revenue generating activity goes against the productivity efforts of a given community, then it is seen to generate public revenue for the government at the expense of the households, the private sectors and the public in general. It is therefore imperative that such source be within the interest of the general economic productivity in order to be considered as effective (Keen, *et al*., 2015). This theory of productivity resonates with the current research as it proposes that the generation of public revenue should be aligned to the productivity within an economy. The use of digital technologies may help the governments achieve this proposition through adoption of practices that would lead to increased revenue generation.

Conceptual Framework

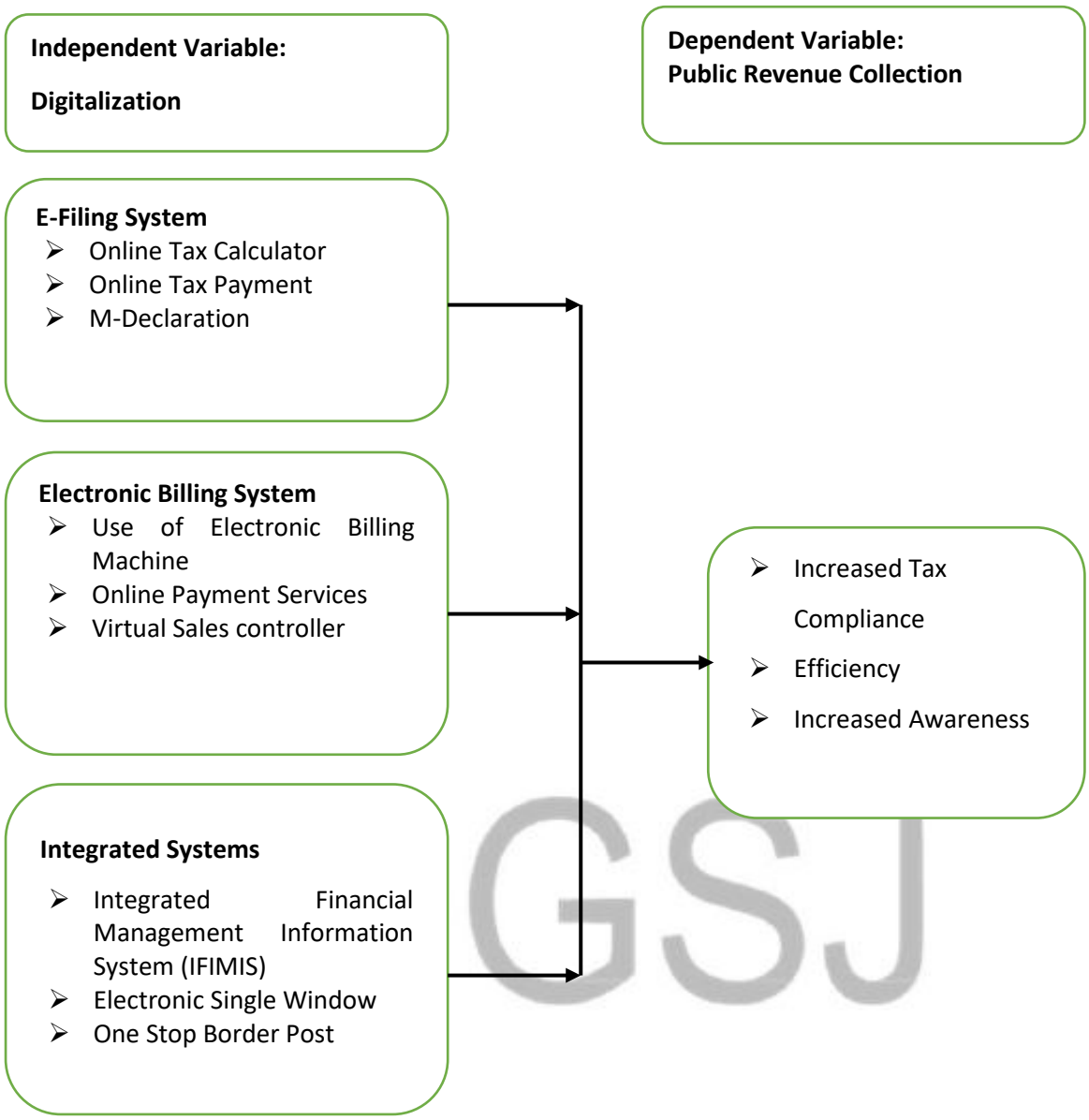

Figure 2.1: Conceptual Framework

The conceptual framework shown in Figure 1 depicts the two variables of interest in this research. The first variable is the independent variable which is digitalization while the second variable is the dependent variable which is public revenue collection. Digitalization was measured using three key indicators, namely, e-filing system, electronic billing system and integrated system. Each of these have their own sub-variables as shown in Figure 1. The dependent variable was measured increased tax compliance, efficiency and increased awareness.

RESEARCH METHODOLOGY

This chapter deals with the research methodology adopted to investigate the effect of digitalization on public revenue collection. It presents the research design, target population, sampling design, data collection methods, data processing and analysis and the ethical considerations.

Research Design

In this research, the researcher used descriptive research design. This approach helped the researcher to present the results using descriptive statistics and tables. In addition, analytical research design was used where the researcher critically analysed the study variable to establish their relationship using Pearson's correlation and regression analysis.

Target Population

A target population can therefore include only the accessible or the relevant members or elements involved in the research. The target population in this research was made up of 400 employees drawn different departments in Rwanda Revenue Authority (RRA) (HR department, 2022).

Sample Size and sampling technique

In this research, Slovin's (2008) formula was used as shown below:

$$n = \frac{N}{(1 + Ne^2)}$$

Where n=sample size, N=target population, e=margin of error which is 5%. Therefore, a sample of 200 was obtained as follows

$$n = \frac{400}{1 + 400 * 0{,}05^2} = 200$$

Sampling Technique

In this study, the researcher used stratified random sampling technique. According to Raju and Prabhu (2019), stratified random sampling technique is whereby the researcher first divide the population in to different strata (groups) with elements that are homogenous and then randomly sample from these strata. Each stratum was represented in the sample according to its proportion to the target population. In this way, the stratified random sampling allows proportionate representation of each of the stratum.

Table 1: Population and Sample Size Distribution

Department	Population	Proportion	Sample size
Revenue Investigation & Enforcement Department	58	0.15	29
Internal Audit and Integrity	34	0.09	17
Taxpayer Services & Communication Department	67	0.17	33.5
Planning and Research Department	32	0.08	16
Legal and Board Secretariat Department	10	0.03	5
Human Resource Department	8	0.02	4
IT and Digital Transformation Department	27	0.07	13.5
Finance Department	15	0.04	7.5
Training Department	50	0.13	25
Strategy and Risk Analysis Department	45	0.11	22.5
Administration and Logistics Department	54	0.14	27
Total	**400**		**200**

Source: RRA HR department and Researcher Computation (2022)

Table 1 shows the distribution of the population and sample size per each stratum (department) considered under this research. The proportion was found by dividing the size of each stratum by the total population. For example, the proportion for revenue investigation & enforcement

department is equal to 58 divided by 400. The answer is multiplied by the 200 which is the size of the sample size as determined using Slovin's formula.

Data Collection Tools

Data that was used in this research was both primary data and secondary data. Primary data was gathered using structured questionnaire and interview guide. The questionnaire was structured through use of closed ended statements that use the Likert scale to measure the responses obtained from the participants. The Likert scale is a five-point scale with 5=strongly agree, 4=agree, 3=not sure, 2=disagree and 1=strongly disagree. Using the structured questionnaire enabled the researcher to provide a direction to the participants and in a way focus the participants towards providing responses that can easily be translated to quantifiable data.

In addition, interview guide was used to gather more information. Key informants were identified and interviewed according to their availability. Secondary data was collected using the documentary review method. In this regards, different relevant documents and reports were used to provide further information on the use of digital technologies and revenue collection in the public sector.

Data Analysis

When the data is collected, it was entered in to SPSS version 23 for process and analysis. First, the researcher went through the questionnaires to ensure they are filled accordingly. Then the researcher did the coding for all the statements used in the questionnaire to enable data entry into the software. Where necessary, the researcher further did data transformation to create and combine statements to come up with research variables as stipulated in the conceptual framework. Data analysis were thereafter done using descriptive statistics and presented using frequency tables, means and standard deviation. The Pearson's coefficient of correlation analysis was used to analyse the relationship between digitalization and public revenue collection. Further, multiple regression analysis was conducted to measure the contribution of each indicator variable on the public revenue collection. The regression model was formulated as given below:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon$$

Where $y(\text{dependent variable}) = \text{digitalization}$

$\beta_0 = \text{constant}$

$\beta_1, \beta_2 \text{ and } \beta_3 = \text{regression coeficients for indicators } x_1, x_2 \text{ and } x_3 \text{ respectively}$

$x_1, x_2 \text{and } x_3 (\text{indicators of independent variable})$
$= e - \text{filing syste}, e - \text{billing system and integrated systems respectively}$

DATA ANALYSIS, FINDINGS AND INTERPRETATION

This research investigated the effect of digitalization on public revenue collection in Rwanda. This chapter then provides the findings following the specific research objectives. All the questionnaires distributed were filled and returned. This section presents the findings, starting with participants' profile and then followed with the specific objectives.

Table 2: Correlation Analysis between E-Filing and Public Revenue Collection

		Revenue Collection	Online Tax Collection	Online Tax Payment	M-Declaration
Revenue Collection	Pearson Correlation	1	.814**	.699**	.598**
	Sig. (2-tailed)		.000	.000	.000
	N	200	200	200	200

Online Tax Collection	Pearson Correlation	.814**	1	.408**	.471**
	Sig. (2-tailed)	.000		.000	.000
	N	200	200	200	200
Online Tax Payment	Pearson Correlation	.699**	.408**	1	.344**
	Sig. (2-tailed)	.000	.000		.000
	N	200	200	200	200
M-Declaration	Pearson Correlation	.598**	.471**	.344**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	200	200	200	200

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Researcher (2022)

Table 2 shows the results for correlation analysis for e-filing and public revenue collection in Rwanda. The main key indicators for e-filing of taxes included the online tax collection, online tax payment services and m-declaration services. As shown in the table, all the three indicators were significantly related to public revenue collection since their respective p-values were less than 5%. For the online tax collection ($r=0.814$, $p<0.05$) the Pearson correlation was strong and positive. Since the p-value was less than 5%, the relationship implied it was positive and statistically significant.

With regards to online tax payment services, the correlation analysis ($r=0.699$, $p=0.000$) showed that the relationship between online tax payment and public revenue collection was positive and significant at 5%. This implied that the online tax payment increases significantly the public revenue collection. On the relationship between m-declaration and public revenue collection, the Pearson correlation analysis ($r=0.598$, $p=0.000$) showed that m-declaration services significantly influence public revenue collection. The p-value was found to be less than 5% indicating that an increase on m-declaration would lead to significant increase in the public revenue collection in Rwanda. These findings are consistence with earlier research which showed there is significant effect of electronic filing system on public revenue collection. For instance, Adu *et al*., (2020) who showed that the use of online platforms increases revenue collection. In addition, Uyar, *et al*. (2021) revealed that modernization of government services tends to increase revenue collection as it reduces chances of noncompliance.

Table 3: Correlation Analysis between E-Billing and Public Revenue Collection

		Revenue Collection	EBM Use	Online Payments	Virtual Control
Revenue Collection	Pearson Correlation	1	.809**	.807**	.810**
	Sig. (2-tailed)		.000	.000	.000
	N	200	200	200	200
EBM Use	Pearson Correlation	.809**	1	.591**	.481**
	Sig. (2-tailed)	.000		.000	.000
	N	200	200	200	200
Online Payments	Pearson Correlation	.807**	.591**	1	.585**
	Sig. (2-tailed)	.000	.000		.000
	N	200	200	200	200
Virtual Control	Pearson Correlation	.810**	.481**	.585**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	200	200	200	200

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Researcher (2022)

The correlation analysis between the use of electronic billing system and public revenue collection in Rwanda was conducted using Pearson coefficient correlation. As shown in Table 4.9, the use of electronic billing machine (r=0.809, p=0.000) was found to be strong positive and significant to the public revenue collection in Rwanda. This implied that the use of EBM greatly impacts on the public revenue collection. On the relationship between online payment platform (r=0.807, p=0.000) and public revenue collection, the Pearson collection showed that the correlation was strong and positive. It was also significant since the p-value was less than 5%. Similarly, virtual sales control system (r=0.810, p=0.000) was strongly and positively related to public revenue collection. The p-value was also less than 5% showing that the correlation was statistically significant. These findings are in line with the finding from Adu *et al*., (2020) and Uyar, *et al*. (2021) who showed that the use of online billing systems greatly influences the revenue collection. In addition, Gnangnon and Brun (2018) research indicated that the use of internet increases public revenue mobilization and hence increase the government potential to collect revenues. Twizeyimana, *et al*. (2018) study showed that the use of *irembo* government online platform improved the quality of service delivered while at the same time increasing revenue collection. Similarly, Ayakwah, Damoah and Osabutey (2021) study indicated the same effect showing that the use of digital platforms increases quality service delivery, accountability, reduce corruption, thereby increasing the revenue collected.

Table 4: Correlation analysis between System Integration and Public Revenue Collection

		Revenue Collection	IFIMIS	Electronic Window	One Stop
Revenue Collection	Pearson Correlation	1	.745**	.875**	.869**
	Sig. (2-tailed)		.000	.000	.000
	N	200	200	200	200
IFIMIS	Pearson Correlation	.745**	1	.684**	.552**
	Sig. (2-tailed)	.000		.000	.000
	N	200	200	200	200
Electronic Window	Pearson Correlation	.875**	.684**	1	.790**
	Sig. (2-tailed)	.000	.000		.000
	N	200	200	200	200
One Stop	Pearson Correlation	.869**	.552**	.790**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	200	200	200	200

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Researcher (2022)

Table 4 shows the findings obtained after conducting Pearson correlation analysis between system integration and public revenue collection. As shown in the table, all the three indicator variables used to measure the integration of the information system were positive and significant at 5% since their p-values were less than 5%. For the use of IFIMIS (r=0.745, p=0.000), the correlation analysis showed that the relationship was positive and significant at 5%. Similarly, the use of electronic single window system (eSW) (r=0.875, p=0.000) was positive and significant. It was also very strong. Lastly, the use of one stop border post system (r=0.869, p=0.000) significantly helps RRA in revenue collection. This is indicated by the positive and strong correlation which was also found to be significant since the p-value was less than 5%.

Table 5: Regression Analysis Model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.952[a]	.906	.905	.11961

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	27.178	3	9.059	633.173	.000[b]

	Residual	2.804	196	.014
	Total	29.982	199	

a. Dependent Variable: Revenue Collection
b. Predictors: (Constant), E-Filing, E-Billing, System Integration

Source: Researcher (2022)

The regression analysis output of shown in Table 5. The findings in this research have shown that digitalization has a significant effect on public revenue collection. This conclusion is drawn from the fact that the regression model (F=633.173, p=0.000) was significant since the p-value was less than 5%. In addition, the regression analysis has given an R^2=0.906, which indicated that 90.6% of the changes in public revenue in Rwanda Revenue Authority can be attributed to the use of digital technologies. These results confirm that the digitalization process adopted by RRA has been bearing fruits on the compliance issues, taxpayers' awareness and thereby on increasing the public revenue collection.

Table 6: Regression Coefficient Analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.007	.112		-.060	.952
	E-Filing	.281	.029	.266	9.776	.000
	E-Billing	.289	.034	.307	8.500	.000
	System Integration	.430	.030	.506	14.181	.000

a. Dependent Variable: Revenue Collection

Source: Researcher (2022)

In the said regression analysis, the researcher further analyzed the contributing effect of each of the indicator variables of digitalization. In this study, three key indicator variables were used, namely, e-filing system, e-billing system and information systems integration. As shown in Table 6, all the variables were significant since their individual p-values were less than 5%. For e-filling ($\beta_1 = 0.281, p = 0.000$) indicated that e-filing positively influences the public revenue collection. An increase by one unit in e-filing would result to an increase in public revenue collection by 0.281 units. E-billing system ($\beta_2 = 0.289, p = 0.000$)was also positive and statistically significant at 5%. A one unit increase in e-billing would give an increase in public revenue collection by 0.289. Similarly, information system integration $\beta_2 = 0.430, p = 0.000$) meant that there is significant effect of system integration on the public revenue collection. An increase by one unit in system integration would lead to an increase in public revenue collection by 0.43. The findings showed that integration of the information system has a higher contributing effect as compare to the other factors.

Discussion on findings

This study endeavoured to investigate the effect of digitalization on public revenue collection in Rwanda. The research was concerted around three key indicators identified in literature as concerning digitalization. This included e-filing system, e-billing system and information system integration. The e-filing system was concerned on the availability of electronic filing platforms where a taxpayer can be able to compute ad file his/her taxes using the digital technologies. On the other hand, e-billing system entailed electronic payment systems including use of Electronic Billing Machine (EBM) and online payment platforms for government services. Lastly, the information system integration looked at the use of digital technologies interlink different systems for efficient coordination and communication among different government entities. It identified the use of IFIMIS and other system integration like electronic single window and one stop border post services.

Form the findings obtained, it was demonstrated that most of the participants involved in this study saw the link between digitalization and public revenue collection. In particular, majority of the

participants indicated that the use of e-filing, e-billing and system integration has increased the public revenue collection in Rwanda. The research went further and used Pearson correlation and multiple regression analysis to establish the relationship and the effect of the indictor variables to public revenue collection. As the analysis have shown, e-filing, e-billing and system integration all have positive and statistically significant relationship with the public revenue collection. The regression analysis showed that the three variables contribute to 90.6% of the public revenue collection. In particular, the regression coefficient showed the contributing effect of each of these variables towards public revenue collection. Further, the analysis showed that information system integration has the highest contributing effect followed by e-billing system. This research has therefore supported the government's effort towards moving all government service delivery and payments to online and use of digital platforms for the same. This also supports the work by RRA towards improving tax compliance through digitalization and public awareness efforts.

Further, the findings in this research have shown the need for digital transformation where the use of internet technologies has increased the level of public revenue collection. These findings are consistence with previous findings by other researchers. For instance, past researchers like Gitaru (2017) showed that with system automation governments across the globe can increase their ability to collect revenue. Adu *et al*., (2020) demonstrated that the use of digitization of local revenue collection influence the amount of revenue collection. Ayakwah, Damoah and Osabutey (2021) study pointed out that the use of online and digital platforms not only improve on quality service delivery, but also tends to increase revenue generation. It also brings accountability in the system enabling the government to save a lot in the process. Further, Gnangnon and Brun (2018) and Uyar, *et al*. (2021) studies emphasized the effect of using modernization and internet on public revenue mobilization.

CONCLUSION

This study sought to investigate the effect of digitalization on the public revenue collection. As per this study, three indicator variables were identified, namely, e-filing system, e-billing system and information systems integration. The research therefore undertook the study to investigate how these factors would influence the public revenue collection in Rwanda Revenue Authority. The findings have shown that e-filing system, e-billing system and information integration system has significant effect on the public revenue collection. The use of these digital technologies increase efficiency, transparency, quality of services delivered and at the same time improve revenue collection.

Recommendations

The study recommends that the Government of Rwanda should continue in its trajectory in digital transformation. Digital transformation reforms and policies should focus on incorporating new innovations that can help in reducing the costs of tax administration as well as on the side of the taxpayers' compliance aspects. Therefore, the use of digital technologies should be such that they are user friendly. They should not bring complications in use or applying them. Moreover, the government agencies should always carry out sensitization and public campaign whenever new technologies are adopted. This would increase the taxpayers' awareness, and thereby improve on the usage of these technologies. In addition, the use of integrated system should be accomplished to cover all the government agencies and all revenue collection points. Further, the findings in this research have highlighted the efficiency created through the use of digital platforms and their effect on public revenue collection. However, despite these positive benefits, the government must be vigilant to monitor its systems to avoid system failures. Therefore, the researcher recommends that RRA in conjunction with other government agencies should continuously monitor the performance of the information system to protect and safeguard the system from vulnerabilities, hacking and complete system failures. Further, such continuous monitoring would help the government to incorporate new technologies as they may arise.

Suggestions for Further Studies

The researcher suggests the following topics for future research. Future research could be carried to investigate the effect of the use of digital platforms on increasing tax compliance in Rwanda. The purpose of the use of these digital platforms is to ensure that the costs associated with revenue collection and administrations are reduced and that revenue collection is maximized. However, study on the compliance issues would add a gist to these arguments. Secondly, future study to investigate the effect of digitalization on the efficient public administration process in Rwanda could be carried out. Lastly, the researcher suggests further research to be carried out to investigate the effect of digital information on creating public awareness and increasing public revenue collection in Rwanda.

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