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ACCOUNTING, CORPORATE GOVERNANCE & BUSINESS ETHICS | RESEARCH ARTICLE

The digital era of taxation: Analysing the effectiveness of digital tax adoption on petroleum excise duty revenue

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Twaha Kigongo Kaawaase², Livingstone Senyonga³ and Simon Echegu⁴

Abstract: This paper investigates the relationship between digital tax adoption and the performance of petroleum excise duty using a sample of 52 petroleum importing companies in Uganda for the period 2022. Ordered probit regressions were used in the analysis to achieve the study's objectives. Consistent with the results of prior studies, we find a statistically significant and positive association between digital tax adoption and the performance of petroleum excise duty. Distinct from past studies, we further examined the link between the attributes of digital tax adoption and the performance of petroleum excise duty. In line with the technology adoption model, our results revealed that among the digital tax adoption attributes, perceived usefulness, information infrastructure, and digital skills significantly contribute to positive variance in petroleum excise duty performance. Though digital tax adoption has received sizeable study in the literature, its application in the context of petroleum excise duty has received less scholarly attention.

Subjects: Information & Communication Technology (ICT); Political Economy; Economics; Finance; Business, Management and Accounting;

Keywords: digital tax adoption; the performance of petroleum excise duty; digital tax adoption attributes; Uganda

1. Introduction

The purpose of this paper is to investigate the association between digital tax adoption and the performance of petroleum excise duty (PPED) among Uganda's petroleum importing companies (PICs). Specifically, we attempt to answer the following crucial policy questions. First, does technology utilisation matter in the payments of petroleum excise duty (PED) among PICs? Finally, and most importantly, given the technology's diverse attributes that can influence its adoption and use among the Ugandan PICs, which attribute contributes to technology adoption and use in the management of PEDs?

Petroleum is the world's main source of fuel and plays a substantial role in the global economy through petroleum excise duty (PED) payments (Besanko & Malik, 2017; Cnossen, 2020). PED is levied on imported petroleum products like gasoline, diesel, and aviation fuels (Cnossen, 2020; Habibullah et al., 2022; Speight, 2015) and contributes 11.7 % to total taxes in Uganda (UBOS

statistical abstract, 2022). This revenue potential links with the World Bank and International Monetary Fund (IMF) requirement for developing countries to generate more revenue domestically (Mahdavi et al., 2022; Olaoye & Borode, 2019). Similarly, the need to achieve SDGs by 2030 has reinvigorated efforts to collect more revenue locally through prime sources like PED (Cnossen, 2020). Nonetheless, the global level of petroleum excise tax collections has been unstable in both developing and developed countries (Cnossen, 2020; Mahdavi et al., 2022; Ross et al., 2017; Rybová, 2015), yet it is one of the major taxes in the whole world. The volatility of this crucial tax is even more common in low-tax economies (Ross et al., 2017) like Uganda, yet such countries significantly depend on petroleum products in their production and services systems (Speight, 2015).

The Uganda Revenue Authority (URA) has, for the last five years up to the first quarter of 2021/2022, managed to meet the performance of petroleum-duty revenue targets only once in 2017. In 2020, it registered a deficit of UGX 27.78 billion (7,310,526 USD) (World Bank, 2023) and a further deficit of UGX 43.34 Billion (11,405,263 USD) in the last quarter of the financial year 2021/2022 (URA, reports, 2022; NTVU, 2023). Such dwindling excise tax collection is due to the low use of digital technologies and leads to inadequate implementation of government programs and increased external borrowing at exorbitant interest rates (UBOS, 2022; URA Press Brief, 2021). To increase PPED, URA deployed technologies such as scanners, electronic cargo, and driver trucking systems (ECDTS) to manage PED (URA Press Brief, 2021). The scanners are used to capture the image of duty payment and convert it into digital information that can be stored on a computer through optical character recognition. The ECDTS is used to track the specific location of the petroleum fuel track. Given the nature of the petroleum products, ECDTS can only facilitate the determination of the specific location of the fuel track but does not monitor fuel consumption by fuel transit tracks to the targeted country by PICs to avoid fuel diversion. Additionally, the technologies being used are unable to automatically generate and transmit reports on fuel distribution and consumption to the revenue authorities in real-time using digital technology like sensors. This shows the need to strengthen digital technologies for real-time generation and transmission of reports on fuel products, monitoring fuel levels through immersing digital sensors in the transit fuel, and monitoring of re-exported fuel (entrepot).

Theoretically, technology adoption and use by petroleum importing companies are directly linked to the performance of petroleum excise duty. First, people's acceptance and use of technology are significantly influenced by how practical and simple they perceive it to be (Davis, 1989). Second, the wide spread use of information and communication technology (ICT) infrastructure enables PICs to adopt and use the digital tax system in the management of PED (Davis, 1989). Finally, employees who are proficient in technology use are able to navigate and influence firm performance, including petroleum excise duty payments (Davis & Venkatesh, 1996; Gitaru, 2017).

Generally, recent evidence offers empirical support to the technology acceptance model that perceived usefulness and perceived ease of use influence technology adoption and use by firms. Abdul Wahab et al. (2021), Sondakh (2017), Marangunić and Granić (2015), and Muturi and Kiarie (2015) report positively perceived usefulness of technology adoption and use in tax management in Malaysia, Indonesia, Croatia and Kenya, respectively. Similarly, Holden and Karsh (2010), King and He (2006) and Chau (1996) report similar findings from the USA and Hong Kong. While a large number of reasons have been offered to explain why enterprises adopt and use technology, as aforementioned, TAM's viewpoint emphasises the internal benefits of adopting digital taxes, yet technology adoption is heavily influenced by external factors. Recent theoretical developments suggest that a wider socio-economic context affects how effectively these systems are adopted and used through the lenses of modernisation theory (Barker & Jane, 2016). According to modernisation theory, socio-economic factors, in particular, influence how people embrace and use new technology (Barker & Jane, 2016; Vega-Gonzalo et al., 2023). It emphasises the role that social acceptance, availability of information infrastructure, political consensus and organisational culture play in how rapidly individuals adopt new technologies. Therefore, organisations with an

innovative culture and resources are more likely to employ digital tax solutions, including paying petroleum excise duty, which can enhance their performance (Chen, 2022; Li, 2020). The notion goes on to claim that there is a connection between technological advancement and economic growth. This implies that when the economy expands, business activity expands as well, resulting in a rapid uptake and use of technologies due to commercial requirements.

Also, major issues of interest are that prior studies on the performance of petroleum excise duty have largely focused on mitigating the adverse effects of fossil fuels on the environment by limiting their usage (Fairbrother et al., 2019; Hussain et al., 2022; Montag, 2015), others studies are on restricting the consumption of tobacco due to health-related challenges (Munga et al., 2023; Patrice et al., 2022) but a few studies on generating revenue (Cnossen, 2020; Mahdavi et al., 2022). The studies on revenue from excise tax have, however, concentrated on exploring its nature, scope, and relevance (Cnossen, 2020) and the justification of the tax on Fossil Fuels (Mahdavi et al., 2022) with a little empirical examination of how the efficient technology enhances petroleum excise duty payments, particularly in a developing economy. This limits the current understanding of what factors are responsible for the petroleum excise duty performance. To realise PED payments, there is a need for an efficient technology system that enables tax payment and monitoring of petroleum importing companies (PICs) (Munga et al., 2023). Broadly, studies that have examined the association between technology use in revenue payments document inconclusive results. For example, Daszykowski et al. (2020) examined the spectroscopic technique for rapid visual verification of the tax levels that are imposed on fuel products as well as identifying fuel usage in Poland and found that monitoring the amount of excise duty components in fuel products is insufficient to confirm illegal attempts at fuel laundering. At the same time, others advocate for technology's use to lessen illicit actions like tax evasion (Bellon et al., 2022).

Additionally, previous analysis of petroleum excise duties has been based on either a review of tax policies (Kraal, 2019), interviews (Fairbrother et al., 2019), or a compilation of case studies (Clements et al., 2013; Turner et al., 2022) or a public data set that measures prices of petroleum products (Cheon et al., 2015) and tells relatively little about the performance of PED. Quantitative data, particularly primary data on the firm-level performance of excise duty, is scarce. Yet, excise duty as an indirect tax covers a wider base, and its proper analysis would necessitate robust research methods like a survey on the PICs.

This paper, therefore, seeks to make three significant contributions to the existing literature through the following avenues: First, We present empirical data illuminating the connection between the adoption of digital taxes and the revenue payments by petroleum importing companies from excise duties on fuel. This empirical emphasis broadens our comprehension of how the modernisation of tax administration may affect payment behaviours in the context of the petroleum business. Second, by focusing on petroleum importing companies, we provide a sector-specific analysis that contributes to a detailed understanding of how the implementation of digital taxes can affect the dynamics of revenue payment within the petroleum business. Third, for governments, tax agencies, and petroleum importing companies alike, our findings have clear policy consequences. This study provides stakeholders with practical insights to improve the payments and management of petroleum excise duty at a time when tax procedures are rapidly becoming digital.

In line with the prior studies, our results indicate that digital tax adoption significantly contributes to positive variance in the PPED. Our initial understanding of digital tax acceptance can be effective only if taxpayers perceive it as useful and easy to use; the spread of ICT is relatively high and easy to learn. This study only confirms that the core attribute of digital tax adoption for purposes of PPED payments is perceived usefulness, information infrastructure, and digital skills, which contribute significantly to the PPED.

The findings of this study add to the body of knowledge on digital tax adoption, in contrast to the majority of the earlier studies that used content analysis methodologies, which are more well-known for their theoretical than practical contribution (Kraal, 2019). This study helps in theory integration in PED payments and offers empirical evidence on the role that perceived usefulness, information infrastructure, and digital skills, a key component of digital tax uptake, play in enhancing PPPD.

The next sections of this study include a study setting/background, theoretical literature review, empirical literature review and hypotheses development, research design, empirical results and discussion, and summary and conclusion.

2. Study setting

2.1. *The regulatory framework of petroleum excise duty in Uganda*

The Excise Duty Act (2014) serves as the main source of legislation governing excise taxes in Uganda. In this act, the legal requirements for excise duty are outlined, along with the categories of items that are subject to the tax, its rates, applicable exemptions, and other pertinent information. Any modifications to this act, which require parliamentary approval, are often undertaken in order to change the excise duty framework, such as changing the tax rates. The EACMA (2004), as amended, is an addition to the Excise Act (2014) as a regulatory tool for the administration of the petroleum excise duty.

The government has the authority to enact rules that offer more specific instructions and methods for carrying out the Excise Duty Act. Specific parts of excise duty may be covered by these rules, including the value of excisable items, manufacturer and importer licenses, and compliance standards. Usually, in conjunction with interested parties, these regulations are developed by the responsible government agency, such as the Uganda Revenue Authority (URA), and then authorised by the Minister of Finance.

The administration and collection of excise duty falls within the mandate of the Uganda Revenue Authority (URA). Administrative guidelines and circulars that give taxpayers helpful advice on their responsibilities, filing requirements, record-keeping specifications, and compliance with excise duty rules are issued by URA. These rules aid in ensuring consistent application and enforcement. Therefore, to meet its energy demands and promote economic growth, Uganda mainly depends on petroleum imports. The amount of money collected from petroleum excise duty is a major factor in the nation's budgetary allocations. This means that any changes to the taxation of petroleum products have a big impact on both government revenue and the overall health of the economy. In addition, Uganda has been actively investigating and implementing digital tax solutions as a way of modernising its tax collection procedures. This requires the implementation of digital invoicing, online payment methods, and other technology tools for tracking and collecting taxes. This development is consistent with growing global trends involving the use of digital taxes, making it an important case study.

The excise Act (2014) further provides that the importers of petroleum products pay the petroleum excise duty at the point of importation, with all the enforcement mechanisms to guarantee that no product is allowed into the country without payment of PED. Despite this robust policy strategy for harnessing PED from the PICs, its compliance by the importers has been wanting. Given that PED is collected from the importers at the point of importation, it is surprising that Uganda is unable to realise its target revenue from petroleum fuels. As a result, this offers the perfect setting for examining how the use of digital taxes influences how the petroleum excise duty is managed. Moreover, Uganda has had trouble collecting excise taxes because of tax evasion, excise duty leaks, and compliance issues. Due to these problems, the government has been obliged to alter its procedures and policies in an effort to increase the effectiveness of tax payments by the PICs. But all these interventions have yielded less on the performance of

petroleum excise duty. By examining the implications of the adoption of digital taxes in this context, we are able to completely analyse how technology may either address or exacerbate these issues.

Also, the Excise Duty Act (2014) and EACMA (2004), as amended, do not address the issue of disparities in digital literacy, the digital divide among urban and rural petroleum product importers, and variances in technology infrastructure availability. The ability to understand how these contextual elements interact with the deployment of digital taxes will not only benefit firms but also help other developing nations facing analogous challenges. Hence, this study is timely at the time when the global trend is moving to digitalisation of taxes. This study's results can aid in the development of effective tax legislation, direct the adoption of digital tax strategies, and improve excise duty payment behaviour by petroleum importing companies, ultimately fostering economic stability and growth.

3. Theoretical literature review

3.1. Theoretical framework

In this study, the Technology Acceptance Model (TAM) was used to examine the petroleum excise duty (PED). This model offers a systematic framework for understanding and evaluating the elements that affect how technology is adopted and used, and it can be directly applied to the situation of digital tax systems in the petroleum industry (Davenport, 2018; Davis, 1989; Ofori et al., 2022). TAM, first proposed by Davis (1989), serves as the basis for understanding the adoption and application of technology inside businesses. With perceived utility and perceived simplicity of use as its main pillars, this paradigm contends that acceptance of digital taxes strongly predicts company performance, including the payments of petroleum excise duties. The primary premise of TAM, according to Davis and Venkatesh (1996), is that people's acceptance and use of technology are significantly influenced by how practical and simple they perceive it to be. Accordingly, employee job performance is enhanced when they see the implementation of digital taxes as beneficial, which boosts the performance of the entire company. It also implies that the perceived usefulness and usability of digital tax systems, which are supported by a strong information infrastructure, are made simpler to use, which facilitates their adoption and, subsequently, increases their usefulness (Davis & Venkatesh, 1996). This is possible if employees who are proficient in digital skills can fully utilise the features of digital tax systems, improving the systems' perceived value and simplicity and contributing to business performance, including petroleum excise duty tax payments (Gitaru, 2017). In this way, the implementation of digital taxes necessitates resources at the level of the tax agency as well as the enterprise to acquire the information infrastructure, digital training, and access to internet services and electricity.

However, TAM does not go uncontested (Kačaljak, 2020). The TAM, proposed by Davis (1989), has been extensively used to research the uptake of technologies. However, it is less suited to analysing complex organisational processes like the adoption of digital taxes since it focuses exclusively on individual views of technology and lacks a wider socio-technical viewpoint. Modernisation theory, which dates back to the middle of the 20th century, offers a solid framework for analysing societal and organisational change in response to technological advancements (Rostow, 1960). It emphasises the connection between social, cultural, and economic factors and technology. The petroleum excise duty sector's implementation of digital taxes can be seen from various angles using the modernisation theoretical framework. It implies that additional socio-technical elements, in addition to perceived usefulness and usability (as in TAM), affect how people adopt new technology and use it (Barker & Jane, 2016; Vega-Gonzalo et al., 2023). The notion stresses how company culture influences how quickly people adopt new technologies. Businesses with an innovative culture are more inclined to use digital tax solutions, which can improve their performance (Chen, 2022; Li, 2020). The theory further asserts that the development of technology and economic expansion are related. This means that as the economy grows, business activities grow as well, leading to the rapid adoption of technologies as a result of business needs. This is because

the use of effective digital systems in the context of petroleum excise duty can result in cost reductions and increased profitability, thereby improving compliance, lowering the risk of penalties, and improving the firm financial performance.

According to Barker and Jane (2016), using cutting-edge digital technologies to impact PED payment is essential in this age of digitalisation to improve TAM. The application of modernisation theory looks at how different civilisations have been affected by technological advancement (Barker & Jane, 2016). The theory states that the use of digital technologies for tax payment will be more advantageous for nations with stronger macro-environmental capacities for delivering internet services and broad ICT services than their counterparts (Chatterjee et al., 2022; Nam, 2018). As a result, countries that support technical advancement in the digital transformation of important activities, including online tax payments, can reduce tax evasion and increase revenue. Collectively, in the context of petroleum excise duty, the modernisation theoretical framework provides a more comprehensive way to analyse the adoption of digital taxes and their effects on firm performance. This paradigm adds to a deeper understanding of the complex interaction between technology, tax laws, and organisational outcomes by integrating socio-technical factors.

4. Empirical literature review and hypotheses development

4.1. Digital tax adoption

The adoption and use of digital tax systems by petroleum importing companies for the payment of petroleum excise duty (PED) can have a significant positive impact on internal advantages, notably in terms of efficiency and accuracy. Our argument is supported by the Technology Acceptance Model (TAM), which is a reliable framework (Davis, 1989). Prior studies have paid little attention to excise duty payments, instead concentrating on the environmental effects and health issues associated with cigarette and gasoline taxes. Notably, Montag (2015) emphasised the effects of gasoline taxes on behavioural change and environmental mitigation, whereas Hussain et al. (2022) underlined the importance of political trust in lowering transportation emissions through investments in green transportation. However, technology adoption is crucial in the field of PEDs. We suggest that installing a track-and-trace excise goods management system with digital sensors can increase excise tax payments and fight illicit trade among importers. Our argument is based on the findings of Munga et al. (2023), who investigated excise duty management in Kenya. Therefore, these digital sensors can automatically produce reports for authorities while simultaneously monitoring the distribution and consumption of gasoline (Li et al., 2020; Pitić et al., 2019; Raikov, 2021; Uyar et al., 2021). Thus, for this system to be adopted and used, it must be viewed as practical, easy to use, and affordable to encourage taxpayers to adopt it (Bassey et al., 2022; Sugandini et al., 2018).

Although the TAM viewpoint emphasises the internal benefits of adopting digital taxes, we contend that a wider socio-economic context affects how effectively these systems are adopted and used (Barker & Jane, 2016). According to modernisation theory, outside variables like political agreement, social acceptance, and access to technology matter a lot (Nam, 2018). The effects of these outside pressures on the adoption and use of digital tax management of petroleum excise duties have received only scant study in the literature. Also, the disparities in the adoption and use of digital tax systems can result from unequal access to technology, which affects its adoption and use (Armenta et al., 2012; Ayinla & Adamu, 2018). Moreover, it might be difficult to agree on tax reform, especially in complex industries like petroleum. Martinez-Vazquez et al. (2023) emphasise how crucial it is to take these extraneous aspects into account because the TAM approach does not adequately account for them. As a result, the argument over the application of digital taxes in the payment of petroleum excise duties is influenced by views from the Technology Acceptance Model (TAM) and Modernization Theory (Barker & Jane, 2016; Davis, 1989). The Modernization Theory approach highlights the impact of external influences, while the TAM perspective emphasises internal benefits like efficiency and

accuracy. It is crucial to take into account both viewpoints to completely understand the effects of adopting digital taxes. Thus, we hypothesised that:

H1: Digital tax adoption is significantly related to the performance of petroleum excise duty.

4.2. Perceived usefulness and petroleum excise duty performance

In the context of technological adoption and user acceptance, the notion of perceived utility is crucial. The Technology Acceptance Model (TAM) and modernisation theory are central to understanding the user's technology adoption and use. Drawing on TAM and modernisation theory, this study examines how perceived usefulness affects predictions of petroleum excise tax payment performance at the corporate level (Barker & Jane, 2016; Davis, 1989). In the context of the petroleum sector, we examined both viewpoints and their implications. According to TAM's theory of perceived utility, a technology's adoption and use are greatly influenced by people's perceptions of its potential to increase productivity and efficiency. Businesses are more likely to use digital tools for petroleum excise duty reporting successfully and perform better if they believe that these solutions are valuable. Davis (1989) and Venkatesh et al. (2003) both agree with this point of view. The perception that digital tools and systems for reporting petroleum excise duties are accurate and efficient can result in increasing adoption and enhanced compliance and performance.

The efficacy of technology adoption, according to modernisation theory, is determined by broader socio-economic issues, such as social acceptance, political consensus, and availability of technology infrastructure (Barker & Jane, 2016). It asserts that the adoption and usage of technology may not be fueled solely by perceived utility. Studies like those conducted in Indonesia by Tahar et al. (2020) provide credence to this viewpoint. According to Tahar et al. (2020), perceptions of usefulness had little bearing on whether electronic tax filing was used in Indonesia. They contend that increasing the usability and security of electronic filing systems is crucial to promoting adoption. Similar findings were made by Hammouri and Abu-Shanab (2017) in Jordan, who discovered that perceived usefulness was not a reliable indicator of user adoption and technology use. This has been silent in the literature on technology adoption and use. The application of these viewpoints in the petroleum sector is difficult. To predict the uptake and effectiveness of digital solutions for excise duty payment, perceived usefulness, as defined by TAM, is crucial. Thoughts on quality and wider technological infrastructure, social acceptance, and political consensus are important as well in enhancing digital tax adoption and use. Thus, we hypothesise that:

H2: The perceived usefulness of digital tax has a positive relationship with the performance of petroleum excise duty.

4.3. Perceived ease of use

The concept of perceived ease of use is paramount when examining how businesses interact with digital systems for reporting petroleum excise duties and the ensuing effect on their performance; the notion of perceived usability is crucial. The Technology Acceptance Model (TAM) and modernisation theory are used to explore the role of perceived ease of use in this study. Within the context of the petroleum sector, this study investigated these viewpoints and their ramifications. Accordingly, TAM claims that the adoption and usage of technology are significantly influenced by perceived ease of use (Venkatesh & Davis, 2000). Therefore, businesses are more likely to employ the petroleum excise duty reporting system if they believe it to be user-friendly, which improves performance (Davis, 1989). This viewpoint is supported by Venkatesh et al. (2003), who claim that companies that see digital solutions for petroleum excise tax reporting as simple to use are more likely to achieve greater levels of compliance and accuracy, improving overall performance. Moreover, the perception of usability has a favourable correlation with the adoption of technology and improves productivity in terms of time and resource efficiency. Thus, Mustapha and Obid

(2015) in Malaysia and Tahar et al. (2020) in Indonesia, who underline the crucial importance of perceived ease of use in predicting electronic tax filing, support this point of view.

According to modernisation theory, a variety of contextual factors, such as the quality of the technological infrastructure, have an impact on how effectively technology is adopted and used (Barker & Jane, 2016; Nam, 2018). It implies that although perceived usability is important, other elements like infrastructure accessibility must also be taken into account. This view has received less emphasis in the literature, yet it is critical for technology adoption and use. According to research by Tahar et al. (2020) conducted in Indonesia, the adoption of electronic tax filing was not effectively predicted by perceived ease of use alone. To increase acceptance, they contend that electronic filing systems must be improved in terms of use and security. The modernisation notion serves as a signal that broader socio-economic issues might have an impact on how well technology is adopted and used. Understanding the significance of perceived ease of use is essential for the petroleum business. TAM emphasises how crucial it is to foresee technological adoption and ensuing performance enhancements in excise duty reporting. However, modernisation theory emphasises the need for a comprehensive strategy that takes into account elements other than usability, like the quality of technological infrastructure. *Thus, we hypothesise that;*

H3: The perceived ease of use of digital tax positively predicts the performance of excise duty filing.

4.4. Information infrastructure

Information infrastructure is a key element in the implementation of digital taxes, acting as the framework for efficient digital tax structures (Abdul Wahab et al., 2021; Borgman, 2010). The Technology Acceptance Model (TAM) and modernisation theory are used in this study to examine the link between information infrastructure and the effectiveness of petroleum excise tax payments (Nam, 2018). In the context of the petroleum industry, this research examined these viewpoints and their applicability. The TAM approach emphasises how important information infrastructure is for promoting technology adoption and, ultimately, performance enhancements (Davis, 1989). Businesses that have a solid information infrastructure, including strong data management systems, are better able to correctly measure petroleum usage, which results in more effective excise duty payments (Ofori et al., 2022). Moreover, by keeping digital records and having robust auditing capabilities inside the information architecture, compliance with petroleum excise duty requirements can be improved, lowering the likelihood of tax evasion (Jemielniak, 2014). The calculation and reporting of petroleum excise duties can be streamlined, reducing errors and the risk of penalties (Kwarteng & Aveh, 2018) by integrating accounting and tax systems into the information architecture. Hence, businesses can react quickly to changes in petroleum consumption patterns because of the infrastructure's real-time monitoring and reporting capabilities, which also improve excise duty computations and compliance (Jia et al., 2017).

The socio-economic impact of information infrastructure is better understood through the lens of modernisation theory (Nam, 2018). It implies that a better information infrastructure might not be enough to ensure increased tax revenue collections. The potential for tax evasion outside of the ICT system, for example, can have an impact on the results (Mallick, 2021). Mallick's findings in India show that there is a chance that ICT infrastructures won't have a big impact on overall tax revenue collecting. When taxpayers perform transactions outside the ICT system while leaving no traces behind, it results in tax revenue losses to the authority. Technology infrastructure needs to be in line with larger organisational and societal concerns, as modernisation theory provides. TAM stresses how it makes tracking and compliance with fuel excise duty efficient. Modernisation theory, however, emphasises the significance of taking into account how socio-economic and technological elements interact in this business. Therefore, information infrastructure such as the internet, websites, and ICT, among others, provides an administrative and technological framework that aids online tax payment. While

the internet facilitates online tax payment, the issue of cybercrime is a threat to taxpayer information (Baylon & Antwi-Boasiako, 2016). Accordingly, the taxpayers' belief in the existence of factors supporting or inhibiting e-tax filing affects adoption. Therefore, we hypothesise that:

H4: Information infrastructure is related to the performance of petroleum excise duty.

4.5. Digital skills

The role of digital skills in predicting the performance of petroleum excise duty payment at the firm level is at the nexus of taxation, technology, and business (Ferrari, 2012). Utilising both the Technology Acceptance Model (TAM) and modernisation theory, this study examined the importance of digital skills in the context of payments of petroleum excise duties. To promote the adoption and efficient use of digital tax reporting systems, the TAM approach emphasises the significance of digital skills (Davis, 1989) possession by business staff. Businesses with staff that are proficient in digital literacy are better able to use these systems, which lowers errors and improves compliance with rules governing petroleum excise duty (Ofori et al., 2022). TAM principles state that investing in the development of digital skills, particularly in data analytics, gives employees the ability to use data-driven insights for cost-savings identification, optimisation of petroleum excise duty computations, and general performance improvement (Davenport, 2018). This viewpoint is consistent with TAM's emphasis on perceived utility and simplicity in technology adoption (Venkatesh et al., 2003).

On the other hand, modernisation theory highlights the broader socio-economic context within which digital skills operate (Nam, 2018). It suggests that while digital skills are important, their impact can be influenced by factors such as social support and opportunity (Ala-Mutka, 2011). Moreover, successful tax administration reform may not solely be a technical issue but a social and political one, requiring a broad consensus among stakeholders (Martinez-Vazquez et al., 2023). Therefore, according to Ala-Mutka (2011), using technology may not always result in the advancement of advanced digital competence, which might affect business performance. However, there can be differences in digital access and skill levels among various employee groups, which would limit their ability to contribute to tax-related issues (Gitaru, 2017). As a result, deliberate social support by an organisation in terms of training its staff is crucial in enhancing their digital competencies to be able to perform their role. This aligns with the modernisation theory quest for addressing broader socio-economic challenges in digital tax adoption and use (Barker & Jane, 2016). In the petroleum industry, digital skills are essential for optimising excise duty payments because employees are able to navigate through complex tax reporting systems efficiently, reducing errors and enhancing compliance. Thus, we hypothesise that:

H5: Digital skills positively and significantly related to the performance of petroleum excise duty.

4.6. Control variables

Failure to take into consideration confounding variables may result in the hypothesis being incorrectly rejected when it should be accepted (Bartov et al., 2000; Kabuye et al., 2017). The study considers the taxpayer's gender, age, and educational status at the firm level as a consequence. Studies have shown a link between taxpayer gender and tax payment (Prasetyo et al., 2020). However, contradictory findings have been reported by other studies (D'attoma et al., 2020), which claim that women are more likely to pay taxes and use technology. Additionally, according to some studies (Hofmann et al., 2017), tax payment and technology use are positively correlated with age, while others (Fauziati & Kassim, 2018) find no correlation. To generalise research findings to larger populations and evaluate the representativeness of the sample, it was also vital for us to understand the sample composition by looking at control variables.

5. Research design and methodology

5.1. Population and sample

The study targeted a population of 60 petroleum importing firms registered by the Uganda Revenue Authority (URA) as of June 2022. The sample of 52 petroleum importing firms was determined according to Krejcie and Morgan (1970). This sample was chosen because they are directly involved in the importation of petroleum products that are subject to petroleum excise duty, and this constituted the unit of analysis. The unit of inquiry consisted of at least three managers per firm (operations, finance, accountant, and tax compliance manager) because of their knowledge of the petroleum product business. The questionnaires were distributed to 52 importing companies, and 50 usable questionnaires were returned, giving a response rate of 96%. The firms that are 100 per cent government or state-owned, which import for government entities, are exempted from excise duty and, therefore, were excluded from the survey because they do not contribute to petroleum excise duty payments as per the Excise Act (2014). The frequencies of the respondent characteristics are as follows: the majority of the respondents (58%) were males serving in petroleum importing firms because of the complex nature of the business that operates 24 hours, making it suitable for men compared to females who have a lot of domestic activities. Regarding the age of respondents, the majority of them were in the age range of 31–40 (48.7%) to be able to attach meaning to the questionnaire. Relating to the education level of respondents, the majority of them (57.3%) had a bachelor's degree to be able to respond to the questionnaire competently. For the positions held, the majority of the respondents (38.0%) were serving in the position of operations manager. Furthermore, relating to the experience of the respondents, the majority of them (50.7%) had served for 6–10 years, implying that they knew about PED payment, period, and the frequency of petroleum fuel import frequency.

5.2. Model specification

5.2.1. Empirical method, data, variables description, and measurements

The three components of filing, reporting, and payment of petroleum excise duty serve as indicators of the performance of PED: Regarding the filing, reporting, and payment of petroleum excise duty (a tax procedure), petroleum importing firms were surveyed on a scale of 1 = strongly disagree to 4 = strongly agree. For petroleum excise duty payment by the petroleum importers, the average score across the four items was used. The classification of the level of petroleum excise tax payments into poor, average, above average, and excellent was based on these scores. The ordered probit regression estimation was then used to estimate the dependent variables based on this scaled ranking information (Engida & Baisa, 2014; Chen & Tsai, 2012; McKelvey & Zavoina, 1975). This ordered regression was chosen because it can handle categories like poor, average, above average, and excellent excise tax payments. It accounts for the fact that the average is closer to poor than it is to excellent, which is significant in the examination of performance categories (Long & Freese, 2006; Wooldridge, 2010). This enables us to evaluate how the adoption of digital taxes impacts the likelihood of better or worse petroleum excise duty performance. Furthermore, Ordered Probit can ascertain threshold effects or the point at which the likelihood of shifting from one category to another increases intensely in response to changes in the predictor variable, such as the adoption of digital taxes. To determine how the independent variables were related to the categorical dependent variable on an ordinal scale, the maximum likelihood functions and asymptotic standard estimates (SEs) were used. The latent regression of this model can be specified as follows: $y_i^* = \beta_0 + X_{1i}\beta_1 + X_{2i}\beta_2 \dots X_{ki}\beta_k + \varepsilon_i$

$$Y_i^* = \beta'X_i + \varepsilon_i \quad (1)$$

Where y^* represents the dependent variable, levels of excise tax payment (poor, average, above average, and excellent excise tax payment); β represents the vector of estimated parameters, and X_i is the vector of explanatory variables; ε_i is the error term, which is assumed to be normally

distributed (zero mean and unit variance). The observed ordinal variable Y_i has values from 0 to m per the following formula.

$$y = j \leftrightarrow \mu_{j-1} < y_i^* \leq \mu_j, \text{ where } j = 0 \dots m$$

The aim of this study, like the models for binary data, is to determine how changes in the explanatory factors affect the likelihood of observing a specific level of petroleum excise tax payment. As a result, the probability of observing each tax payment level such as (poor- y_1 , average- y_2 , above average- y_3 , and excellent excise tax payment- y_4) can be determined by:

$$\begin{aligned} y_i &= 1 \text{ if } y_i^* \leq u_1 \\ y_i &= 1 \text{ if } u_1 < y_i^* \leq u_2 \\ y_i &= 3 \text{ if } u_2 < y_i^* \leq u_3 \\ y &= 4 \text{ if } y_i^* > u_3 \end{aligned}$$

Taking this into account, we estimated the probability function of Y_i in the following form.

$$\begin{aligned} \text{Prob}(Y_i = 0) &= \Phi(X_i) \\ \text{Prob}(Y_i = 1) &= \Phi(z_1 X_i) - \Phi(X_i) \\ \text{Prob}(Y_i = 2) &= \Phi(z_2 X_i) - \Phi(z_1 X_i) \\ \text{Prob}(Y_i = 3) &= \Phi(z_3 X_i) - \Phi(z_2 X_i) \end{aligned} \quad (2)$$

Where Φ represents the standard normal density, and in this analysis, the performance of PED ranges from 0 to 1 and is taken as a dependent variable and classified into four levels. Based on the theoretical arguments described in the previous sections and the specifications and consistent with Lubian and Zarri (2011), we postulate the following model:

$$PPED = \beta_0 + \beta_1 PU_i + \beta_2 PEU_i + \beta_3 IF_i + \beta_4 DS_i + \varepsilon \quad (3)$$

Where PPED is the performance of petroleum duty, PU is the perceived usefulness, PEU is the perceived ease of use, IF is the information infrastructure, and DS is digital skills.

We also tested whether the control variables, such as the gender of the operations manager, age, and educational level, provide a better explanation of PPED. We model this by including the control variable in our model

$$PPED = \beta_0 + \beta_1 PU_i + \beta_2 PEU_i + \beta_3 IF_i + \beta_4 DS_i + \delta + \varepsilon_i \quad (4)$$

Where δ is the control variable

5.2.2. Variables measurement and description

The study used two variables: dependent, independent, and control variables. The dependent variable was the PPED proxied by filing, reporting, and payment rate by PIFs. This was previously used by several studies when measuring excise duty non-compliance behaviour by taxpayers (Sinnasamy & Bidin, 2017; Sinnasamy et al., 2015). Digital tax adoption is considered an independent variable, and the control variable included the gender, age, and educational level of respondents. The variable description is presented in Table I.

5.2.3. Reliability, validity, and parametric tests

To assess the validity and reliability of the scales as measures of PPED and DTA, we employ Cronbach's α exploratory factor analysis (EFA) based on main components (Tables II and III). EFA was used to find the patterns and condense the data to a size that could be handled. Principal component analysis utilising the varimax rotation method was used to extract the principal components for each variable to demonstrate convergent validity. Factor loadings below 0.5 coefficients were suppressed to prevent factor loadings with weak loadings from being extracted. We evaluated the eligibility of the data for

Table I. Operationalisation and measurement of variables

Global variable	Dimensions	Definitions	Measurements	Sampled question items
Dependent variable				
Performance of petroleum excise-duty	Filing-tax payment	The company's ability to file and pay petroleum duty	Respondents' probability rank of 12 items of information included in the questionnaire on a four-point Likert scale, ordinal	We always submit returns to URA and in addition, submit hard copies
	Tax efficiency	Strategic management of a company's tax affairs to minimize its tax liabilities while staying in compliance with all With applicable law	Respondents' probability rank of 8 items of information included in the questionnaire on a four-point Likert scale, ordinal.	We have a full-time dedicated staff to handle excise tax matters with URA.
	Tax effectiveness	The ability of companies in the petroleum industry to manage their tax-related activities efficiently and effectively.	Respondents' probability rank of 5 items of information included in the questionnaire on a four-point Likert scale, ordinal.	Upon filing returns, we register payment and proceed to pay
Independent variable				
Digital tax adoption	Perceived useful	The ability to adopt the online platform that enables the taxpayer to access tax services (Al-Gahtani et al. (2007); Venkatesh and Davis (2000)	Respondents' probability rank of 9 items of information included in the questionnaire on a four-point Likert scale, ordinal	We find it better to use an electronic-tax payment system than the manual system of tax payment.
	Perceived ease of use	The ability to adopt and use the online platform that enables the taxpayer to access tax services through the internet (Abdullah et al. (2016); Davis (1989).	Respondents' probability rank of 5 items of information included in the questionnaire on a four-point Likert scale, ordinal.	We find it easy to submit our tax returns using electronic filing.
	Information infrastructure	The accessibility of computers, internet broadband for online tax filing and payments Laudon and Laudon (2015).	Respondents' probability rank of 6 items of information included in the questionnaire on a four-point Likert scale, ordinal.	Our business computers are connected to the internet for purposes of handling tax issues.
	Digital skills	The ability to navigate the online tax filing and payments (Chui et al. (2016).	Respondents' probability rank of 7 items of information included in the questionnaire on a four-point Likert scale, ordinal.	We are able to teach the staff of our sister company, how to use electronic filing system.

Source: Primary data

Petroleum excise duty performance is largely explained by the adoption of digital tax systems given its complex nature, and factors including perceived usefulness, perceived simplicity of use, information infrastructure, and digital skills are significant in this regard. These systems enable automated data collecting, processing, and reporting, which lowers errors and fraud (see Table 1).

factor analysis on sample size adequacy using Kaiser-Meyer-Olkin (KMO) and Bartlett's test before carrying out the main factor analysis for scale. The findings demonstrate that the KMO values were all above 0.5 and considered acceptable (Field, 2009) and appropriate for factor analysis with Bartlett's test of Sphericity on all scales obtained at ($p < 0.05$) and (significant at 0.00). These findings all validated the correlation matrix's factorability. There was no risk of multicollinearity, as indicated by the fact that all the correlation results were below the threshold of 0.8. The Cronbach's α coefficient

Table II. Factor structure for digital tax adoption

Items	Components
Perceived usefulness	
Electronic filing is beneficial because it allows us to access tax services	.782
We find it better to use an electronic tax payment system than the manual system of tax payment	.837
The electronic tax payment system has made our life easy in terms of tax compliance matters and follow-ups	.850
The electronic tax payment system is safe, secure, and comfortable to use	.826
Using an electronic tax payment system is convenient for taxpayers	.782
Using electronic filing enhances effectiveness in preparing tax returns, resulting in fewer errors	.789
Using electronic filing improves the speed at which tax returns are processed	.866
All information relating to tax on imported fuels is relayed on the electronic tax payment system	.705
Customs officers use the electronic tax system to monitor petrol transportation tracks	.650
Perceived ease of use	
We find it easy to submit our tax returns using electronic filing	.738
We find it easy to become trained in using the electronic filing system	.862
Using an electronic tax payment system helped us avoid tax penalties	.840
We register for the excise duty identification number through the electronic tax system	.867
We use electronic tax systems for other tax issues, such as objections, appeals, and so on.	.782
Information infrastructure	
The system is user-friendly and enables us to teach others how to use it	.564
Resources required to use electronic filing are readily available to me	.727
Our business computers are connected to the internet for purposes of handling tax issues	.800
Electricity or power supply for electronic tax payment system is available	.785
The internet used for electronic filing is cheap for us	.782
The internet is stable when we are using electronic filing	.871
Digital skills	
We feel comfortable using the electronic tax system as compared to the old manual system	.725
We can teach others how to use the electronic filing system	.771
Assistance and information are provided to our staff by the tax authority	.800
It's comfortable using the electronic filing system on my own	.721

(Continued)

Table II. (Continued)

Items	Components
I will be able to use electronic filing without any technical support or learning tutorials	.851
It is easy for us to get technical support when using the electronic filing system	.550
Learning how to use the electronic filing system is easy for us	.924
Eigen Values 6.475 4.940 3.305 3.046 Percentage of Variance 23.983 18.295 12.241 11.280 Cumulative Percentage 23.983 42.278 54.518 65.798	
KMO = 0.791; approximate chi-square = 3253.379; Bartlett's test of Sphericity: df = 351; Significance = 0.000	

also indicates that the measures are very reliable. The findings indicate that perceived utility, perceived usability, information infrastructure, digital skill, filing payment rate, reporting, and payment had dependability of 0.7366, 0.7364, 0.7067, 0.6951, and 0.6631, respectively. It suggests that these questions test the same fundamental construct or idea consistently.

Before carrying out the test of hypotheses, we checked the data for normality for purposes of inferential statistics. Inferential statistics starts with the fundamental premise that things are normal. It is difficult to extrapolate meaningful conclusions if the data is not normally distributed since this alters the precision of confidence intervals, p-values, and hypothesis tests (Field, 2013). Moreover, a lot of statistical techniques and tests, like t-tests, ANOVA, and regression analysis, include the assumption that the data has a normal distribution. Deviations from the norm produce skewed results and false conclusions. As a result, maintaining normalcy is essential for the reliability of statistical analyses (Tabachnick et al., 2013). This was done by skewness and kurtosis statistics. The skewness scores for all variables were close to 0, and the kurtosis results were all within the range of +2 to -5 (Table IV), in line with Hair et al. (2010). Therefore, normality was tenable. Also, we tested for heteroskedasticity using the Breusch-Pagan test (Breusch & Pagan, 1980) to ensure the validity, dependability, and precision of the data. Ordered regression models presuppose that the variance of the error terms is constant across the whole range of the ordinal dependent variable's values. Contravention of this assumption results in heteroskedasticity, which causes changes in the error variability between the various categories of the ordinal outcome (Wooldridge, 2010). To evaluate heteroskedasticity, we compare the obtained p-value to the 0.05 significance level with a null of constant variance (Breusch & Pagan, 1980). The null hypothesis is rejected, and heteroskedasticity is accepted if the p-value is less than or equal to the significance threshold. We fail to reject the null hypothesis if the p-value is higher than the significance threshold. The test's results indicate that the $\chi^2(1) = 2.90$, with a p-value of 0.0887 larger than the significance level of 0.05, does not indicate heteroskedasticity. As a result, the null hypothesis could not be rejected.

6. Empirical results and discussions

6.1. Descriptive statistics

Table IV shows that the mean results are close to the Likert scale value of three. This shows that the respondents agreed with the asked questions. Given that the standard deviations relative to the mean values are small, it indicates that the results are a reflection of reality (Field, 2009).

Table III. Factor structure for performance of petroleum excise duty

Items	Components
Filing payment rate	
It is non-mandatory to have the tax identification number (TIN) from the Uganda Revenue Authority	.825
We state all taxes when declaring returns	.568
We always submit returns to URA and, in addition, submit hard copies	.665
We file returns on the due date	.615
We make additional excise tax return amendments sometime	.830
Doing business between one oil company and another without reporting it in a tax return is permissible	.740
With the rising costs of production currently, it is okay for oil companies to cut a few corners on their tax return just to pay less excise tax liability	.908
It is not so wrong to underreport certain income, as it does not hurt the government	.936
The chances of getting caught are so low that it is worthwhile for oil companies to try to manipulate taxes	.867
Under-reporting the excise duty declaration is ethical for us.	.883
Petroleum fuel is released to us from the port irrespective of full excise duty payment	.527
Customs tax officials may monitor the petroleum fuels from the time of importation till duty is paid	.744
Tax efficiency	
We have a full-time dedicated staff to handle excise tax matters with Uganda Revenue Authority	.819
Our company has a tax agent who interfaces with customs officers on matters of excise declaration	.728
Our computers are routinely maintained for purposes of excise tax payment	.534
We receive a notice of tax assessment from URA through our mobile phone	.546
We get tax training materials from the internet (YOUTUBE), which improves our staff skills	.722
We object and appeal excise tax assessment from URA through the URA Website	.769
Our company uses BLOG (recorded video message on a page) to give feedback to URA on excise taxes	.897
Our company uses Podcasts (recorded audio messages) for conforming excise duty payment	.858
Tax effectiveness	
Upon filing returns, we register payment and proceed to pay	.809
We pay our excise taxes on time	.857
We pay our excise taxes on the due date upon filing returns	.753
We pay actual excise tax assessed to URA	.737
We pay our URA dues first before any other bills	.722
Eigen Values 4.936 4.603 3.249	
Percentage of Variance 24.783 16.438 11.604	
Cumulative Percentage 24.783 41.221 52.825	
KMO = 0.705; approximate chi-square = 2367.248; Bartlett's test of Sphericity: df = 378; Significance = 0.000	

6.2. Correlations

The Spearman correlations are presented in Table V. Results show that DTA (the independent variable) is positively and significantly related to PPED (the dependent variable). This means the adoption of digital technologies in the collection of PEDs is synonymous with its performance. The element of DTA, aside from perceived ease of use, is strongly associated with the PPED. DS had the highest correlation, followed by PU and IF, indicating that these were the most important factors in explaining the adoption of digital taxes and PPED.

Table IV. Descriptive statistics

Variables	N	Mean	Std. Deviation	Skewness		Kurtosis	
				statistic	Std. Error	statistic	Std. Error
Digital tax adoption	50	3.0404	.23792	.637	.198	5.901	.394
Performance of excise-duty	50	2.7659	.19042	.280	.198	2.770	.394

Source: primary data

Table V. Spearman correlation matrix for dependent, independent variables, and control variables

	1	2	3	4	5	6	7	8
(1) PPED	1							
(2) PU	0.314***	1						
(3) PEU	0.0131	0.0727	1					
(4) IF	0.310***	0.292***	0.0630	1				
(5) DS	0.362***	0.395***	-0.0859	0.427***	1			
(6) GENDER	-0.0479	-0.0643	0.0288	0.0787	-0.0323	1		
(7) AGE	0.0251	-0.0836	-0.0823	0.0549	0.0336	-0.0373	1	
(8) EDUC	0.103	0.0157	-0.0738	-0.107	-0.0181	0.0143	0.162*	1

*** $p < 0.001$, ** $p < 0.05$, * $p < 0.01$ (representing level of significance at 1%, 5%, and 10% respectively)

Concerning control variables, results indicate that gender was not substantially linked with petroleum excise duty performance when viewed in the context of the significance of the control variables. Rejecting the idea that the male taxpayers were much less compliant in the link between gender (male = 2) and PED performance, which was negative and not significant. The hypothesis that older taxpayers are much more compliant is not accepted because the relationship between age and PED performance was negative and not significant. Further, these results suggest that the control variables do not explain PPED.

6.3. Ordered regression results

According to Table VI's ordered probit regression analysis, implementing a digital tax system is essential for improving PPED. The results revealed that digital tax adoption is positive and statistically significant ($\beta = 1.443$ $p < 0.000$). This indicates that higher adoption of digital technologies in the context of petroleum importing firms is associated with a higher probability of being in a higher category of PED payment compliance. This means that the use of digital technologies for petroleum excise duty collection by the tax authority not only improves the revenue collection but also increases the efficiency and effectiveness of tax payment at the firm level and lowers compliance costs.

Additionally, for digital tax adoption to be effective, taxpayers should perceive it as useful, easy to use, easy to learn, and information infrastructure widely used. This study further decomposed digital tax adoption attributes in terms of perceived usefulness, perceived ease of use, information infrastructure, and digital skills in understanding their contribution. First, the results show that perceived usefulness, information infrastructure, and digital skills are positive and statistically significant with perceived usefulness ($\beta = 0.496$ $p < 0.044$), information infrastructure ($\beta = 0.472$ $p < 0.049$), and digital skill ($\beta = 0.58$ $p < 0.035$). This indicates that perceived usefulness, digital skills, and widespread use of information infrastructure correlate with a higher probability of PED performance.

Table VI. Performance of petroleum excise duty - ordered probit regression results

PPED	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
DTA	1.443	0.367	3.93	0	0.723	2.163	***
cut1	1.674	1.132			-0.544	3.892	
cut2	2.014	1.116			-0.174	4.202	
cut3	2.198	1.111			0.02	4.376	
PU	0.496	0.247	2.01	.044	0.013	0.98	**
PEU	0.092	0.265	0.35	.728	-0.428	0.613	
IF	0.472	0.24	1.97	.049	0.002	0.942	**
DS	0.58	0.274	2.11	.035	0.042	1.118	**
cut1	2.137	1.235			-0.283	4.557	
cut2	2.509	1.212			0.134	4.884	
cut3	2.695	1.205			0.333	5.058	
Log-likelihood	-596.69						
LR chi2(4)	25.77						
Number of obs	150						

*** $p < 0.001$, ** $p < 0.05$, * $p < 0.01$ (representing level of significance at 1%, 5%, and 10% respectively). The upper section of the table shows PPED and DTA, and the lower part is the decomposed elements of DTA. cut 1–3 are the threshold in ordered regression

6.4. Discussions of the results

This study's motivation was to examine whether digital tax adoption in the management of PICs can increase PPED. The results show that this is true. The respondents agreed that there is a need to enhance the real-time generation of information about fuel in transit to explicitly determine the right tax and counter any tax evasion. Also, tax collectors have to design and implement new technologies like digital sensors that can be immersed in the transit fuel to ensure continued monitoring and ascertainment of the actual quantity of fuel. This finding is furthering extant debates on increasing PPED. For example, Uyar et al. (2021) found that the digitalisation of government services mitigates tax evasion. In addition, these findings support the study by Habibullah et al. (2022) in Japan, who found that the use of a software architecture platform accurately collects fuel taxes with no losses. In contrast, others have shown contrary results (Etim et al., 2020). Overall, the positive and significant correlation between the adoption of digital taxes and the performance of petroleum excise duty at the firm level suggests that individual petroleum companies' and firms' ability to manage and comply with petroleum excise duties is significantly impacted when they adopt digital tax-related technologies and practices. The accurate calculation, reporting, and payment of petroleum excise duties are therefore anticipated to be made easier for businesses that use digital tax solutions (Abdul Wahab et al., 2021). By improving compliance, they may be able to avoid fines and other consequences of non-compliance.

Additionally, automated reporting systems are frequently used in digital tax adoption, which makes it easier for businesses to file needed excise duty reports on time (Alm, 2021). As a result, the administrative burden is lighter, and the possibility of reporting errors is reduced. The government must lower the cost of internet bundles in order to promote the use of digital taxes and PED tax collection, which will boost the rate at which PICs embrace technology.

Similarly, the perceived usefulness of technology was also found to positively and significantly influence PPED. This result is substantiated by the fact that Uganda's revenue authorities, like other revenue authorities across the world, are moving towards the use of digital technologies in tax collection activities. Indeed, electronic filing improves the speed at which tax returns are

processed; it enhances taxpayers' effectiveness and reduces errors. Previous studies by Sijabat (2020) in Indonesia and Chen and Aklirikou (2020) in China have presented similar positions. Overall, since the level of technology adoption is on the increase in Uganda, there is a need for taxpayers and collectors to know its usage even in paying complex taxes like excise duty.

With regards to the perceived ease of use of digital tax, the results of this study were concurrent with studies by Sijabat (2020) and Tahar et al. (2020), all in Indonesia, who found that taxpayers' negative perception of ease of use of electronic filing lowers the adoption and use of online tax system. For example, individuals and corporations are less likely to adopt and use online tax systems if they believe it requires a lot of effort to execute them. This assertion is supported by the findings of this study, which showed that the adoption of digital taxes and perceived ease of use was not significant. This demonstrates the need for URA, particularly to make the online tax system effortless in executing transactions.

The findings of this study are consistent with the TAM's (Technology Acceptance Model) guiding principles (Davis, 1989). Perceived utility and perceived usability, according to TAM, are important elements affecting users' acceptance and adoption of technology (Venkatesh & Davis, 2000). According to the results of our study, perceived usefulness is a strong predictor of petroleum excise duty performance, which is consistent with the TAM's emphasis on the positive effects of technology when taxpayers see its advantages. However, the lack of a substantial correlation between performance and perceived ease of use shows that, in this case, perceived ease of use may not be the primary factor influencing performance, which calls into question one of TAM's basic tenets.

With regards to the probability of broader use of information infrastructure, this finding endorses that the widespread utilisation of ICT infrastructure, access to internet services, and the availability of electricity are essential in PED performance. Certainly, the broader usage of ICT infrastructure and access to internet services not only facilitates the adoption and use of online tax systems but also mitigates PED tax evasion through monitoring PICs, which enhances revenue mobilisation. Prior studies, such as Munga et al. (2023) in Kenya, Bellon et al. (2022) in Peru, and Uyar et al. (2021) in France, present similar findings. Thus, leveraging ICT usage in tax payments helps countries reduce tax evasion and improve revenue collection.

Finally, concerning the probability of taxpayers' possession of the abilities (skills) needed for digital tax usage, the result of this study was in agreement with the study by Gitaru (2017) in Kenya and Wassermann and Bornman (2020), who claim that educational initiatives sponsored by the tax authority or other public institutions improve taxpayer's comprehension of the self-assessment system, which improves their capacity to fulfil their obligations. The ability of taxpayers to possess digital tax knowledge and skills, either as the general, procedural, or legal tax system, enables them to fully comply. This claim is supported by this study's findings, which revealed a substantial relationship between digital abilities and petroleum excise duty performance. Therefore, when taxpayers have inadequate technical digital abilities and perceive the tax system as complex, it may prevent them from fulfilling their tax obligations.

Our findings are also related to modernisation theory, which examines the process of society development and transformation (Barker & Jane, 2016). The adoption of digital tax practices is a step towards modernisation in the context of tax administration, as evidenced by the positive and significant relationships between dimensions of digital tax adoption (perceived usefulness, information infrastructure, and digital skills) and petroleum excise duty performance. This is consistent with the notion that technology developments are frequently essential to the modernisation and development of the economy. The significance and positive correlation between information infrastructure and performance underline the value of having a solid technology base. According to modernisation theory, a crucial factor in economic growth is the availability of technology infrastructure (Barker & Jane, 2016). In the context of this study, a strong information infrastructure helps digital taxes be adopted and implemented successfully, which boosts the efficiency of firms in tax management.

This study also contributes to the scant body of research on the relationship between performance and acceptance of digital taxes in the context of the petroleum industry. The petroleum sector is distinguished by intricate supply chains, significant tax obligations, and enormous potential earnings (Crivelli et al., 2016; World Bank Group, 2016). The correlation between digital tax adoption and performance that is positive shows that utilising technology in tax compliance procedures can result in significant economic benefits. Numerous economic ramifications stem from the good correlation between the adoption of digital taxes and petroleum excise duty performance (Cnossen, 2020). First, increasing government revenue through enhanced tax payment efficiency has the potential to lower budget deficits and support public spending (Mahdavi et al., 2022). Second, a rise in petroleum excise duty revenue can make government finances more stable, obviating the need for other revenue sources or austerity measures. Finally, it can improve the investment climate in the petroleum sector, luring potential investors and fostering economic growth.

Governments and tax authorities should take note of these findings since they have significant policy consequences (Mahdavi et al., 2022). Given that digital tax systems can result in more effective revenue collection, policymakers should think about providing incentives for businesses in the petroleum sector to adopt them. Governments may further need to spend money on the infrastructure and training required to efficiently facilitate the switch to digital tax systems. In addition, tax authorities can improve tax laws and policies with the use of the data produced by these systems, enhancing their ability to collect money from the oil industry.

7. Summary and conclusion

In conclusion, our study investigated the crucial relationship between the adoption of digital taxes and the effectiveness of petroleum excise duty among Ugandan enterprises that import petroleum. Our theories have been effectively tested through meticulous data collecting and the use of probit regression analysis. Our results offer convincing evidence that the adoption of digital taxes does play a substantial and critical role in predicting the overall performance of petroleum excise duty in this context. In addition, we have examined the particular aspects of digital tax adoption, such as perceived utility, information infrastructure, digital skills, and perceived usability. Perceived usefulness, information infrastructure, and digital abilities were all discovered to be positive and significant predictors of petroleum excise duty performance, but perceived ease of use did not provide a favourable and significant association with performance. This shows that the perceived ease of adopting digital tax tools may not directly influence performance outcomes within the Ugandan petroleum import sector. These research findings contribute to the existing body of knowledge in several ways:

The findings highlight how crucial it is to prioritise and promote digital tax adoption techniques among petroleum importing companies to improve tax compliance. These findings can be taken into account by policymakers and tax authorities when creating policies and initiatives aimed at enhancing tax administration. Our analysis offers insightful information about the particular aspects of digital tax adoption that have the greatest impact on performance. This can guide focused initiatives and training programs to improve the information infrastructure, digital skills, and perceived usefulness among industry players.

The empirical verification of the link between the adoption of digital taxes and petroleum excise duty performance adds to the growing body of research on how digitalisation affects the results of taxation. This is especially true now when economic activity is being transformed by digital technology.

Further, our results have significant economic implications. Increased revenue for governments, which can be used to fund vital public services and infrastructure development, can result from improved performance in the payments of petroleum excise duties. Also, improved tax compliance can result in greater financial performance and fewer legal risks for companies that import petroleum. Our study adds to the expanding body of knowledge in the academic community about the relationship between technology and taxes. It underlines the significance of taking

into account more than just perceived ease of use when evaluating the impact of digital tax adoption on performance. For upcoming studies in this area, this has methodological implications.

The necessity for tax authorities to encourage digital tax adoption initiatives and give them top priority is one of the policy consequences. To increase perceived usefulness, strengthen information infrastructure, and foster digital capabilities within the petroleum importing industry, policymakers may want to pursue specific initiatives. Our findings also highlight the value of tax laws tailored to certain industries to handle the particular opportunities and problems faced by the petroleum industry.

Further, examining the causes of the lack of a beneficial and substantial association between perceived ease of use and petroleum excise duty performance is one possible direction for future research. Examining the particular obstacles or difficulties that can make it appear more difficult to use digital tax adoption tools could provide insightful information for improvement.

Therefore, in summary, our research confirms the claim that the use of digital taxes greatly affects Uganda's petroleum import sector's performance of petroleum excise duty. We provide useful information for industry stakeholders and policymakers by analysing the aspects of the implementation of digital taxes. The lack of a substantial correlation with perceived usability also draws attention to a subject that is ripe for further study and potential interventions to speed up the adoption of digital taxes.

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