



Leveraging blockchain technology innovations for tax compliance: A Nigerian perspective

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ABSTRAT

Blockchain technology (BCT) has enhanced tax administration worldwide, but inability to integrate it into the Nigerian tax system led to ineffective compliance system in Nigeria. Thus, tax noncompliance is pervasive in Nigeria. Therefore, it is vital to assess the effect of BCT innovations on tax compliance in Nigeria using the technological-organizational-environmental (TOE) model. Primary data were obtained from 748 respondents across Nigeria's six geopolitical zones, including tax officers, tax specialists, and blockchain experts. Partial Least Squares Structural Equation Modelling (PLS-SEM) was used with SmartPLS 4.0.9.2 to evaluate the study's models. The study found a significant relationship between BCT and tax compliance ($\beta = 0.637$; $t = 21.109$; $p < 0.001$). The study concluded adoption of BCT innovations increases the likelihood of taxpayer compliance, technological and organizational factors are what will really drive the use of BCT innovations for tax compliance. Thus, tax authorities should implement BCT innovations for tax compliance.

Keywords: Blockchain, Cryptographic, Electronic, Innovations, Taxpayers, Tax Compliance, Technological





1. INTRODUCTION

Revenues constitute the lubricants of the expenditure wheel of government across the globe as they are used by the government to develop and maintain infrastructure, and provide public goods and services to citizens. The revenues are generated through various means including taxation, which is considered a major source. Taxation is a necessary tool for developing countries to mobilize resources needed to create an environment conducive to economic growth (Organisation for Economic Co-operation and Development [OECD], 2014). Tax revenue represents a vital means of state financing (Fatz, Hake & Fettke, 2019) and the current digital era has further strengthened the importance of tax revenue in ensuring the citizens' well-being (Yayman, 2020). However, Nigerian tax revenue position reveals that the country has a low level of tax compliance (Adeyemi & Adeduro, 2020) as it accounted for 8% of Gross Domestic Product (GDP) in 2021 (Nnodim, 2022). This is the lowest among the 30 African countries, whose tax revenue data were compiled by the OECD and one of the lowest in the world (Mariam, 2021; Nnodim, 2022; OECD/ATAF/AUC, 2022) compared with the bulk of revenue generated by the Federal Government during the period.

The low tax-to-GDP ratio, an indication of tax performance, can be attributable to the lack of an efficient tax compliance system (Kristiaji, 2016). This inefficiency may have hindered compliance, which reduces tax revenue's contribution to Nigeria's GDP. Due to inefficiencies and a lack of transparency, certain taxable transactions may go overlooked, and identifying faux transactions becomes harder. Taxpayers and tax officials take advantage of holes in the tax system to manipulate tax data and reduce taxes, leading to an inability to achieve revenue targets. Without compliance-oriented tax collecting systems, tax authorities struggle to get high-quality data (Nemitari, 2017). Moreover, Piotr (2018) argued that tax avoidance and evasion cast doubt on every tax system. Thus, if the Nigerian government wants to generate enough tax revenue, it must re-examine its tax administration and collection mechanisms because successful tax administration should result in higher tax compliance and lower tax evasion. However, Fatz et al. (2019) noted that tax compliance is difficult and must be integrated into corporate operations to enable compliance by design and efficient processes. Transparent, safe, and real-time information is crucial to a tax collecting system's efficiency, according to Demirhan (2019). In addition, Pearse (2018) opines that tax authorities may consider new legislation, tactics, and technologies to collect taxes as the digital world and sharing economy increase.





Given the foregoing, one may wonder if the current tax structure, initially designed for tangible commodity transaction, is still appropriate in the age of digital commerce. Absolutely not. Keeping up with tax regulations in the age of increasing digitalization of corporate activity requires a fresh strategy. Tax compliance requires a fresh approach. Thus, tax authorities, citizens, and businesses must advocate for a system that upholds transparency, justice, immutability, and equity. Satoshi (2008) proposes a cryptographic proof-based electronic system that allows any two interested parties to interact directly without a trusted third party. Blockchain technology (BCT) has the potential to enable such a system. BCT provides a visible and immutable ledger of financial transactions for firms that do not trust each other (Hoffman, 2018). Underwood (2016) states that BCT platforms keep permanent and unchangeable records of transactions between multiple parties and allow them to use smart contracts, which are self-executing agreements that don't need third-party verification.

Many countries, including Germany, France, Switzerland, the UK, Sweden, and Brazil, are using BCT to improve tax compliance, particularly to aid voluntary compliance, enforce compliance, reduce tax avoidance, and prevent tax evasion since BCT could allow real-time taxation, where deductions are automatically made on the spot. This would speed up the tax refund process and gather information to prevent tax evasion, making the system faster, fairer, safer, and simpler while reducing non-compliance (Nemitari, 2017; Piotr, 2018). Thus, all tax administration stakeholders must evaluate the BCT, which may be a disruptive innovation that streamlines tax administration and lowers compliance and collection costs (Tiloby 2018). Hence, Nigerian government could employ BCT to build a transparent and shared database to the tax system, which may propel confidence in the tax system.

BCT has been adopted in several nations and domestic sectors, including banking and fintech, but the literature suggests that BCT innovations and the technological, organizational, and environmental (TOE) factors that are critical to its implementation in Nigeria's taxation sector have not received enough attention. Thus, BCT innovations to improve tax compliance, especially to aid voluntary compliance, enforce compliance, reduce tax avoidance, and prevent tax evasion, should be empirically investigated in Nigeria. To address this gap, the study examined the factors of BCT innovations using TOE factors in their association with tax compliance dimensions in Nigeria since tax compliance affects a country's tax revenue performance, which in turn determines government resources to meet citizens' needs. The purpose of this study is to examine, through the lens of the TOE framework, the adoption of BCT innovations for tax compliance in Nigeria. Specifically, the study examined the relationship between BCT innovation adoption





and tax compliance in Nigeria and the TOE factors that may influence it. This paper analysed the relationship between tax compliance and the uptake of BCT innovations in Nigeria, focusing on the role of the TOE framework. It is expected to be useful for fiscal policymakers and other stakeholders to make informed decisions and serve as guidelines for the implementation of a BCT-based automatic tax compliance system.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Nigerian Tax Administration Issues

Nigeria's three tiers of government—federal, state, and local—collect tax income according to the Taxes and Levies (authorized list for collection) Decree, 1998. Section 8(a) of the Federal Inland Revenue Service Establishment Act 2007 created integrated tax offices with the power to assess, collect, and record tax. However, tax processes are still bureaucratic and labour-intensive, costing a lot of money and time, and there are several contentious issues that need urgent attention, such as the lack of a database, the issue of multiple taxes administered by different levels of government, and the appropriate tax authority to administer taxes (Unegbu & Ireferin, 2011). According to Edori, Edori, and Idatoru (2017), Nigerian tax rules are complex and difficult to understand, even for learned officials. As a result, the system's inherent inefficiencies and ineffectiveness will have an impact on the degree to which taxpayers comply with it. Thus, Asaolu, Olabisi, Akinbode and Alebiosu (2018) stated that successive Nigerian governments have expressed concern over the tax system's low productivity, which is largely due to tax administration deficiencies, especially the compliance system.

Tax Compliance (TCP)

TCP has been conceptualized as voluntary compliance, enforced compliance, tax avoidance, and tax evasion (Kirchler, 2007; Slemrod, 2007). The OECD (2016) created registration, filing, and reporting, and payment compliance measures. Tax compliance enhancement has been a complex and ongoing issue because some taxpayers exploit tax law loopholes to avoid tax duties, posing a major challenge to tax authorities and impeding government revenue drives (Alm, 2019; Kirchler, Kogler & Muehlbacher, 2014). Tax compliance is crucial to generating tax income for economic development and non-compliance can slow progress (Shakkour, Almohtaseba, Matahenb & Sahkkour, 2021). This study defined TCP as the willingness of individuals and other entities to comply with tax law and administration.





Blockchain Technology (BCT)

BCT is a distributed ledger that organizes data into blocks, integrates transaction data in a network, and is chronologically linked by a cryptographic hash function (Setyowati, Utami, Saragih, & Hendrawan, 2020; Wijaya, Liu, Suwarsono & Zhang, 2017). Blockchain is a consensus-based secure decentralized public or private database that stores encrypted and time-stamped transaction records immutably over a peer-to-peer network, forming a chain without risk (Abeyratne & Monfared, 2016; Mougayar & Buterin, 2016; Satoshi, 2008). It is an immutable repository of information shared among network nodes in a transparent, safe, and autonomous manner without agent control (Bitjoka & Edoa, 2020; Zhao, Fan & Yan, 2016). Boschi, Borin, Raimundo, and Batocchio (2018) claim that BCT is enabled through consensus and a smart contract mechanism. Smart contracts are computer algorithms that create and maintain self-executable contracts in the blockchain environment (Valentine & Viktoriia, 2018), which are legally enforceable and auditable when all their conditions are met and verified by the block containing the contract's code (Arjuna, 2018; Christidis & Devetsikiotis, 2016; Reijers, O'Brolcháin & Haynes, 2016). Thus, smart contracts in tax administration could improve income and transaction reporting by allowing tax authorities to design their own smart contract system (Allison, 2020; OECD, 2018).

Many countries view blockchain transactions positively, and BCT is thought to promote tax compliance among taxpayers because the authority can observe all taxable transactions and track money movement (Yayman, 2020). Thus, authorities can obtain high-quality data and cover more taxpayers, increasing tax collection. BCT in the tax system can reduce external and undesirable cash outflows, create an efficient record of economic activities, and determine where and when taxation transactions occur, making it better than the centralized data storage system of current tax office operations like declaration, payment, and audit (Alrasheedi & Abualfalayeh, 2020; Kartik & Yatish, 2017). BCT is therefore an immutable digital ledger of economic and commercial transactions that can be configured to document both financial and non-financial activities. Thus, the study hypothesized as follows:

H₀₁: There is no statistically significant relationship between the adoption of Blockchain technology innovations and tax compliance in Nigeria.

Theoretical Review and Framework

This study was anchored on the Technological-Organisational-Environmental (TOE) framework (Tornatzky & Fleischer, 1990), which described the innovation process





from its initial development through its adoption to its eventual implementation, which is considered from an organization-level perspective with regards to adoption of technological innovations (AL-Ashmori et al., 2022; Chiu et al, 2017). The TOE framework asserts that three contexts – technological, organizational, and environmental – influence the process by which an organization adopts and accepts a new technology (Lippert & Ph, 2006).

The technological context, according to Wang et al. (2010), refers to the technologies pertinent to the firm, including both existing and emerging technologies, and it includes both the characteristics and usefulness of the technology (Chiu et al., 2017) as well as the extent of its availability. The TOE framework does not assign pre-set technological features because the aspects of technology that affect adoption are clearly quite different for each technology (Ilin, Ivetiæ & Simiæ, 2017). Similarly, the organizational context refers to an organization's internal characteristics and resources that influence the decision for the adoption and operation of new technology in several aspects including organization's linking structures, communication processes, size, and slack (Azmi et al., 2016; Baker, 2012; Oliveira & Martins, 2011). In addition, the environmental context represents the setting in which the organization conducts business, the industry, competitors, and dealings with government, which constitutes factors outside of the organization that influence the adoption and operation of innovative technologies (Henderson, Sheetz & Trinkle, 2012; Lippert & Ph, 2006).

The TOE contexts are used to present insights on the technological factors, internal factors and external factors influencing BCT adoption in tax administration among the stakeholders. As a result, the TOE provides a framework that enables researchers to choose the elements they have determined from the literature to be pertinent (Ramdani & Kawalek, 2007) to the adoption of innovative technologies like BCT. The foregoing provides a ground for the application of TOE framework to B2G, C2G and B2C scenarios in accordance with view of (AbuAkel & Ibrahim, 2022) because the tax administration involves government, business and individual (customer).

Various researchers have used TOE to investigate a variety of Information System (IS) and Information Technology (IT) innovations (AL-Ashmori et al., 2022; Gutierrez, Boukrami & Lumsden, 2015; Kulkarni & Patil, 2020). The studies show how the TOE's perceptions can be used to understand how new technologies like BCT are being adopted in a variety of fields, including taxation. In the area of taxation, TOE model has been used to examine the primary variables that foster the adoption of an IT-driven tax-compliant system, support electronic tax services adoption and affect the adoption of BCT innovations at the organizational level,



particularly, in tax administration (Azmi et al., 2016; Deogratus, Maiga & Eilu, 2019; Fu, & Su, 2014). The TOE contexts represented by factors of technological context (FTC), factors of organisation context (FOC) and factors of environmental context (FEC), BCT innovations' adoption and tax compliance (TCP) are the latent variables of the investigation, as such they are presented in Figure 1 showing the research framework.

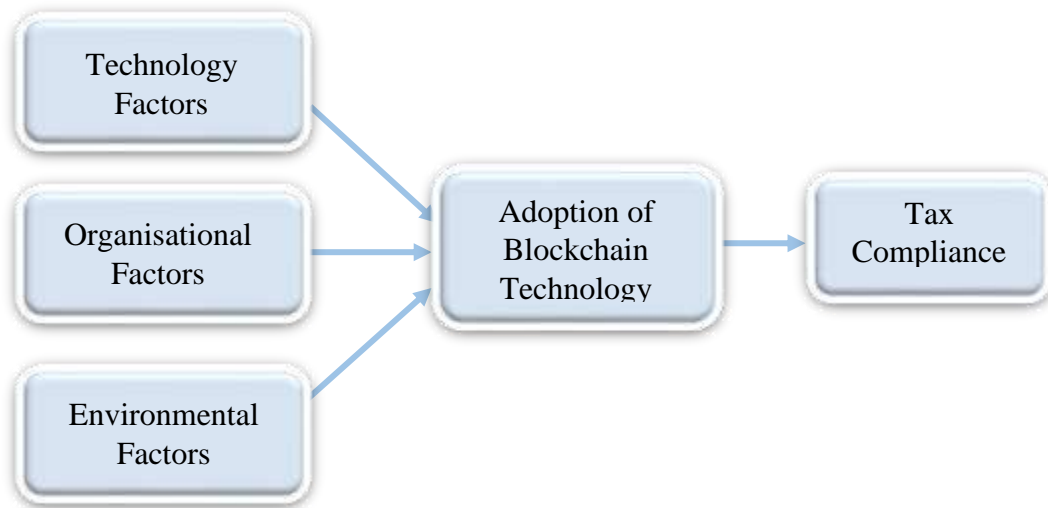


Figure 1: Conceptual Model for the Study

Source: Authors' Conceptualisation (2023).

In the light of this, the study identified and adapted implementation costs, complexity, compatibility, and relative technological advantages as technological factors (FTC), organizational readiness and economic benefits as organisational factors (FOC); while environmental factors (FEC) were identified as standardisation, stakeholders' readiness and regulatory support (Alexopoulos, Charalabidis, Androutsopoulou, Loutsaris & Lachana, 2019; Azmi et al., 2016; Clohessy, Acton & Rogers, 2018; Kasiri, Guan, Cheng, Koens & Poll, 2019; Wamba, Queiroz & Trinchera, 2020). The triad group of factors were hypothesised to influence the adoption of BCT innovations for tax compliance in Nigeria, which, perhaps are essential for tax authorities, taxable organisations and individuals in the Nigeria context. This leads to the development of the following hypotheses:

H₀₂: Technology factors do not positively affect adoption of BCT innovations for tax compliance in Nigeria.



H₀₃: Organisation factors do not positively affect adoption of BCT innovations for tax compliance in Nigeria.

H₀₄: Environmental factors do not positively affect adoption of BCT innovations for tax compliance in Nigeria.

Empirical Review

Irefe-Esema and Akinmade (2020) examined the impact of tax automation on tax compliance in Nigeria using the tax compliance metrics (registration, filing, reporting and payments) of the OECD. Adopting a structured in-depth interview administered to tax professionals comprising tax consultants and staff of the Nigerian Federal Inland Revenue Service (FIRS), the study found that automation significantly improved the registration and payment compliance in Nigeria, but not the filing and reporting compliance due to usage complexity of the electronic platform. However, the study did not consider the nature of the technology behind the automation and the taxpayers, who constitute the critical stakeholders in the tax value chain. Similarly, Shakkour et al. (2021) explored the factors which have positive effect on tax compliance among the Jordanian SMEs using One-Way Analysis of Variance (ANOVA). The study found that personal characteristics, tax education, and audit system have positive effect on tax compliance. Although these studies considered the influence of tax compliance, tax fairness and tax system complexity, there was limited efforts to identify factors that may support a fair, simplified, transparent and immutable tax system.

Azmi et al. (2016) used TOE framework to examine the factors behind the adoption of a tax-compliant accounting system among small and medium-sized enterprises (SMEs). It was found that combining the three groups of TOE's contextual factors influences an organisation's intention to adopt any Information Technology (IT) innovation such as Blockchain technology. A study by Kulkarni and Patil (2020) explored the acceptance of BCT adoption as well as its antecedents and outcomes in banking services in Indian by using PLS-SEM techniques to analyse the data gathered from Information Technology officers, bank managers and bank employees of banks. The study found that Blockchain infrastructure, knowledge, relative advantage, transaction cost, perceived security, organizational scope, consumer readiness, competitive pressure, government policies and bank partner readiness are the factors that affect the Blockchain technology adoption.

A qualitative descriptive study by Belonwu (2020) emphasized that the blockchain, a peer-to-peer or person-to-person network, is useful for tracking corporate fraud and can also help resolve the problems of manual collection and submission of tax



returns, which can be programmed to automatically trigger payment and verify the validity of VAT paid thereby making all transactions traceable and providing transparent and accurate information. However, the study noted that BCT is not an immediate solution for fraud and error detection.

3. MATERIALS AND METHODS

The study used a quantitative cross-sectional survey approach to investigate how TOE characteristics affect BCT innovation adoption and tax compliance in Nigeria. 748 respondents, including tax officials, tax experts, and blockchain experts in Nigeria were surveyed to obtain primary data. Tax officials include 3,972 FIRS workers (FIRS, 2023) and Internal Revenue Service officials from Nigeria's 36 states and the Federal Capital Territory. The tax experts consist of tax researchers (university professors) and tax professionals who are officials of the big 4 consulting firms (PwC, KPMG, Deloitte, and Ernst & Young) as well as other indigenous tax consultancy firms (non-big 4). Thus, the study sampled the population's known and unknown aspects using Yamane (1967) and Cochran (1977) methods. After data collection, respondents were randomly stratified by population subgroups, including tax officials, tax specialists, and blockchain experts. The study's constructs were measured using a scale derived from past studies (Kulkarni & Patil, 2020; OECD, 2016; Tusubira, 2018; Faridy, 2016; Farrar, 2011). A seven-point Likert scale was used to quantify the responses of the tax officials, tax professionals, and blockchain specialists. SmartPLS version 4.0.9.2 (Ringle, Wende & Becker, 2022) was used to estimate the study's partial least squares structural equation modelling (PLS-SEM) models after cleaning the data in IBM's Statistical Package for the Social Sciences version 29.0.1.0. Due to its two-stage technique, SEM was commonly used to examine numerous latent constructs or variables at once (Hair, Sarstedt, Pieper, & Ringle, 2012). Table 1 presents the construct indicators' measurements.

Table 1
Measurement Items

| Construct | Items | CODE |
|------------------|--|-------------|
| Tax Compliance | Taxpayers declare all taxable transactions willingly. | TCP1 |
| | Tax authorities regularly examine taxpayers to ensure compliance. | TCP2 |
| | Taxpayers can legally and creatively minimize their tax liability via tax loopholes. | TCP3 |
| | Not declaring all income is a significant tax offense. | TCP4 |
| | Taxpayers may omit taxable income or transactions that cannot be verified. | TCP5 |



| | | |
|-----------------------------------|---|------|
| | Tax returns are usually filed on time. | TCP6 |
| | Taxpayers typically pay the correct amount. | TCP7 |
| Adoption of Blockchain Technology | Adoption of BCT innovations will enhance voluntary compliance among taxpayers. | BCT1 |
| | Adoption of BCT innovations will automatically enforce tax compliance in Nigeria. | BCT3 |
| | Adoption of BCT innovations will prevent tax avoidance. | BCT3 |
| | Adoption of BCT innovations will eliminate or reduce to the barest minimum the incidences of tax evasion? | BCT4 |
| | Adoption BCT innovations will enhance registration compliance. | BCT5 |
| | Adoption of BCT innovations will enhance reporting compliance. | BCT6 |
| | Adoption of BCT innovations will enhance payment compliance. | BCT7 |
| Factors of Technological Context | High implementation costs negatively influence decision to adopt BCT innovations in tax administration. | FTC1 |
| | BCT innovations are easy to integrate with existing technologies and processes in tax administration in Nigeria. | FTC2 |
| | Compatibility of BCT innovation with existing technologies has a positive influence on BCT adoption in tax administration in Nigeria. | FTC3 |
| | Technological advantages have positive influence on adoption of BCT innovations in tax administration in Nigeria. | FTC4 |
| Factors of Organisational Context | Organizational readiness would positively influence BCT adoption in tax administration in Nigeria. | FOC1 |
| | Economic benefits of BCT would positively influence BCT adoption in tax administration in Nigeria. | FOC2 |
| Factors of Environmental Context | Increased standardization for wider adoption of BCT would positively influence BCT adoption in tax administration. | FEC1 |
| | The willingness of stakeholders in tax administration would positively influence BCT adoption. | FEC2 |
| | Government legislation and regulations support the adoption of BCT in tax administration in Nigeria. | FEC3 |

Source: Authors' Conceptualisation (2023).

4. RESULTS AND DISCUSSION

Table 2 shows that the sampled respondents were drawn from the six geo-political zones in Nigeria. Of the total respondents, Table 2 shows that 39/2% were tax officials (Federal and State), tax experts claimed 39.4% and the balance of 21.4% were received from blockchain experts. These results show that relevant organisations connected to the subject matter of the investigation were adequately covered by the respondents spread. It was observed that about 95.3% of the respondents have more than five years' experience in the subject matter of this

investigation. In addition, majority of the respondents (75.8%) possessed postgraduate qualifications (PhD, MSc or MBA). Similarly, 93.72% of the respondents belong to the three leading professional organisations (CITN, ICAN and ANAN) with mandates to engage in tax practice in the country. About 55.6%, 30.6% and 3.9% of the respondents possess expert, middle-level expert and adequate knowledge of Nigerian tax system respectively with beginner and fairly adequate accounting for 1.1% and 8.8% respectively. Of these figures, more than 80% were individuals with sufficient (adequate =18.6%; proficient = 26.3%; advanced = 41.3%) knowledge of BCT, while 78.7% of the respondents were either aware or highly aware of BCT use in tax area. The foregoing reveals that the respondents are individuals with cutting-edge understanding and skills in the subject matter of this investigation. Hence, any finding emanating from their responses may be deemed as credible and reliable.

Table 2
Sample Profile

| Details | Respondents (N = 748) | Percentage (%) |
|---|-----------------------|----------------|
| Sample Spread: | | |
| Southwest | 299 | 40.0 |
| Southsouth | 114 | 15.2 |
| Southeast | 115 | 15.4 |
| Northwest | 24 | 3.2 |
| Northcentral | 188 | 25.1 |
| Northeast | 8 | 1.1 |
| Role: | | |
| Tax Officials | 293 | 39.2 |
| Tax Experts | 295 | 39.4 |
| Blockchain Experts | 160 | 21.4 |
| Position: | | |
| Executive | 83 | 11.1 |
| Top level manager | 222 | 29.7 |
| Middle level Manager | 208 | 27.8 |
| Lower level manager | 87 | 11.6 |
| Supervisor | 110 | 14.7 |
| Others | 38 | 5.1 |
| Duration of Professional Experience: | | |
| Less than 5 years | 35 | 4.7 |
| Between 5 and 10 years | 203 | 27.1 |
| Between 11 and 15 years | 489 | 65.4 |
| More than 15 years | 21 | 2.8 |
| Educational Qualification: | | |
| PhD | 83 | 11.1 |
| MSc/MBA | 484 | 64.7 |
| BSc/HND | 157 | 21.0 |

| | | |
|---|-----|-------|
| Others | 24 | 3.2 |
| Professional Affiliation: | | |
| CITN | 245 | 32.75 |
| ICAN | 239 | 31.95 |
| ANAN | 217 | 29.01 |
| Others | 47 | 6.28 |
| Knowledge of Nigerian Tax System: | | |
| Beginner | 8 | 1.1 |
| Fairly adequate | 66 | 8.8 |
| Adequate | 29 | 3.9 |
| Middle level Expert | 229 | 30.6 |
| Expert | 416 | 55.6 |
| Knowledge of Blockchain Technology: | | |
| Beginner | 103 | 13.8 |
| Adequate | 139 | 18.6 |
| Proficient | 197 | 26.3 |
| Advanced | 309 | 41.3 |
| Awareness of Blockchain use in tax area: | | |
| Not aware | 26 | 3.5 |
| Fairly aware | 133 | 17.8 |
| Aware | 226 | 30.2 |
| Highly aware | 363 | 48.5 |

Source: Field Survey (2023).

Measurement Model

The measurement model depicts construct-indicator relationships, and involves the evaluation of indicator reliability, internal consistency, convergent validity, and discriminant validity through factor loading, Cronbach's alpha, average variance extracted (AVE), and Heterotrait-Monotrait (HTMT) Ratio respectively. In contrast to the permitted limits of 0.60, 0.70, and 50%, the values of factor loading, Cronbach's alpha, and AVE were above those values (see Table 3 and Figure 2). However, factor loading of BCT7 was below the threshold of 0.60 but was retained in line with the suggestion of Awang (2014) since it was above the threshold of 0.5 factor loading for newly developed measurement items. In addition, Table 4 shows that discriminant validity was demonstrated with HTMT ratios less than the conservative and liberal threshold values (Hassan, Naeem & Gulzar, 2021; Henseler, Ringle & Sarstedt, 2015). Thus, the distinctiveness of the latent constructs was established.



Table 3
Indicators, Factor Loadings, Cronbach's Alpha and AVE

| Construct | Indicator | Loadings | Cronbach's Alpha | AVE |
|-----------------------------------|-----------|----------|------------------|-------|
| Tax Compliance | TCP1 | 0.770 | 0.874 | 0.568 |
| | TCP2 | 0.718 | | |
| | TCP3 | 0.784 | | |
| | TCP4 | 0.741 | | |
| | TCP5 | 0.739 | | |
| | TCP6 | 0.802 | | |
| | TCP7 | 0.718 | | |
| Adoption of Blockchain Technology | BCT1 | 0.760 | 0.851 | 0.529 |
| | BCT3 | 0.806 | | |
| | BCT3 | 0.777 | | |
| | BCT4 | 0.716 | | |
| | BCT5 | 0.728 | | |
| | BCT6 | 0.698 | | |
| | BCT7 | 0.584 | | |
| Factors of Technological Context | FTC1 | 0.878 | 0.815 | 0.639 |
| | FTC2 | 0.708 | | |
| | FTC3 | 0.879 | | |
| | FTC4 | 0.715 | | |
| Factors of Organisational Context | FOC1 | 0.931 | 0.877 | 0.890 |
| | FOC2 | 0.956 | | |
| Factors of Environmental Context | FEC1 | 0.814 | 0.780 | 0.686 |
| | FEC2 | 0.854 | | |
| | FEC3 | 0.817 | | |

Source: Authors' Computation (2023).



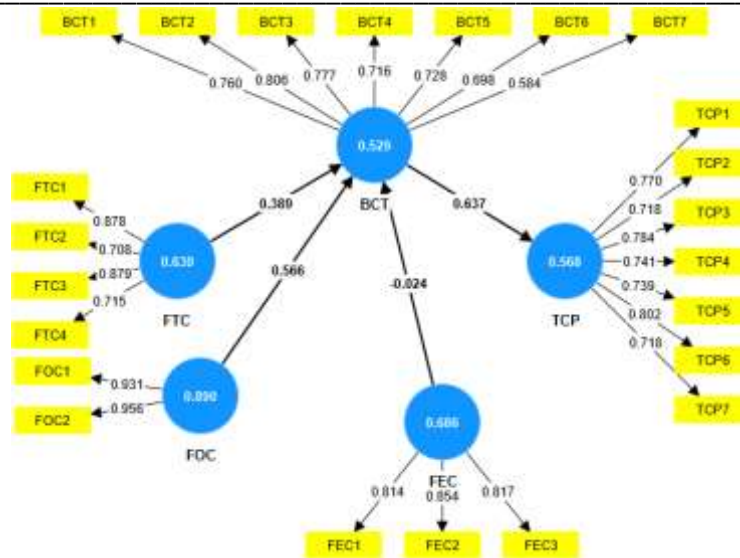


Figure 2: Measurement Model Assessment

Source: SmartPLS 4.0.9.2 Output (2023).

Table 4
Heterotrait-Monotrait (HTMT) Ratio

| Constructs | BCT | FEC | FOC | FTC | TCP |
|------------|-------|-------|-------|-------|-----|
| BCT | | | | | |
| FEC | 0.099 | | | | |
| FOC | 0.810 | 0.121 | | | |
| FTC | 0.777 | 0.283 | 0.568 | | |
| TCP | 0.726 | 0.187 | 0.487 | 0.500 | |

Source: Authors' Computation (2023).

Structural Model

The structural model used the Variance Inflation Factor (VIF), the coefficient of determination (R^2), the effect size (f^2), predictive relevance (Q^2), and the path coefficients (β) to assess the strength and direction of associations among the constructs. The VIF values were clearly below the threshold of 5 (Table 5), which show that collinearity among the predictor constructs is not a critical issue in the structural model. The results (Table 5) revealed that R-square values for BCT and TCP were 67.6% and 40.6% respectively, showing that the R^2 criterion was met and the structural model has adequate predictive ability since FTC, FOC and FEC explain 67.6% of the variance in BCT innovations adoption, while BCT explain 40.6% variation in TCP. Similarly, f-square size ranged from 0.002 (negligible) for FEC on

BCT to 0.766 (high) for FTC on BCT. In addition, the Q^2 values for the endogenous constructs (BCT and TCP) were over 0, hence, the predictive relevance was established. Finally, the values of the path coefficients were all within the allowable range of +1 and -1 (Figure 3, Table 6).

Table 5
Explanatory Power

| Predictors | Outcomes | R-Square | f-Square | Q-Square | Inner Model VIF |
|------------|----------|----------|----------|----------|-----------------|
| FTC | BCT | 0.676 | 0.359 | 0.343 | 1.299 |
| FOC | | | 0.766 | | 1.291 |
| FEC | | | 0.002 | | 1.018 |
| BCT | TCP | 0.406 | 0.684 | 0.221 | 1.000 |

Source: Authors' Computation (2023).

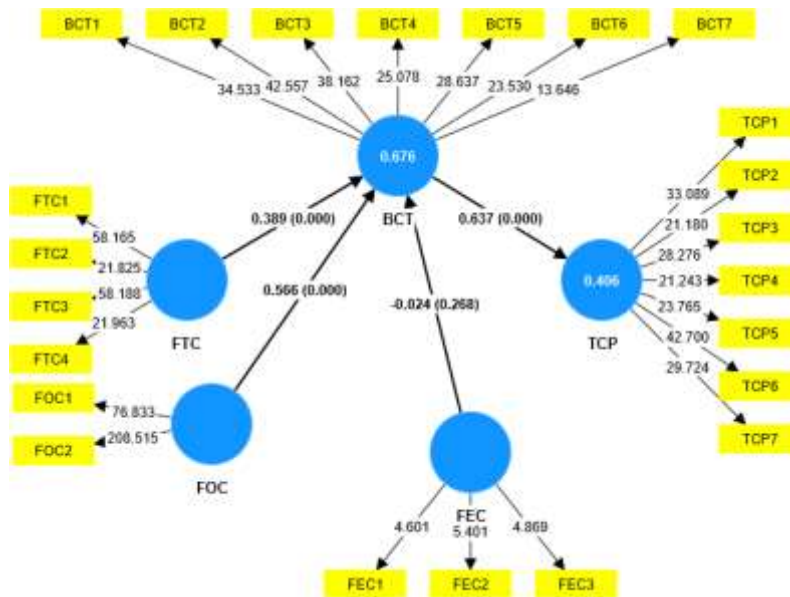


Figure 3: Structural Model Assessment

Source: SmartPLS 4.0.9.2 Output (2023).

Consequently and in deviation from what was hypothesized (H_{01}), the empirical analysis (Table 6) revealed that adoption of BCT innovations has a positive and statistically significant effect on tax compliance in Nigeria ($\beta = 0.637$; $t = 21.109$; $p < 0.001$), hence, the rejection of null hypothesis one. Similarly, null hypothesis two

(H₀₂) was rejected because the results (Table 5) of the analysis showed a statistically significant positive relationship between technological factors and adoption of BCT innovation for tax compliance in Nigeria ($\beta = 0.389$; $t = 10.824$; $p < 0.001$). Moreover, H₀₃ evaluates whether organisational factors of the TOE framework has statistically significant positive influence on adoption of blockchain innovations for tax compliance in Nigeria. The results in Table 6 revealed a positive and statistically significant relationship between organisational factors and adoption of BCT innovations ($\beta = 0.566$; $t = 16.034$; $p < 0.001$). However, the hypothesised relationship between environmental factors of the TOE framework and the adoption of BCT innovations (H₀₄) was found to be negative and statistical insignificant ($\beta = -0.024$; $t = 1.108$; $p = 0.268$), thus, the acceptance of the null hypothesis four. These empirical results demonstrate that while adoption of BCT innovations is a significant predictor of tax compliance, technological and organisational factors are significant predictors of BCT innovations' adoptions for tax compliance.

Table 6
Direct Effects

| Hypothesized Paths | B | T-Statistics | P-value | Decision |
|------------------------------|--------|--------------|---------|----------|
| H ₀₁ : BCT -> TCP | 0.637 | 21.109 | 0.000 | Rejected |
| H ₀₂ : FTC -> BCT | 0.389 | 10.824 | 0.000 | Rejected |
| H ₀₃ : FOC -> BCT | 0.566 | 16.034 | 0.000 | Rejected |
| H ₀₄ : FEC -> BCT | -0.024 | 1.108 | 0.268 | Accepted |

Source: Authors' Computation (2023).

Discussion of Findings

This study evaluated the relationship between the adoption of BCT innovations for tax compliance in Nigeria and the effect of TOE factors on BCT adoption. Consistent with prior studies (Alrasheedi & Abualfalayeh, 2020; Kartik & Yatish, 2017), the empirical findings indicate that adoption of BCT innovations is a significant predictor of tax compliance in Nigeria as the implementation of BCT innovations can determine where and when taxable transactions occur, thus making tax system compliance-focused. In addition, the findings of this investigation supported an aspect of the dichotomous findings of Irefe-Esema and Akinmade (2020), who found that automation significantly improved the registration and payment compliance in Nigeria but not the filing and reporting compliance. The empirical evidence is, however, contrary to the finding of Belonwu (2020), who emphasised that BCT is not an immediate solution for tax issues.



Similarly, the findings of this investigation established that technological and organisational factors effectively predict the adoption of BCT innovations for tax compliance in Nigeria. The findings are consistent with the submissions of scholars that TOE factors are primary variables that foster and affect the adoption of IT-driven tax-compliant system like BCT-based tax-compliant system (Azmi et al., 2016; Deogratus, Maiga & Eilu, 2019; Fu & Su, 2014). However, the empirical evidence from this study found that factors of environmental context of the TOE framework are not potent enablers of adoption of BCT innovations for tax compliance system.

The findings of this study show that issues relating to the technology and internal factors of organisations are of utmost concern in adopting BCT innovations for a compliance-focused tax system in Nigeria. This empirical data confirmed that, according to the sampled respondents, the adoption of BCT innovations for tax compliance is favourably associated to tax compliance. Therefore, when investigating the adoption of BCT innovations for tax compliance, it is important to consider technological factors (implementation costs, complexity, compatibility, relative technological advantages) and organizational factors (organizational readiness and economic benefits), which are likely to influence the adoption of BCT innovations in tax administration in Nigeria. Environmental factors (standardisation, stakeholders' readiness, and regulatory support) do not significantly affect BCT innovation adoption, but they should be monitored as they create the external environment in which technological and organizational factors thrive.

5. CONCLUSION AND RECOMMENDATIONS

The Nigerian government's imperative to generate sufficient tax revenue has prompted a reassessment of its tax administration and collection procedures. Effective tax administration is expected to yield increased tax compliance, which in turn demands a novel approach that prioritizes transparency, fairness, consistency, and impartiality. A cryptographic proof-based electronic system, such as BCT innovations, is capable of supporting such an approach. The findings of this study show that, while BCT innovation adoption will increase tax compliance, factors related to technological and organizational settings will encourage BCT innovation adoption for tax compliance. Therefore, implementation of BCT innovations in the taxation process to access information on all transactions that give rise to tax liability is recommended to the relevant tax authorities at federal and state levels. It is also recommended that tax authorities should team up with developers, regulators, fiscal policymakers, tax professionals and financial institutions to form a consortium to develop a BCT-based tax-compliant system and its governance framework.





However, future research may focus on revenue implications of a BCT-based system for core taxes such as corporate income tax (CIT), personal income tax (PIT), value added tax (VAT), and domestic excise taxes.

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