Investigating the Impact of Using Blockchain Technology on the Efficiency of the Tax System (Case Study: Corporate Income Tax)

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ABSTRACT

The country's tax administration is faced with a large volume of various data, and the use of blockchain as a distributed data structure for effective data management and smartening the tax system seems to be a necessity with the aim of increasing the efficiency of the tax system and achieving income tax justice. Therefore, in this study, the impact of using blockchain technology on the efficiency of the tax system (Case Study: Corporate Income Tax) has been investigated, which in addition to its novelty and innovation, can be used as an applied framework. This study is a fundamental-applied research in terms of its purpose.The research method was quantitative and six hypotheses were formulated.A researcher-made questionnaire was used to collect data.The statistical population of the study included professors and doctoral students, tax affairs staff, accountants of companies and government organizations, auditors and tax consultants from all over the country, and using the Cochran formula for a limited population, the number of statistical samples was determined to be 384 people.The questionnaire data was analyzed using structural equation modeling (SEM), and the statistical techniques of correlation coefficient and structural equations and one-sample t-test were used to test the research hypotheses.the results of this study showed that using technology helps to achieve tax justice and increase the efficiency of tax system.

Keywords: Blockchain, tax, Efficiency, Tax System

1. Introduction

Taxes, as one of the most important sources of government revenue, play a significant role in meeting government expenses, especially in cutting the country's current budget's dependence on oil revenues and achieving economic independence. Fraud in transactions, fraud, and conducting fictitious transactions, technological advances, especially the increase in the speed of financial transactions, have always led to new ways to circumvent the law, as well as increasing tax evasion and, as a result, reducing government tax revenues. One of the main sources of tax collection is from the income of legal entities (companies), but the emergence and development of financial accounting and independent auditing cannot solve the problem of information asymmetry between them due to the conflict of interests between companies and external information users (government, investors, shareholders, etc.) (Yermak, 2017). Therefore, a new technology such as blockchain technology is needed to fairly realize tax revenues from the activities of legal entities. Blockchain is cited as a prominent example of transformative innovation (Penn et al., 2019) and the World Economic Forum considers blockchain to be one of the six computing supertrends that are likely to shape the world in the next decade, and it is predicted that blockchain technology, like the Internet, will be the cornerstone of new business models and social interactions (Fizobarker et al., 2019). In addition, blockchain can be used to prevent and detect fraudulent transactions. Since blockchain keeps a record of asset transfers, any misuse can be detected by tracing it through the blockchain. To combat fraud in financial reporting, such as overstating earnings, transaction data on the blockchain can provide reliable evidence. In addition, the persistence, irreversibility of the blockchain ledger can prevent management from creating fictitious transactions or past-dated options. Blockchain transparency makes it easy for accountants to access and review material-related transactions (Dai Vosarai, 2017). In the past, blockchain was only used in digital currencies. Currently, various fields are seeing the benefits of blockchain implementation. One-way transactions without a reverse state make blockchain a desirable platform for data and information transparency and credibility. The digital age has changed not only the relationship between taxpayers and tax authorities, but also the way information is paid, sent, and stored. Blockchain can be a breakthrough for the tax administration to make the tax system more accurate, transparent, and trustworthy, as blockchain is a shared ledger of information (Misran et al., 2022). Therefore, in this study, we intend to examine the impact of applying blockchain technology on corporate income tax. The present study is organized into five sections. After the introduction, the second section first reviews the relevant theoretical foundations and then the empirical studies conducted. The third section is dedicated to the methodology and introduction of the model. The fourth section presents the research findings and the fifth section presents the general conclusions and suggestions.

Theoretical Basis

The purpose of taxation is to raise resources to finance government expenditures in a way that is fair, efficient, and administratively feasible (Burgess & et al., 1993). Taxation also provides one of the main criteria for measuring government capacity, government formation, and power relations in a society. Taxation is used to encourage or discourage certain types of behavior, correct market failures, and improve the distribution of income or wealth. Traditional centralized approaches to tax collection have shortcomings, although tax systems vary from country to country. Tax evasion and fraud are also common in almost all governments. Legal entities (corporations) and businesses can use the complexities of taxation to avoid and evade taxes. Infiltration of this traditional centralized system can even allow criminals to steal individuals' identities and abuse them. Technology has come to the aid of politics at various times. It now seems to be able to solve the main problem of tax collection, namely the lack of trust in returns and the lack of a unified database. One form of distributed ledger design is the blockchain system, which can be public or private (Scardovi, 2016).

Blockchain A distributed ledger on a network that records transactions. Each transaction is verified by network nodes before being added to the chain blocks based on a majority consensus mechanism. Recorded information cannot be changed or erased, and the history of each transaction can be recalled at any time (Frankowski et al., 2017). Blockchain technology will have a great impact on the tax field due to its decentralization, lack of intermediaries, transparency, and security. This technology can drastically change the tax structure and, through a distributed database, access to all data and all past processing by users of blockchain technology will be possible, and control of information by a single person or entity will not be possible, and this information will be publicly visible to all users, and person-to-person communications will eliminate the need for a centralized institution. Blockchain technology can also make significant strides in improving processes through the transparency it creates in systems. Blockchain technology prevents manipulation or unauthorized revisions by minimizing intentional or unintentional record changes in a decentralized system. Both taxpayers and tax authorities must trust the information. The processes used to calculate their tax liability and have ultimate confidence that the system is working fairly are important because blockchain is a system of verifying transactions and maintaining their ongoing integrity. This technology provides a means to create reliable, valid audit trails. Information that can be trusted by all relevant parties, and given that in recent years the government's largest revenue has come from income tax and property tax, and one of the main sources of tax collection is from the income of legal entities (companies), therefore, implementing this platform in the tax system can identify taxpayers and facilitate and accelerate the collection of taxes or duties (Stevati et al., 2020). Companies can use blockchain as a platform for voluntary disclosure of financial and non-financial information in the short term (Yermak, 2017), and as a result, information asymmetry is reduced, and the main advantage for the government is to reduce tax evasion, collect taxes fairly, and as a result, increase government tax revenues (Zheng, 2018). In fact, it can be hoped that by applying blockchain technology, the level of public trust in financial and accounting data will increase to an incredible extent, and companies will not have much ability to use profit management tools. The infrastructure of smart contracts will provide the possibility of reducing uncertainty in the accounting of technological products. Due to the ability to track transactions in a blockchain and smart contracts with specific and planned rules, there is a possibility of more favorable access to the profitability process and it has the ability to strengthen trust between market participants and prevent errors, fraud and also fraud in transactions. It is worth noting that so far no country has organized its tax system on the basis of blockchain technology, but several plans have been defined to assess the feasibility of using this capacity. In fact, it can be said that its exploitation is still in the study phase. The most important of these is the studies of Tencent in China. Recently, the tax authorities of the United Kingdom, Switzerland, Sweden, Brazil, and the Chinese Academy of Information Technology have supported the plan of Tencent and a number of other technology companies to implement a comprehensive distributed ledger-based invoicing scheme, which will reduce the manipulation of audit trails and the issuance of fake invoices and bills, leading to a significant reduction in tax evasion (Ali Nasiri Aghdam et al., 1402).

Therefore, based on the main research problem and in order to achieve the stated research objectives, the following hypotheses were designed:

Hypothesis1: “Hardware Areas of Blockchain Implementation” affect “Realization of tax Justice Based on Blockchain”.

Hypothesis2: “Software Areas of Blockchain Implementation” affect “Realization of tax Justice Based on Blockchain”.

Hypothesis3: “Hardware Areas of Blockchain Implementation” affect “realization of tax revenue through blockchain”

Hypothesis4: “Software Areas of Blockchain Implementation” affect “realization of tax revenue through blockchain”

Hypothesis5: “Realization of tax Justice Based on Blockchain” affect “realization of tax revenue through blockchain”

Hypothesis6: “Realization of tax revenue through blockchain” affect “efficiency of tax system”.

According to the extracted hypotheses, the conceptual model of the research was developed for the purpose of investigation using structural equation modeling (SEM) as shown in Figure 1).

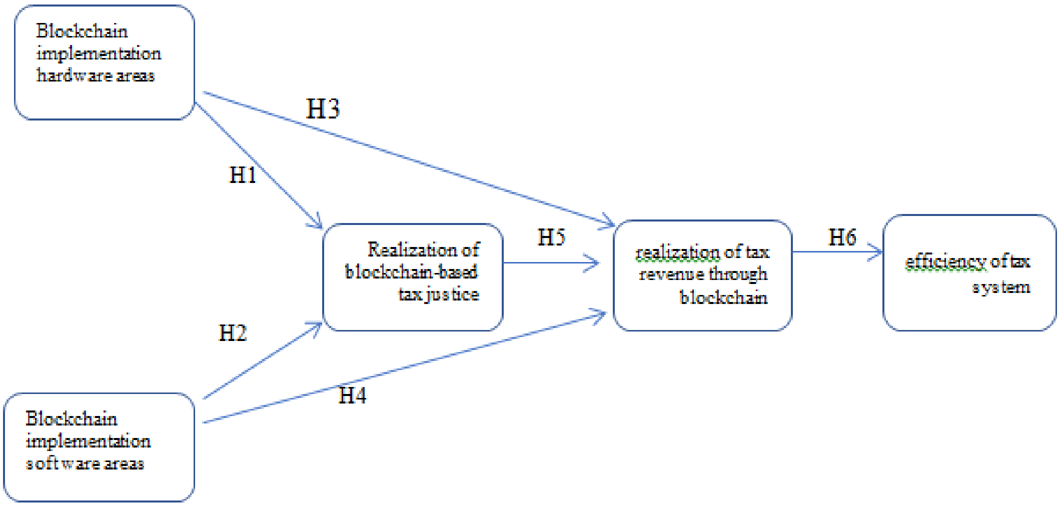

Figure (1): SEM model

Research background

Yu (2019) in a study titled Introduction to Blockchain and its Application in Financial Accounting showed that in the short term, public blockchain can be used as a platform for voluntary disclosure of information by companies. In the long term, blockchain can effectively reduce errors in disclosure and earnings management, increase the quality of accounting information, and reduce information asymmetry.

Lara Dorado et al. (2023) presented blockchain-based application models in the Brazilian tax system in a study. The results of the study showed that the implementation of the proposed models in this work requires a preliminary scoping stage to select the most relevant operations according to the expected volume of transactions and the most complex functions of smart contracts, and it is very difficult to design a system that can cope with a wide range of situations and possible changes. Ha Wan Sang and Lee Fong Duyen (2023) reviewed a study titled Blockchain in Tax Management (Paradigm Shift in Transparency and Efficiency). The research results showed that from tax reporting and compliance to identity verification, auditing, supply chain management and cross-border transactions, blockchain streamlines processes, increases transparency and improves accuracy. It simplifies tax calculations, reduces manual errors and automates enforcement, leading to increased compliance rates and improved revenue collection. Despite its potential, the adoption of blockchain in tax administration comes with challenges and considerations. Regulatory frameworks, scalability, privacy, integration with legacy systems, training and collaboration must be addressed to ensure successful implementation. Governments, tax authorities and industry stakeholders should work together to develop guidelines, standards and interoperability frameworks and their research points to case studies by countries such as Estonia, Australia, South Korea, Sweden, Singapore and the UAE that have conducted studies and projects on implementing blockchain in tax systems including traceability of goods at customs, tracking of transactions, verification of income and expenditure records using blockchain, real estate transactions, digital tax on goods and services and value added tax and have taken effective steps to explore the potential of blockchain and have seen positive results in increasing tax administration and compliance.

Sampson Anoma et al. (2024) in a study examined the potential of integrating blockchain technology with tax policy (Examining the challenges and opportunities for improving taxation of the digital economy in Ghana). Unstructured and semi-structured interview questions were designed to gain insights and a survey was conducted to obtain views on the variables that explain the potential. Correlation analysis was used to validate the propositions derived from it. The research results revealed that blockchain has significant benefits in bridging the gap for effective online taxation in the country, and challenges include issues related to institutional and regulatory compliance, technical integration and alignment inconsistencies, and insufficient stakeholder participation.

Joseph Kuba et al. (2024) examined the legal implications of blockchain technology for tax compliance and financial regulation in a study. The legal implications of blockchain technology for tax compliance and financial regulation emphasize the importance of collaboration among stakeholders. By collaborating, governments, businesses, and regulators can leverage the transformative potential of blockchain while protecting against potential risks and ensuring that legal frameworks remain adaptable and flexible in the face of technological change.

Qarsi et al. (1403) in their study Accounting Information System Based on Blockchain Architecture: Model Design Using semi-structured interviews with 19 experts in the fields of information technology and accounting, as well as reviewing related research, the findings were combined and the present model was designed. Accordingly, by analyzing the content of the interviews and research using MaxQda 2020 software, the relevant dimensions and codes were extracted and the importance and priority of each were determined using the Shannon entropy technique. Based on the research approach, 3 categories, 40 concepts and 126 codes were extracted. Digital identity management, improving data security and record security in the causal factors section, scalability, conflict with existing platforms and lack of talent pool in the interfering factors section and improving operational efficiency, balancing sharding trade-offs and dealing with electronic document changes in the consequences section obtained the highest importance coefficient. In this study, the accounting information system model based on blockchain architecture was presented in the form of three sections of causal factors, interfering factors and consequences.

Hassanzadeh and Jamali (1402) conducted a study entitled Investigating the Potential of Blockchain in Realizing Tax Revenues in Iran. The study was descriptive-survey and the statistical population of this study was employees of the Fars General Taxation Office and the opinions of seven experts were used to prioritize the indicators. In order to achieve the research objectives, first, by reviewing the theoretical literature of the research, fifteen initial indicators were identified as the potentials of Blockchain in realizing tax revenues; Then, using the binomial distribution technique, eight indicators were determined as the most important potentials of blockchain in realizing tax revenues, and seven indicators were eliminated. In the next step, the suitability of the proposed model was confirmed by confirmatory factor analysis. Finally, the indicators were prioritized using the OPA technique. Accordingly, the indicators of "increasing trust in the tax system, being unmanipulated, accelerating the tax collection mechanism, not requiring third-party intervention and verification, higher flexibility compared to current systems, higher encryption, storing and preserving all transactions, and viewing transactions in real time" were ranked one to eight, respectively.

Gholizadeh et al. (1403) analyzed the usability of blockchain technology in making virtual businesses smart with a futures research approach, which was conducted using a mixed method and exploratory research designs in two consecutive qualitative and quantitative stages. In the first stage, a qualitative study was conducted, and by reviewing and evaluating studies conducted in the field of blockchain and also in-depth interviews with experts in the field of blockchain technology in virtual businesses who had executive backgrounds at decision-making levels, the necessary information was collected and, using the grounded theory analysis method, coding, categorization, and presentation of a conceptual model were carried out. The second stage of the study was quantitative and structural equation modeling, and for this purpose, the data collected from a researcher-made questionnaire based on the proposed model resulting from the qualitative phase of the study were evaluated using Smart PLS software. The results of structural equation modeling indicate that the effects of variables in the registration domain, identity domain, smart contracts domain, dynamic registration domain, payment infrastructure domain, and hybrid applications domain on the usability of blockchain technology in smartening virtual businesses are significant.

Research Methodology

The present study is fundamental-applied in terms of its purpose and exploratory in nature. The present research method is as follows: first, important specialized texts related to the research topic were selected and reviewed. In the next step, research hypotheses were formulated and an initial model was designed, and a questionnaire based on a five-option Likert scale was created. To measure the validity of the questionnaire, the content validity method was used. Content or subjective validity is based on the subjective assessments of researchers and experts who agree on the quality of the measuring instrument of the traits under study and determines the extent to which the designed measuring instrument measures what the researcher thinks. In this study, to increase the content validity of the questionnaire, the opinions of supervisors and consultants, specialists and experts in the field of the present study, the study of questionnaires close to this study, articles and books, as well as convergent validity and divergent validity were used. Then, the reliability of the questionnaire questions was examined. Reliability, which is interpreted as validity, accuracy, and trustworthiness, is a measuring instrument that is designed to measure a variable or attribute and that produces similar results under similar conditions at different times or places (Hafeznia, 1998). There are various methods to determine the reliability of a measuring instrument, and in this study, Cronbach's alpha coefficient was used. Then, the questionnaire was distributed to the statistical population and after collecting them, it was analyzed using structural equation modeling (SEM). The statistical population of the study included: professors and doctoral students, tax affairs staff, accountants and financial managers of companies and government organizations, auditors and tax consultants from all over the country. Using the Cochran formula for a limited population, the number of statistical samples was determined as 384 people and had the characteristics of at least 5 years of teaching experience at a university or at least 5 years of work experience in the relevant field, complete mastery in the field of accounting and tax studies with a minimum of a master's degree.

In order to collect the required information for the research, the study of documents and library information sources, field studies were used, and the data collection tool was the development of a questionnaire. The questionnaire was used to collect the required statistical data. In this study, the general content of the questionnaire questions included demographic questions and attitudinal questions, where demographic questions addressed the general characteristics of the respondents, and attitudinal questions were organized with the aim of discovering the views, opinions, and perceptions of the respondents regarding the dimensions and components of the conceptual model. A questionnaire was designed to include 30 components based on a five-option Likert scale.

In this study, the following methods were used to increase the content validity of the questionnaire:

- Using the opinions of supervisors and consultants, specialists and experts in the field of the present research.
- Studying questionnaires related to this study, articles and books
- Convergent validity and divergent validity

There are various methods to determine the reliability of a measurement tool. In this research, Cronbach's alpha coefficient was used.

Research findings

The mean, standard deviation, skewness, and kurtosis of the research variables are shown in Table (1). The abbreviations of the variables are also introduced in this section.

Table (1): Descriptive statistics of research variables Sample adequacy test

Variables	Code	Average	Standard deviation	Skewness	Elongation
Hardware Areas of Blockchain Implementation	HA	3.250	1.320	0.400-	1.380-
Software Areas of Blockchain Implementation	SO	3.380	1.314	0.481-	1.345-
Realizing Tax Justice Based on Blockchain	JU	3.313	1.269	0.494-	1.406-
Realizing tax revenue through blockchain	RE	3.333	1.231	0.523-	1.449-
Efficiency of the tax system	EF	3.289	1.393	0.390-	1.360-

One of the methods for examining sample adequacy is calculating the sample adequacy index. The sample adequacy index was presented by Kaiser, Meyer, and Olkin, and for this reason it is represented by the symbol KMO. The KMO index should be above 0.7, and of course, between 0.5 and 0.7 is also acceptable with caution. Bartlett's test is also used to examine sample adequacy, in which the normalized chi-square (chi-square divided by the degree of freedom) should be less than 5 (Momeni and Akab Qayumi, 2017). Table 2 shows the output of the KMO and Bartlett tests, which show that the KMO index was at an acceptable level. Bartlett's test was also significant and the normalized chi-square was 4.65.

Table (2): Sampling adequacy test

KMO indicator		**0.919**
Bartlett test	Xi two	2493.357
	Degree of freedom	536
	Significance level	0.000
	Normal xi2	4.65

Checking the normality of data distribution

Before any test or generalization is applied to the data, the type of data distribution of the variables under study must be determined so that an appropriate and scientific statistical method can be used based on the type of data distribution. The Kolmogorov-Smirnov test was used to check the type of data distribution, and the test results are shown in Table 3.

As is clear from the table above, the significance level of the Kolmogorov-Smirnov test for all variables is less than the 0.05 error level. Therefore, it can be concluded that the data distribution of all variables is non-normal and methods appropriate to the type of data distribution should be used.

Table (3): Results of the data distribution type test

Variables	**Kolmogorov Smirnov**		**Result**
	Amount of statistics	**Significance level**	
Hardware Areas of Blockchain Implementation	0.179	0.00	Abnormal
Software Areas of Blockchain Implementation	0.192	0.00	Abnormal
Realizing Tax Justice Based on Blockchain	0.205	0.00	Abnormal
Realizing tax revenue through blockchain	0.236	0.00	Abnormal
Efficiency of the tax system	0.172	0.00	Abnormal

Table (4): Correlation coefficients between the variables studied in the research

Research variables	**Hardware Areas of Blockchain Implementation**	**Software Areas of Blockchain Implementation**	**Realizing Tax Justice Based on Blockchain**	**Realizing tax revenue through blockchain**	**Efficiency of the tax system**
Hardware Areas of Blockchain Implementation	1.000				
Software Areas of Blockchain Implementation	0.700	1.000			
Realizing Tax Justice Based on Blockchain	0.690	0.680	1.000		
Realizing tax revenue through blockchain	0.652	0.712	0.676	1.000	
Efficiency of the tax system	0.663	0.700	0.694	0.689	1.000

Spearman's correlation coefficient test

Before reaching the stage of model analysis and structural equation modeling, it is necessary to determine the extent and direction of the relationship between the variables. For this purpose, due to the non-normality of the data distribution, Spearman's correlation coefficient has been used. The absolute value of the correlation coefficient varies between zero and one, and the closer it is to zero, the weaker the relationship between the two variables, and the closer the absolute value of the correlation between the two variables is to one, the stronger the relationship between the two variables. Table 4 shows the correlation matrix.

The research findings show that the level of significance between the pairwise relationships of the research variables is less than the 0.05 error level. Therefore, the null hypothesis of the correlation test is rejected and the opposite hypothesis of the existence of a relationship between the variables is confirmed.

Model and Hypotheses Examination

The partial least squares (PLS) method consists of two main steps: 1) Examination of the fit of the measurement models, the structural model, and the general model 2) Testing the relationships between the constructs.

Checking the fit of measurement models

In this section, the accuracy of the relationships in the measurement models is ensured using reliability and validity criteria. In confirmatory factor analysis, the researcher tries to obtain confirmation of a given factor structure. That is, he determines whether the data is consistent with a certain factor structure stated in the hypothesis or not. Confirmatory factor analysis is also used to measure the validity of the indicators of a construct in a questionnaire to determine whether there is the necessary coordination and alignment between the indicators (questions). In other words, confirmatory factor analysis is a tool for measuring the validity of a questionnaire. That is, the questionnaire measures what it was designed to measure. Unlike exploratory factor analysis, in confirmatory factor analysis the basic assumption is that, in accordance with previous theories, each factor is related to a specific subset of variables. An important application of confirmatory factor analysis is to examine the fit of a model containing questions of a variable that examines the appropriateness of the research model with the collected data.

In the partial least squares (PLS) method, the following items are examined to evaluate the questionnaire and confirmatory factor analysis:

1) Cronbach's alpha
2) Composite reliability (CR)
3) Factor loading coefficients and their significance
4) Validity examination of the average variance extracted (AVE)
5) Fornell and Larker matrix

Reliability and validity

Cronbach's alpha and composite reliability (CR)

Since the value of Cronbach's alpha is a traditional measure for determining the reliability of constructs, the PLS method uses a more modern measure than Cronbach's alpha called composite reliability (CR). The advantage of composite reliability over Cronbach's alpha is that the reliability of constructs is not calculated in absolute terms but according to the correlation of their constructs with each other. As a result, to better measure reliability in the PLS method, both of these criteria are used. If the CR value for each construct is greater than 0.7, it indicates appropriate internal consistency for the measurement models. The CR value is provided in the output of the PLS software, but the formula for calculating it is as follows. The CR value for second-order variables is calculated using the formula. In this formula, λ is the factor loading of the items and δ is the error variance.

$$CR = \frac{\left(\sum_{i=1}^{n} \lambda_i\right)^2}{\left(\sum_{i=1}^{n} \lambda_i\right)^2 + \sum_{i=1}^{n} \delta_i}$$

As can be seen in Table 4, the Cronbach's alpha coefficient values of all research variables were obtained above 0.7, confirming the appropriateness of the reliability with this index. The composite reliability coefficient values of all studied variables were also obtained above 0.7, once again confirming the appropriateness of the reliability of the variables.

Table (5): Cronbach's alpha values and composite reliability

Variable	Code	Cronbach's alpha	CR
Hardware Areas of Blockchain Implementation	HA	0.849	0.898
Software Areas of Blockchain Implementation	SO	0.857	0.897
Realizing Tax Justice Based on Blockchain	JU	0.895	0.916
Realizing tax revenue through blockchain	RE	0.911	0.926
Efficiency of the tax system	EF	0.794	0.879

Construct validity

Construct validity indicates the extent to which the results obtained from the use of measures are consistent with the theories on which the test was designed. This validity is evaluated through "convergent validity" and "divergent (diagnostic) validity". Convergent validity is created when the scores obtained from two different instruments measure the same concept to which it is largely related. Discriminant validity occurs when, when it is predicted based on theory that two variables are not correlated, the scores obtained by measuring them also confirm this empirically. Construct validity is more theoretical than content validity.

Factor loading

Factor loadings are calculated by calculating the correlation value of the indicators of a construct with that construct. If this value is equal to or greater than 0.4, it confirms that the variance between the construct and its indicators is greater than the variance of the measurement error of that construct and the reliability of that measurement model is acceptable. Of course, some authors such as Heer et al. (2010) have mentioned the number 0.5 as the criterion value for factor loadings. Table 5 shows the factor loadings of the measures (questions) of the first-order latent variables. As can be seen in Table 6, the factor loadings of all measures are more than 0.5 and are acceptable.

Table (6): Standardized factor loadings and t-coefficients between latent variables and relevant questions .

Variables	Items	Load factor	T-statistic value	Significance level	Result
Hardware aspects of blockchain implementation	Recruiting blockchain experts and programmers	0.882	95.793	0/00	Desirable and meaningful
	Creating strong infrastructure for the blockchain-based internet	0.802	32.084	0/00	Desirable and meaningful
	Building integrated databases	0.820	40.187	00/0 `	Desirable and meaningful
	Building a national blockchain network	0.815	36.457	0/00	Desirable and meaningful
Software Areas of Blockchain Implementation	Designing blockchain-based information systems	0.827	40.791	0/00	Desirable and meaningful
	Blockchain development alongside e-government	0.802	30.775	0/00	Desirable and meaningful
	Creating and approving blockchain-related laws	0.778	30.205	0/00	Desirable and meaningful
	Creating a tax audit software platform on the blockchain	0.771	26.252	0/00	Desirable and meaningful
	Blockchain training for tax officials and taxpayers	0.808	35.972	0/00	Desirable and meaningful
Realizing Tax Justice Based on Blockchain	Creating more efficient, transparent and accountable tax systems	0.723	24.140	0/00	Desirable and meaningful
	Intelligent identification of taxable individuals and companies	0.778	29.191	0/00	Desirable and meaningful

Variables	Items	Load factor	T-statistic value	Significance level	Result
	Establishing strong tax oversight systems	0.773	29.491	0/00	Desirable and meaningful
	Fair tax calculation	0.759	26.684	0/00	Desirable and meaningful
	Eliminating human errors in tax identification	0.775	28.507	0/00	Desirable and meaningful
	Reforming the tax collection process	0.750	24.968	0/00	Desirable and meaningful
	Rapid detection and identification of tax fraud	0.752	26.606	0/00	Desirable and meaningful
	Connecting to Big Data and Quickly Identifying Taxpayers	0.766	30.377	0/00	Desirable and meaningful
Realizing tax revenue through blockchain	Security of tax receipt and payment	0.719	22.641	0/00	Desirable and meaningful
	Quick tax calculation	0.758	26.300	0/00	Desirable and meaningful
	Reduce tax costs and time	0.704	21.800	0/00	Desirable and meaningful
	Decentralization	0.783	29.993	0/00	Desirable and meaningful
	Changing the tax structure	0.775	28.605	0/00	Desirable and meaningful
	Transparency and security of tax reporting	0.717	22.812	0/00	Desirable and meaningful
	Secure transfer of tax data	0.688	20.710	0/00	Desirable and meaningful
	Quick and easy tracking of tax information	0.778	29.378	0/00	Desirable and meaningful
	Smart tax transactions	0.770	27.207	0/00	Desirable and meaningful
	Creating smart contracts without human intervention	0.759	27.658	0/00	Desirable and meaningful
Efficiency of the tax system	Increase tax revenue	0.839	45.042	0/00	Desirable and meaningful
	Reducing the cost of collecting taxes	0.845	47.665	0/00	Desirable and meaningful
	Flexibility in tax collection	0.840	43.437	0/00	Desirable and meaningful

As is clear from the table above, the t-statistic value and the significance level between the items and their respective latent variables in all cases are calculated to be greater than 1.96 and less than the 0.05 error level, respectively. Therefore, the significance of the relationships between the items and their corresponding variables is confirmed. Also, the standardized factor loading value for all questions in the questionnaire is greater than 0.4, respectively, and there is no need to delete any item in the model. Reliability of the indicator, which is the square power of the standardized factor loadings of an indicator. It shows how much of the change in an item (item) is explained by the construct (latent variable) and refers to the variance extracted from an item.

Convergent validity

Convergent validity is the second criterion used to fit measurement models in the PLS method. The AVE (average variance extracted) criterion indicates the average variance shared between each construct and its indicators. In simpler terms, AVE indicates the degree of correlation between a construct and its indicators, and the higher this correlation, the greater the fit (Davari and Rezazadeh, 2017). Fornell and Larker (1981) introduced the AVE criterion to measure convergent validity and stated that in the case of AVE, the critical value is 0.5; meaning that AVE values greater than 0.5 indicate acceptable convergent validity. AVE values are provided in the software output, but the formula for calculating it is as follows. The AVE value for second-order variables is calculated using the formula. Table 7 shows the AVE values of the research variables, all of which are above 0.5.

$$AVE = \frac{\sum_{i=1}^{n} \lambda_i^2}{n}$$

Table (7): AVE values

Variables	Code	AVE
Hardware aspects of blockchain implementation	HA	0.689
Software Areas of Blockchain Implementation	SO	0.636
Realizing Tax Justice Based on Blockchain	JU	0.577
Realizing tax revenue through blockchain	RE	0.556
Efficiency of the tax system	EF	0.708

Divergent validity

Discrepant validity is related to examining the relationship of a construct with its indicators in comparison with the relationship of that construct with other constructs. So that acceptable divergent validity of a model indicates that a construct in the model has more interaction with its indicators than with other constructs. According to Fornell and Larker (1981), divergent validity is at an acceptable level when the AVE for each construct is greater than the shared variance between that construct and other constructs (i.e., the square of the correlation coefficient between the constructs) in the model. In PLS, this is examined by means of a matrix whose cells contain the correlation coefficients between the constructs and the square of the AVE values related to each construct. The research model has acceptable divergent validity if the numbers in the main diagonal of the matrix are greater than their lower values (Davari and Rezazadeh, 2017). Table 8 shows this matrix. As can be seen, the divergent validity of the model is acceptable.

Table (8): Divergent validity (Fornell and Larker method)

Variables	Realization of tax revenue through blockchain	Realization of tax justice based on blockchain	Hardware areas of blockchain implementation	Software areas of blockchain implementatio n	Tax system efficiency
Realization of tax revenue through blockchain	0.946				
Realization of tax justice based on blockchain	0.907	0.960			
Hardware areas of blockchain implementation	0.869	0.874	0.889		
Software areas of blockchain implementation	0.901	0.868	0.855	0.924	
Efficiency of the tax system	0.864	0.845	0.816	0.835	0.893

Structural Model Fit Assessment

In the structural section, values related to independent and dependent constructs are presented.

The most basic criterion for measuring the relationship between constructs in the model (structural section) is the t-significance numbers. If the value of these numbers exceeds 1.96, it indicates the accuracy of the relationship between constructs and, as a result, the research hypotheses are confirmed. Of course, t-numbers only indicate the accuracy of the relationships and the intensity of the relationship between constructs cannot be measured with them (Davari and Rezazadeh, 2017). Figure 3 and Figure 4 show the structural model of the research in the state of estimating standard coefficients and estimating t-values. Table 9 shows the t-significance coefficients for the relationships between research constructs.

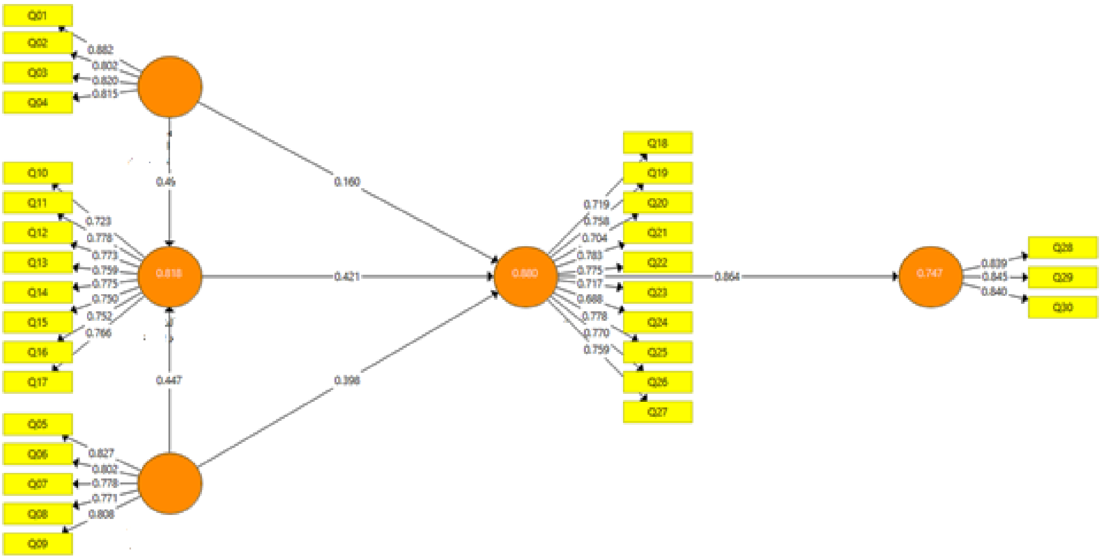

Figure (3): Structural model in the case of estimating standard coefficients

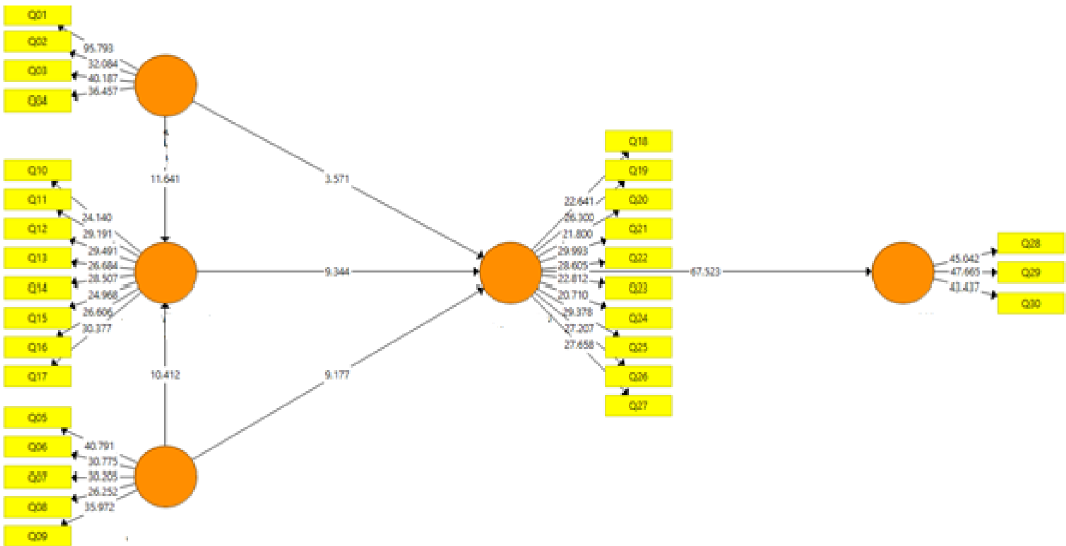

Figure (4): Structural model in the t-value estimation mode

Table (9): Path coefficients and t-significance coefficients for relationships between research constructs

The path of the relationship between latent constructs	Path coefficients	t-value	Result
JU ← HA	0.492	11.641	meaningful
JU ← SO	0.447	10.412	meaningful.
RE ← HA	0.160	3.571	meaningful
RE ← SO	0.398	9.177	meaningful
RE ← JU	0.421	9.344	meaningful
EF ← RE	0.864	67.523	meaningful

According to Table 9, the path coefficients in all paths are significant at the 95% confidence level.

Coefficient of Determination (R2) Criteria for Endogenous Latent Variables

The coefficient of determination is a criterion used to connect the measurement part and the structural part of structural equation modeling and indicates the effect that an exogenous variable has on an endogenous variable. This value is zero for exogenous variables and is reported only for endogenous variables of the model. The higher the R2 value related to the endogenous structures of a model, the better the model fits. Davari and Rezazadeh (2017) citing Chin (1998) have introduced three values of 0.19, 0.33 and 0.67 as criterion values for weak, medium and strong R2 values. The R2 value for endogenous latent variables of the model is presented in Table 10. As can be seen, the model variables have appropriate coefficient of determination values.

Table (10): R2 values for endogenous variables in the model

Variable	R2
Realizing tax revenue through blockchain	0.880
Achieving Blockchain-Based Tax Justice	0.818
Efficiency of the tax system	0.747

Effect Size (f^2) Criterion

The fourth criterion for examining a structural model is the effect size (f^2). Cohen (1988) introduced the effect size criterion to determine the intensity of the relationship between the latent variables of the model. The values 0.02, 0.15 and 0.35 indicate the small, medium and large effect size of one construct on another, respectively, and are shown in Table 11.

Table (11): Effect Size Coefficients (f^2)

Influential (independent) variable	Affected (dependent) variable	
Realizing tax revenue through blockchain	Efficiency of the tax system	2.957
Achieving Blockchain-Based Tax Justice	Realizing tax revenue through blockchain	0.268
Hardware aspects of blockchain implementation	Realizing tax revenue through blockchain	0.042
	Achieving Blockchain-Based Tax Justice	0.357
Blockchain implementation software areas	Realizing tax revenue through blockchain	0.274
	Achieving Blockchain-Based Tax Justice	0.295

Model Predictive Power Criterion (Q2)

This criterion determines the predictive power of the model. Accordingly, models that have acceptable structural fit should be able to predict the indicators related to the endogenous constructs of the model. This means that if the relationships between the constructs in a model are properly defined, the constructs will be able to have a sufficient impact on each other's indicators and thus the hypotheses will be properly confirmed. The Q2 value should be calculated for all endogenous constructs in the model. If the Q2 value for an endogenous construct is zero, it indicates that the relationships between the other constructs in the model and that endogenous construct are not well explained and, as a result, the model needs to be modified. Hensler et al. (2009) have determined three values of 0.02, 0.15, and 0.35 for this criterion, which indicate the weak, medium, and strong predictive power of the model for the endogenous construct indicators, respectively. Table 12 shows the Q2 values for the endogenous constructs in the model, which indicate an acceptable fit of the structural model.

Table (12): Q2 values related to the endogenous variables of the model

Variable	Q2
Realization of tax revenue through blockchain	0.485
Realization of tax justice based on blockchain	0.466
Efficiency of tax system	0.525

Examining the overall model fit

To examine the overall model fit that controls both the measurement and structural model parts, the GOF criterion is used. This criterion was developed by Tenenhaus et al. (2004) and is calculated according to the following formula.

$$GOF = \sqrt{\overline{Communalities} \times \overline{R^2}}$$

and construct each of values shared the average the average $\overline{Communalities}$ Where $\overline{R^2}$ the average R Squares It is the endogenous constructs of the model. Wetzelset al (2009) Three values of 0.01, 0.25, and 0.36 have been introduced as weak, medium, and strong values for GOF.

Table 13 shows the average of the common values and the average of the R Squares values, according to which the GOF value is equal to 0.718, indicating an acceptable fit.

Table (13): Average Communicative Values and Average R Squares Values

$\overline{Communalities}$	$\overline{R^2}$
0.633	0.815
$GOF = \sqrt{0.815 \times 0.633} = 0.718$	
Three values of 0.01, 0.25, and 0.36 represent weak, moderate, and strong fit, respectively.	

Hypothesis Testing

After examining the fit of the measurement models, structural model, and general model, in accordance with the data analysis algorithm in the PLS method, the researcher is allowed to examine and test the relationships between his variables. In this section, the standardized path coefficients related to the hypotheses and t-values are examined. To confirm or reject the hypotheses, the t-value must be greater than or equal to 1.96. The values between these two values indicate that there is no significant difference between the calculated value for the regression weights and the value of zero at the 95 percent level. Table 14 shows the test results.

Table (14): Hypotheses and summary of research results

Row	Hypotheses	Path coefficient	value-T	Result
1	“Hardware Areas of Blockchain Implementation” affect “Realization of tax Justice Based on Blockchain”.	0.492	11.641	Confirmation
2	“Software Areas of Blockchain Implementation” affect “Realization of tax Justice Based on Blockchain”.	0.447	10.412	Confirmation
3	“Hardware Areas of Blockchain Implementation” affect “realization of tax revenue through blockchain”	0.160	3.571	Confirmation
4	“Software Areas of Blockchain Implementation” affect “realization of tax revenue through blockchain”	0.398	9.177	Confirmation
5	“Realization of tax Justice Based on Blockchain” affect “realization of tax revenue through blockchain”	0.421	9.344	Confirmation
6	“Realization of tax revenue through blockchain” affect “efficiency of tax system”	0.864	67.523	Confirmation

In all hypotheses, the t value is greater than 1.96 and the path coefficient is significant at the 0.05 error level. Therefore, all hypotheses were confirmed.

Conclusions and research suggestions

First, specialized texts related to the research topic were selected and reviewed to extract information from them that could be used to analyze the impact of using blockchain technology on corporate income tax. In the next step, based on the initial model, research hypotheses were designed and a questionnaire was created. Then, this questionnaire was distributed to the statistical population and after collecting them, it was analyzed using structural equation modeling (SEM). In the hypothesis testing section, all hypotheses were confirmed. The research findings, broken down by research hypotheses, are as follows:

Hypotheses one and two were confirmed. Attracting blockchain experts and programmers, creating strong infrastructures related to the blockchain-based internet, building integrated databases and building a national blockchain network, designing blockchain-based information systems, developing blockchain alongside e-government, creating and approving blockchain-related laws, creating a tax audit software platform on blockchain, and training tax employees and taxpayers on blockchain will reduce tax evasion and fairly collect taxes from the activities of legal entities.

Hypotheses three and four were confirmed. Creating more efficient, transparent and accountable tax systems, intelligent identification of taxable individuals and companies, establishing strong tax monitoring systems, calculating taxes fairly, eliminating human errors in tax identification, reforming the tax collection process, quickly detecting and identifying tax fraud, connecting to big data, and quickly identifying taxpayers will lead to the realization of tax revenues from the activities of legal entities. Hypothesis five was also confirmed. By using blockchain, the areas for fair detection and collection of income tax on legal entities will be provided, and as a result, tax evasion will be reduced and tax revenues will increase. Hypothesis six was confirmed. Security of tax receipt and payment, rapid tax calculation, reduction of tax costs and time, decentralization, changing the tax structure, transparency and security of tax reporting, secure transfer of tax data, fast and easy traceability of tax information, smart tax exchanges and the creation of smart contracts without human intervention, tax revenues from the activities of legal entities will increase and the cost of tax collection will decrease, so the efficiency of the tax system will increase.

So, in short, blockchain technology will increase public trust in financial and accounting data and serve as a platform for voluntary disclosure of financial and other information. It will simplify processes, increase transparency, and improve accuracy. It will also strengthen trust between market participants, eliminate the need for third-party intervention and verification, provide greater flexibility than current systems, enhance encryption, store and maintain all transactions, and view transactions in real time, increase the country's tax administration's access to tax information, increase tax compliance of companies, reduce tax compliance costs, identify taxes at the time of occurrence, collect them from economic operators, and deposit them into the government's account, and as a result, reduce tax evasion and tax avoidance, collect taxes fairly, and increase government tax revenues.

By comparing the results of the present study with the conducted studies, it was determined that it is consistent with the results of the research of Jo, Yu, Joseph et al., Ghasi et al., Gholizadeh et al., Jamalzadeh et al., and others. It is contrary to the results of the research of La Dorado and is consistent with the results of the research of Hwan Song et al. and Sampson Anoma et al., while they expressed the challenges and consequences of implementing the above technology.

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