Implementation and Validation of USSD-based Mobile Phone Application Prototype for Enforcementof Property-related Tax Compliance: The case of Tanzania

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ABSTRACT
Property tax has been taken as among of the potential source of revenues in almost all governments in developing countries. While Property tax reaches up to more than 2% of GDP in developed countries, the situation is different when it comes to developing countries where it accounts for less than 1%. Together with other reasons, weak enforcement is a big problem facing property related taxes collection in most of developing countries including Tanzania. This paper implements USSD-based mobile phone application for enforcement of property-related taxes compliance and validates the application functionalities with stakeholders. The agile software development approach was used to implement the application. After validating the application with stakeholders, the results show that more 80% of participants commented that the implemented enforcement mechanism is appropriate and useful.

Keywords
USSD Application, information technology, Property tax, tax compliance, compliance enforcement

1. INTRODUCTION
Property related taxes can take many forms in different countries but in Tanzania property related taxes are taxes levied on annual basis on the occupation and ownership of real property such as land and buildings. While Property tax reaches up to more than 2% of GDP in developed countries, the situation is different when it comes to developing countries where it accounts for less than 1% [1]. Together with other reasons, weak enforcement is a big problem facing property related taxes collection in most of developing countries including Tanzania. The enforcement measures speculated in many government laws are politically unenforceable. Politicians are less willing to strongly enforce taxpayers residing in the area of jurisdiction for the purpose of maximizing election votes [1].

The deployment and utilization of appropriate Information and communication technology (ICT) can help to address the problem. The tax authorities have been using ICT in revenues administration but many of the ICT interventions are focusing on operational performance to bring the efficiency and effectiveness [2]. Also, they aim at increasing monthly revenue returns through reducing collection and administrative cost and increasing transparency [3]. In regard to the issue of tax compliance enforcement, many Information Technology in use including technologies for providing E-filing, E-payments, electronic billing machines and online communications are used to facilitate compliance but they are unable to enforce compliance.

In Tanzania, numerous efforts have been put in place that aim at utilizing ICT to implement property related taxes compliance enforcement. In the year 2021 the government announced the collection of taxes from ownership of buildings through the prepaid electricity metering system. This collection mechanism is implemented by making automatic monthly reduction of Tanzania Shillings 1000 for owners of normal buildings and Tanzania Shillings 5000 for owners of story buildings from the token recharge amount paid by electricity consumer. The study conducted in Tanzania identified some challenges associated with this measure including forcing tenants to pay for the taxes and the need for reconfiguration of prepaid metering system to accommodate tax issues. The study then designed ICT based mechanism and developed application prototype to address the identified challenges [4]. The problem with the developed application prototype is that it is not accessible through mobile phone to allow users to make payments of their tax arrears anywhere at any time in the absence of Internet connectivity. Therefore, this paper implements USSD-based mobile phone application and validates the application functionalities with stakeholders.

2. LITERATURE REVIEW
2.1 Tax Avoidance
In both developed and developing countries, the major source of government revenue is tax. For countries to be able to benefit from globalization opportunities they need to mobilize satisfactory fiscal revenues and an effective tax administration is the most dependable means to achieve this dream. Significant part of government functions and national development are guided by tax revenues and are used to provide public social services [5].

According to framework which naturally fits the issue of tax compliance, administration and enforcement into a system, defines a tax system as a set of procedures, rules, regulations having three characteristics namely tax bases and rates, remittance rules and enforcement rules [6]. Avoiding tax among taxpayers is a problem which is still at high rate as proved by many researchers all over the world. Hiding of income from tax departments and beliefs that laws and regulations are not frequently applied are among of the common behaviors of many taxpayers. This makes taxpayers be assured that the chance of them being detected is very minimal [7]. The presence of a semi-formal economy tailed by the lack of political unwillingness to apply the taxation procedure and laws are other reasons for the high rate of tax noncompliance taking place now [8]. This acknowledgement

of tax evasion focuses the attention of this paper on the compliance enforcement measures which can help to illuminate the problem.

2.2 Information Technology for Tax Compliance Facilitation

New technologies used to facilitate tax compliance and improve general effectiveness in collecting taxes over the last few decades have been among of the priorities of many tax systems around the world. One of good examples on how electronic fiscal devices (EFDs) could be used to encourage compliance comes from Ethiopia. The main ground of EFDs is that in their varying versions such machines, they can record transactions automatically as they are performed and easily make communication with tax authorities through the internet or a mobile network. This scenario made taxpayers to be confident that the paid tax real reach the intended tax authority and boost the morally to pay taxes [9].

Another study also conducted Ethiopia gives another interesting story to the narrative. The study considers the fact EFDs may also have compliance effects across other taxes different from Value Added Tax (VAT) [10]. Following the recent change towards studying compliance spillovers across taxes for a complete evaluation of any policy intervention [11].

While technology has been effective in identifying tax base and the tax due more accurately, it has seen to be ineffective in those circumstances missing robust modern enforcement. Though new technology is capable of generating new data, its effectiveness depends on adequate enforcement actions from the authority which on other side of a coin depends on the available resources for traditional enforcement [10].

Another area where the application of technology in taxation has improved taxpayers' compliance is by making it easy for taxpayers to obtain information needed to fulfil their tax obligations. The provision of detailed instructions, guidance and forms on tax authorities' website has helped to facilitate compliance among taxpayers [12]. Making it possible for taxpayers to perform tax transactions online, including the possibility to file and make payments online are the further steps for facilitating compliance. Tax authorities are also communicating electronically with taxpayers through SMS, reminders through email and through announcements and confirmation of payment [13].

2.3 Unstructured Supplementary Service Data

The Unstructured Supplementary Service Data (USSD) also referred to as Quick Codes came in use after the invention of the Global System for Mobile (GSM) phones for accessing short and quick mobile functions. These functions which are basic and primary use of USSD include checking for airtime balance and recharging of airtime [14]. The length of USSD messages varies between 1 to 182 alphanumeric characters which is against the primary characteristic of the GSM of Short Message Service (SMS). USSD messages are always in instant connection when a session is continuing. This feature provides interactional capabilities and attributes to USSD which make it more suitable to many menu-based applications [14].

The building blocks of USSD Network are Home Location Register (HLR), Mobile Station Controller (MSC), Visitor Location Register (VLR), Complex logic to aid collective implementations within a solitary USSD platform, Simple Messaging Peer-Peer (SMPP) interface for applications to authorize services, USSD Gateway and USSD application servers [15]. Figure 1 depicts the architectural design of USSD.

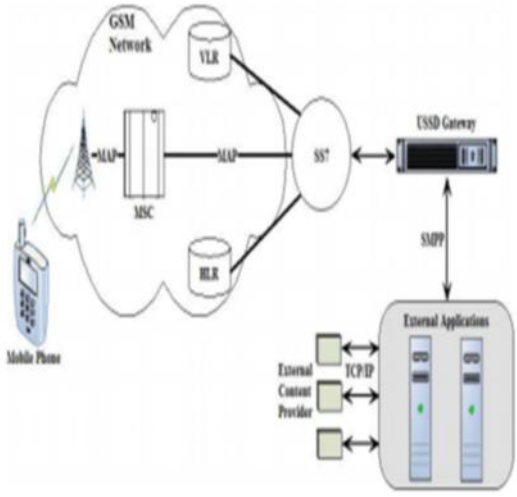

Figure 1: USSD Architecture [15]

2.4 Conceptual Framework of Implemented USSD Application

This paper implements the conceptual framework for property-related taxes enforcement proposed in Tanzania[16]. The framework interconnects four information system which communicate to each other to provide the needed enforcement mechanism as shown in Figure 2.

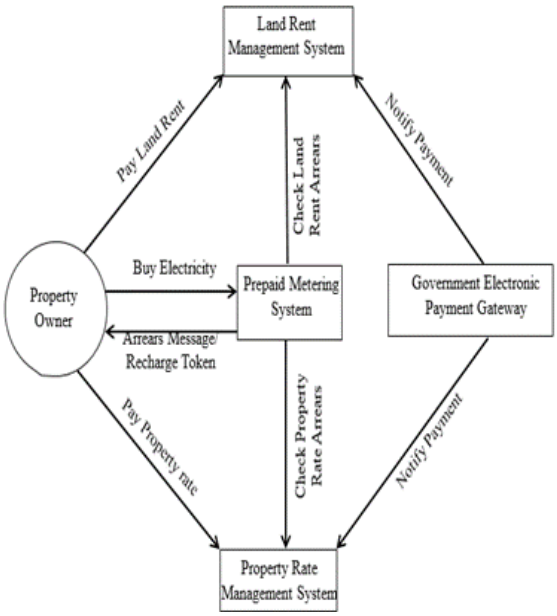

Figure 2: Conceptual Framework of the Implemented USSD Application [16]

3. MATERIAL AND METHODS

The Agile system development methodology with Scrum were used due to its flexibility and rapid software product delivery which allow iterative feedback loop and time-boxed sprints [17]. The tools used for implementing the application were PHP and Notepad++. Africas Talking simulation environment were used for testing the application. The application was demonstrated to the selected stakeholders who validated it by responding to questionnaires

4. RESULTS AND DISCUTION

4.1 User Interactions with the Application

This section presents the results from the developed USSD application by displaying the screenshots involved during user interaction with the application. A user with meter number 2267807 installed to his/her house with plot number 63 and block HG having building (property) tax arrears of Tanzania shillings 12000 and land rent arrears of Tanzania shillings 80000 is used to discuss the results from the application. After dialing the USSD code (*384*43219#), the user (electricity consumer/taxpayer) is then presented with a screen displaying a menu of offered services as shown in Figure 3.

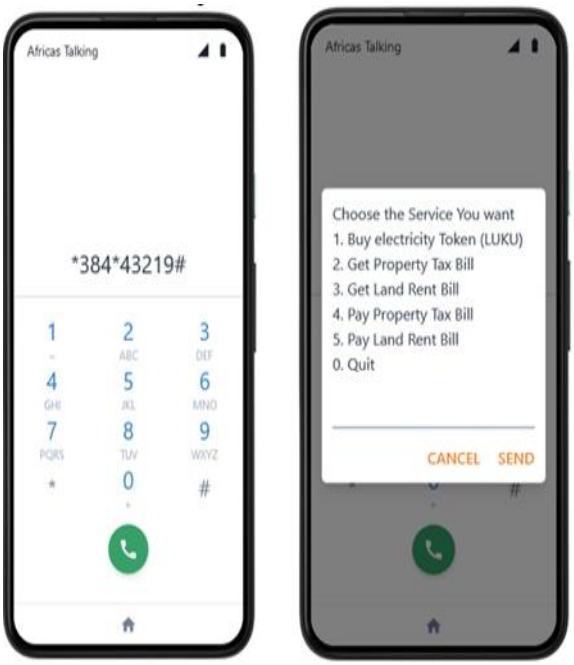

Figure 3: USSD Code and Menu of Offered Services

After selecting service number 1 from the menu for buying electricity recharge token, the application asks the user to enter the meter number and recharge amount as shown in Figure 4. After submitting the recharge information, the application connects to the tax authorities' information systems to check for tax arrears.

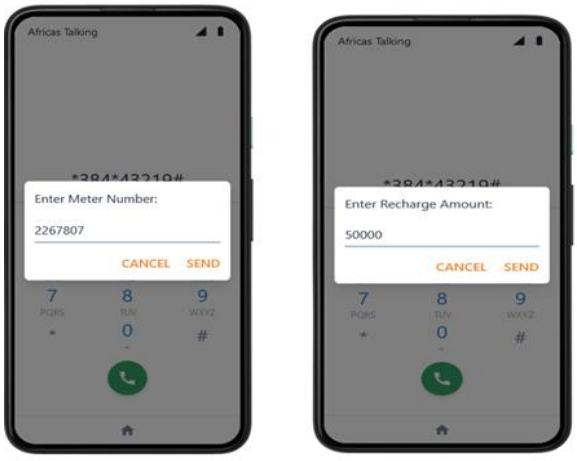

Figure 4: Electricity Recharge Information

Since the user's electricity meter is not registered to any of the two tax authorities, the application responds with the message directing the consumer to visit the tax authorities to register the meter as shown in Figure 5.

Figure 5: Response to Consumer not Registered in Tax Authorities' Database

After registering the meter to the tax authorities and trying to request for electricity recharge token again, the consumer was found with tax arrears in both tax authorities database (land rent and property tax) and the application responds with the arrears message as indicated in Figure 6.

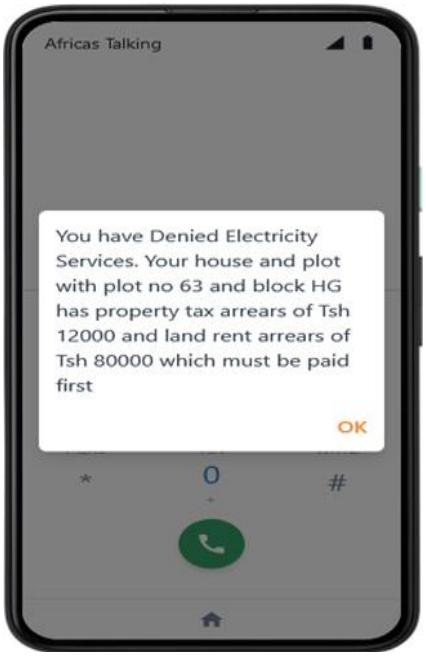

Figure 6: Response to Electricity Consumer Having Tax Arrears

The consumer will need to clear the tax arrears found in order to request for the recharge token again. To do so the consumer must first obtain the tax bill by selecting either services 2 or 3 from the USSD main menu presented and will be asked to provide taxpayer identification information as shows in Figure 7.

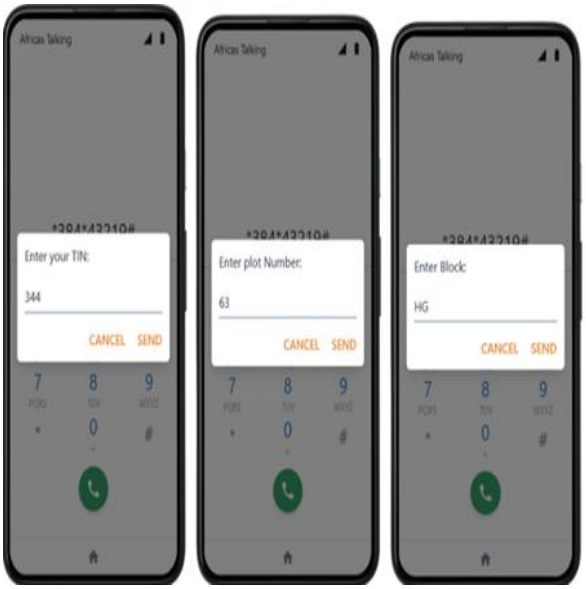

Figure 7: Taxpayer Identification Information

After submitting the taxpayer information to the tax authorities, the application responds with the billing information as shown in Figure 8.

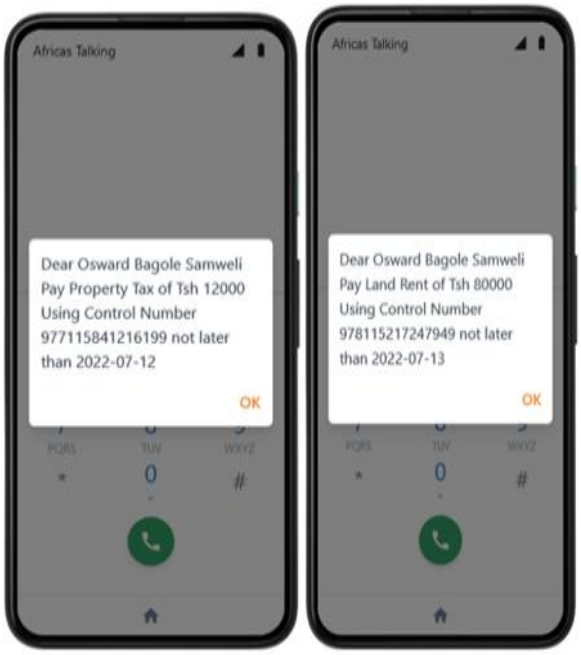

Figure 8: Tax Arrears Billing Information

To clear the tax arrears, the consumer selects either service 4 or 5 from the main menu depending on the bill to be paid and the application asks for the bill payment information as indicated in Figure 9.

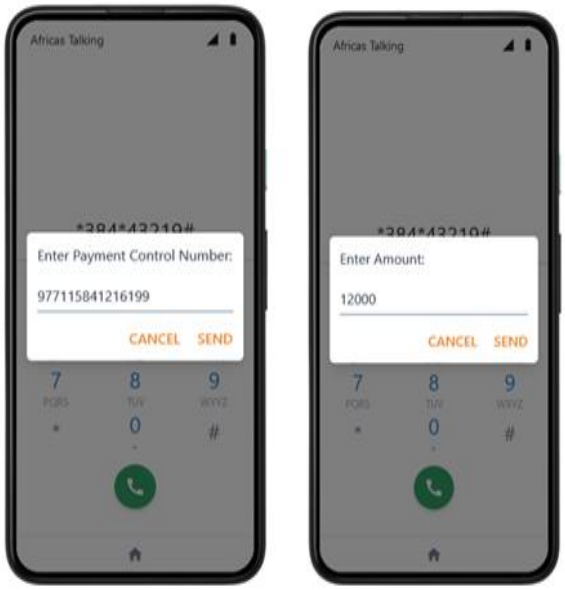

Figure 9: Tax Arrears Payment Information

After submitting the bill payment information, the application responds with the payment confirmation message as shown in Figure 10.

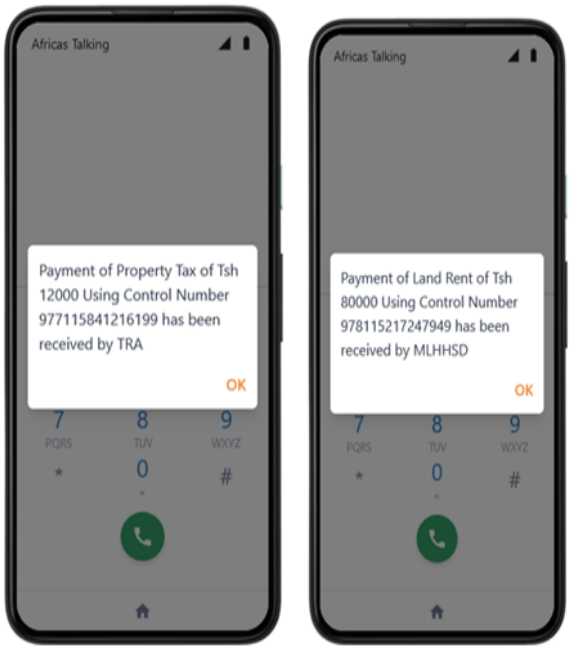

Figure 10: Property Tax Arrears Payment Confirmation

After clearing all the tax arrears, the consumer can continue with the process of buying the electricity recharge token by choosing service number 1 from the USSD main menu. Figure 11 shows the token response from the application. The consumer enters the provided token numbers to the prepaid meter and continue using the electricity.

Figure 11: Electricity Recharge Token Response

4.2 Validation of the Application

In validating the application to discover whether or not the application satisfies the user needs, questionnaires were distributed to the stakeholders. Four themes which include appropriateness of the enforcement mechanism, usefulness, usability and acceptance of the implemented application were measured.

4.2.1 Appropriateness of the Enforcement Mechanism

More than 80% of participants (23.3% strongly agree, 60% agree) said that the enforcement mechanism provided is appropriate as indicated in Figure 12. This shows that the implemented solution is the best one.

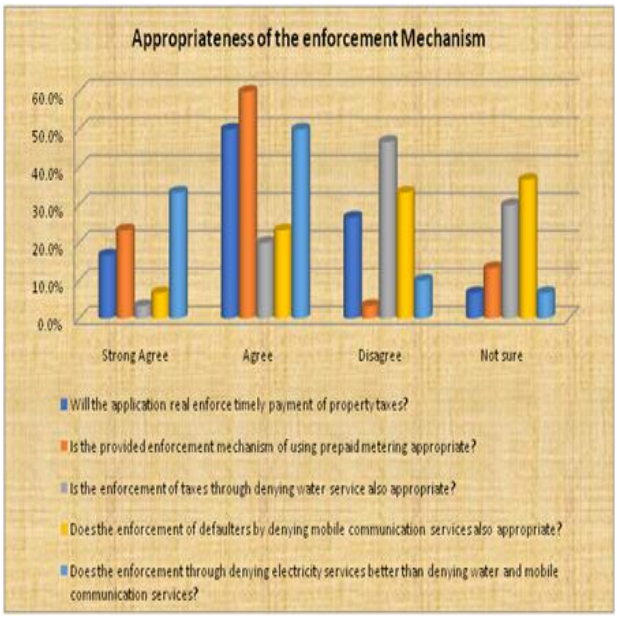

Figure 12: Appropriateness of the enforcement mechanism

4.2.2 Usefulness of the Application in Addressing Existing Problems

More than 80% of participants (strongly agree 33.3%, agree 50%) said that the application will eliminate the problem of year-to-year property related tax arrears as shown in Figure 13. This indicates that the implemented enforcement mechanism is useful.

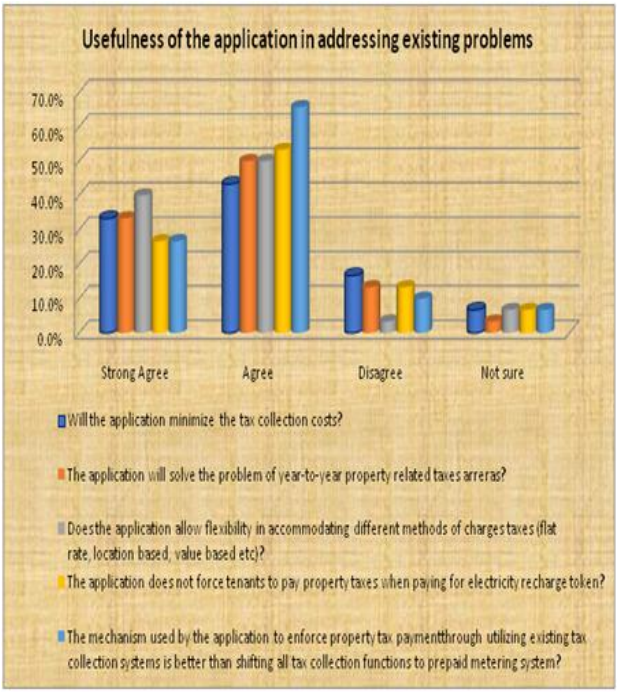

Figure 13: Usefulness of the Application in addressing existing problems

4.2.3 Usability of the Application

86.7% of participants (strongly agree 30%, agree 56.7%) said the application is easy to use as shown in Figure 14.

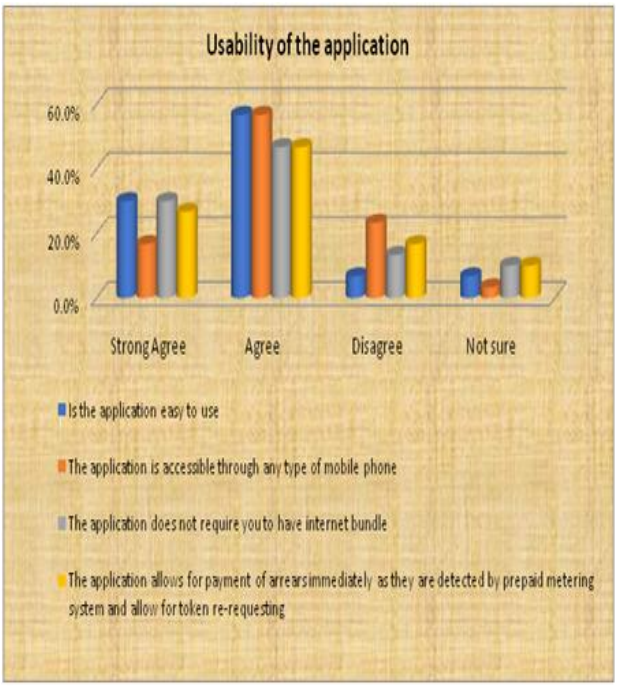

Figure 14: Usability of the application

4.2.4 Acceptance of the Application

83.3%of the participants (30% strong agree, 53,3% agree) said that the application satisfies their needs and they are ready to use it as indicated in Figure 15. This indicates that the application is accepted by the intended users.

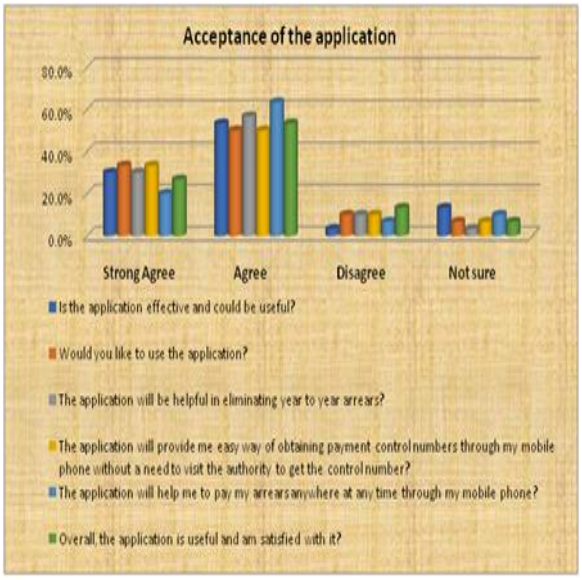

Figure 15: Acceptance of the application

5. CONCLUSION

Enforcement for tax compliance is a very critical element for the successful tax collection system. Traditional tax enforcement measures provided in many government laws are costly, cumbersome, time consuming and politically infeasible. Therefore, more innovative researches need to be done to come up with ICT based tax enforcement mechanisms.

6. REFERENCES

[1] M. Ali and T. Goodfellow, "Taxing the urban boom: Property taxation in Africa," *C. Insight*, pp. 1–8, 2017, [Online]. Available: https://www.cmi.no/publications/file/6190-taxing-the-urban-boom-property-taxation-in-africa.pdf

[2] D. Sanga, "Electronic Revenue Collection: Does it Improve Organization Perfomance? A Case of Ngorongoro Conservation Area Authority," Mzumbe University, 2015.

[3] Y. J. Chatama, "The impact of ICT on Taxation : the case of Large Taxpayer Department of Tanzania Revenue Authority," vol. 3, no. 2, pp. 91–101, 2013.

[4] J. M. Gration, S. Kaijage, and D. Mussa, "Enforcement of Property Related Taxes Defaulters Using Information Systems: The Case of Tanzania," *Int. J. Adv. Sci. Res. Eng.*, vol. 7, no. 12, pp. 57–65, 2022, doi: 10.31695/IJASRE.2021.34122.

[5] G. Jamal, "Appraisal of revenue generations in Numau Southestern Adamawa state, Nigeria," *J. Econ. Financ.*, vol. 2, no. 2, pp. 35–44, 2013.

[6] J. Slemrod and G. Christian, *Tax Systems*. Oxford: Oxford University Press, 2014.

[7] D. George, I. Sorros, D. Karagiorgou, and D. Ioannis, "Tax Audit Effectiveness in Greek Firms: Tax Auditors' Perceptions," *J. Account. Tax.*, vol. 7, no. 7, pp. 123–130, 2015.

[8] N. Artavanis, A. Morse, and M. Tsoutsoura, "Tax Evasion Across Industries: Soft Credit Evidence From Greece," *Chicago Booth Res. Pap.*, vol. 7, no. 6, pp. 12–25, 2012.

[9] M. Ali, B. S. Abdulaziz, and A. Shimeles, "Building Fiscal Capacity: The Role of ICT," Abidjan, Cˆote d'Ivo, 290, 2017.

[10] G. Mascagni, T. M. Andualem, and B. W. Firew, "Can ICTs Increase Tax Compliance? Evidence on Taxpayer Responses to Technological Innovation in Ethiopia," *J. Econ. Behav. Organ.*, vol. 189, pp. 172–193, 2021.

[11] A. L´opez-Luzuriaga and S. Carlos, "Compliance Spillovers across Taxes: The Role of Penalties and Detection," *J. Econ. Behav. Organ.*, vol. 168, no. 3, pp. 518–534, 2019.

[12] K. Grieco, B. K. Amou, and F. M. Niccol´o, "Simplifying Property Tax Administration in Africa: Piloting a Points-Based Valuation in Freetown, Sierra Leone," Brighton: ICTD, 19, 2019.

[13] A. Kamara, N. M. Bakarr, and P. Wilson, "Freetown just implemented a new property tax system that could quintuple revenue," 2020. https://www.ictd.ac/blog/freetown-new-property-tax-system-quintuple-revenue/ (accessed Jul. 12, 2022).

[14] Sanganagouda, *USSD: A communication Technology to Potentially ouster SMS Dependency*. ARICENT, 2011.

[15] A. Baraka, U. Anael, and I. Loserian, "Savvy usage of USSD over SMS.," *Int. J. Res. Rev. Comput. Sci.*, pp. 32–34, 2013.

[16] J. Gration, S. Kaijage, and D. Mussa, "Utilization of Information and Communication Technology in Addressing Property Tax Collection Challenges: The Case of Tanzania," in *ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering 2022*, 2022, pp. 1–12. [Online]. Available: https://doi.org/10.1007/978-3-031-06374-9_1

[17] P. Abrahamsson, O. Salo, and J. Ronkainen, *Agile software development methods:Review and analysis*. 2002.