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Using the structural equation modeling method in building customer confidence in blockchain-based marketing ecosystem

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Abstract

In less than a decade, innovative blockchain technology can become one of the valuable pillars of business marketing with its gradual presence and the emergence and as well as with giving a clear vision of its presence in the future so that based on its characteristics, it will be able to provide the fields of development and strengthening of confidence in customers. Considering that one of the goals of marketing is to gain customer confidence and blockchain technology based on its capabilities is a technology that tries to develop transparency and confidence in both parties of an exchange, the purpose of this study is to investigate the role of confidence-building components in blockchain technology on the development of customer confidence programs in marketing ecosystems. In this field, the focus of the research is specifically on the insurance industry and customer confidence building in this industry based on blockchain technology. In terms of purpose, the present study is classified as an applied study, and in terms of research type; it is classified as descriptive survey research. The data required for the research was collected based on the opinions of 228 managers and experts in the field of information technology in the insurance industry and a closed-ended questionnaire tool. The collected data were analyzed using the structural equation modeling method and SPSS AMOS 18 software to check the significance of the relationships considered in the research. The results of data analysis showed that, in general, confidence derived from mechanisms and confidence-building capabilities of blockchain technology has a significant and positive relationship with the outcomes of customer confidence in both financial and non-financial dimensions. Also, among the various dimensions of customer confidence, three variables including confidence caused by transparency, confidence caused by privacy, and confidence caused by user supervision have significant relationships with both financial and non-financial outcomes, which confirms the importance of three dimensions of protecting privacy, transparency and ability to monitor interactions and communications for users to gain confidence in the insurance industry business.

Keywords: customer confidence building, blockchain technology, marketing ecosystem, structural equation modeling
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1 Introduction

Nowadays, due to the strong competition in different markets, one of the most important capabilities of businesses, as well as the most difficult and complex functions, is to create and maintain long-term relationships with customers. However, to achieve long-term relationships, there is confidence between both parties of exchange. One of the most key elements that can have significant effects on the quality of customer behavior towards the brand is confidence so that according to studies such as Leninkumar et al. [24], confidence is one of the requirements and prerequisites for achieving customers' loyalty and getting good long-term relationships with them. Therefore, many companies and businesses are trying to provide the bases to take advantage of the favorable outcomes of developing communication and customer confidence using different methods such as relational marketing or modern customer relationship management tools [21]. However, studies have shown that in today's world, this confidence has been damaged due to various reasons and it is necessary to make multiple efforts to build confidence in customers. In recent years, confidence in the communication between customers and companies has undergone negative changes due to reasons such as mass production and reduction of quality-oriented approaches, or the use of short-lived consumable parts, along with other reasons such as lack of optimal service after purchase due to a huge number of the customers, as well as the adoption of competitive policies and cost reduction, such as the removal of some previously available and free parts [5]. In this field, studies such as Rejeb et al. [31] also stated that due to the increase in information and awareness of customers in recent years, issues and challenges such as environmental pollution and environmental destruction because of economic activities of businesses and the lack of sustainable approaches in product and service delivery processes have become one of the most important sources for lack of confidence and unwillingness to establish long-term relationships between customers and businesses.

In such a situation, manufacturing, and service businesses have no choice to restore this damaged confidence except to use new solutions and tools; and information and communication technology is one of the most important tools that can be used to reduce the gap between these two parties through creating communication channels between the customer and business. Among these, Blockchain technology is one of the newest and most developing technologies. Blockchain is a distributed and decentralized ledger that can store a large amount of information related to various transactions and makes all this stored information available to all members of the network. Blockchain technology can be defined according to its key components and concepts. Blockchain is a distributed ledger for recording transaction data records dynamically without a central institution using a mechanism based on the universal agreement to check the validity of transactions [4]. In less than a decade, Blockchain technology can become one of the valuable pillars of business marketing with its gradual presence and the emergence and as well as with giving a clear vision of its presence in the future so that based on its characteristics, it will be able to provide the fields of development and strengthening of confidence in customers. Because according to studies such as Shin and Bianco [32], the foundation of this technology is based on transparency, decentralization, and creating confidence and it can well improve confidence through its unique features and capabilities in the marketing activities of brands. According to experts' opinions, Blockchain technology can strengthen the fields of building confidence in customers due to its characteristics. Ding et al. [11], showed that the most basic features and capabilities of Blockchain technology that can be the foundation for its use in brand marketing actions include 1) the ability to track data; 2) to decentralize data storage and access of all network members to all data and 3) the impossibility of manipulation and change in data. Also, studies have shown that due to the transparency and access to information in Blockchain technology, its use is highly attractive in developing customer confidence and loyalty in both B2C and B2B sectors because it leads to a reduction in fraudulent actions and an increase in customer confidence in the program [30]. Thus, Blockchain technology is a desirable tool in the field of building customer confidence.

Despite the value and importance of Blockchain technology in the field of confidence-building actions in the marketing sector, how the confidence mechanisms and capabilities of this technology in marketing ecosystems are practically effective in the field of outcomes and consequences of customer confidence in the brand is ambiguous. This means that it is not clear how the use of Blockchain technology in the direction of customer confidence building will affect the financial and non-financial outcomes resulting from strengthening customer confidence. The present study seeks to investigate the key factors affecting customer confidence building in the Blockchain-based marketing ecosystem. In this context, it can be partially stated that based on recent studies such as Rejeb et al. [31], on the importance of using Blockchain technology in the development and improvement of the quality of relationships between customers and brands, and especially in strengthening confidence and transparency in relationships and declaring the need to develop studies in this sector, as well as Brophy's research [6], in the context of the importance and the role of Blockchain technology in creating fundamental changes in various sectors of the industry and to announce the need to develop studies in this sector, the present research seeks to investigate the effect of factors related to customer confidence based on Blockchain on the consequences of the development of confidence in its various dimensions to expand the scope

of knowledge in the field of applications of Blockchain technology in marketing actions. The researcher tries to check how is the significance of the effects of these mechanisms in terms of financial and non-financial outcomes based on the existing literature in the field of confidence-building mechanisms of Blockchain technology and the consequences introduced due to the strengthening of confidence in customers. In this context, the main research question can be raised as follows:

What is the impact of the key factors affecting customer confidence based on Blockchain on financial and non-financial outcomes resulting from the development of customer confidence?

2 Theoretical foundations

2.1 Blockchain technology in the marketing ecosystem

The business ecosystem metaphor was first proposed by Moore [27]. Based on this metaphor, nowadays the activity space of organizations is in a business ecosystem. This ecosystem consists of members such as customers, suppliers, manufacturers, shareholders, trade associations, labor unions, governmental and semi-governmental institutions, and other interested parties. There are mutual and complex relationships between these members and their success and survival depend on each other. One of the subsets of this system is the marketing ecosystem, which consists of elements that shape companies' marketing and interactions and communications between them. In this ecosystem of interactions and exchanges, information has a major role and contribution, and, in addition to observing the quality of services and products using the information exchanged in the area of that product and service, customers plan and shape their processes of shaping consumption behaviors towards a brand. Therefore, in a marketing ecosystem, how businesses manage communication and interactions is very important, and in the meantime, new technologies such as Blockchain have made the way for this management smoother.

Innovative Blockchain technology became known as the distributed ledger at the same time as the emergence of the Bitcoin cryptocurrency in 2008. In Blockchain technology, the ledger is the main record keeper that maintains the list of blocks. Each block stores data or information. This data and information can have any coordinates and quality. Normally, there is a central device that is responsible for all data and can do whatever it wants with it. Blockchain is based on a distributed and decentralized ledger. In other words, many devices are connected in a peer-to-peer manner. Therefore, this system is not centralized and all these devices have a copy of the ledger. In this structure, the information defined in each block is dependent on the previous block and there is a distributed version, and it is extremely difficult to change and corrupt the information [7]. One of the advantages of this technology is that building confidence is part of its inherent features and its use in business interactions and exchanges can greatly reduce the amount of concern regarding the lack of confidence between the parties because all exchanges are transparent, and practically any change in data must be agreed upon by the entire network on the one hand, and the change records will be completely preserved and undeletable on the other hand [23]. In this context, studies such as Stallone et al [33] stated that Blockchain technology includes a physical and tangible meaning, i.e. a chain of blocks, and it includes a secret and hidden meaning, i.e. digital information in a database and using a concept in the sense of smart contracts, it is capable to provides an executive environment with a high level of reliability for the parties to carry out an exchange. Blockchain facilitates the development of digital marketing due to advantages such as improving transparency and efficiency, preventing fraud, developing a user experience, and direct and unmediated interaction between brands and customers.

Blockchain technology in the market can be an appropriate tool that enables brands and consumers to bypass mediation and create stronger relationships. This technology allows brands to expand their advertising campaigns, improve their customer targeting capabilities, and increase service responsiveness. Its interactive and inclusive features allow marketers to effectively share their commercial content and reduce costs by bypassing intermediaries [30]. In addition, Blockchain in the market can help prevent the malicious marketing of counterfeit products that violate the original manufacturer's intellectual property rights and copyright laws. This is due to technology's ability to facilitate end-product traceability and strict monitoring rules. In addition, transparency based on Blockchain technology builds confidence, because consumers have more visibility and verification of compliance obligations of brand claims [31]. By ensuring this high level of transparency, marketers will be able to show the positive characteristics of their actions and emphasize their altruistic motivation to look after the best interests of consumers.

2.2 Building customer confidence based on Blockchain

Confidence is a complex structure that is related to the relationships between people in different groups and organizations. The difference between the concept of confidence as a desire, expectation, belief, assurance, attitude,

feeling, or behavioral intention with confidence as a mental state, confusion, and misunderstanding has caused many studies to investigate the topic of confidence [14]. Despite this, confidence is recognized as a convergent, dynamic, and reflective process. In this process, the customer (as a confidant) has reliable beliefs and positive expectations from the service provider, both as an organization and as a trustee of an organization [18]. Considering the existence of potential capabilities in Blockchain technology, it can be expected that with the use of this technology, deep and significant developments have been made in areas such as confidence, data integrity, data traceability, correct scheduling and transparency, and based on researches such as Antoniadis et al. [2], the confidence of customers towards brands and their marketing actions will be increased by creating transparency. One of the reasons for creating confidence in Blockchain technology is the elimination of interactive intermediaries and the creation of direct communication. The removal of intermediaries between commercial parties in the field of financial and non-financial interactions and exchanges, and its ability to validate stored and distributed interactions and exchanges are among the most fundamental and confidence-building features of Blockchain technology [36].

The review of research literature in the field of customer confidence building in the Blockchain-based marketing ecosystem shows that the studies in this area are in the early stages and only ideas and suggestions are being formed. In this context, it can be said that the investigation of the role of Blockchain technology in strengthening customer confidence in organizations and companies has been noticed since 2017 due to the expansion of the applications of this technology in various fields. Studies over the past few years based on the nature and characteristics of Blockchain technology recommend its use in the field of interactions and exchanges between natural and legal customers and brands due to the transparent nature of interactions and its decentralized nature. In this field, studies such as [31] and [9] introduce the use of Blockchain as a factor in strengthening and developing customer confidence, believing in the honesty of organizations, and effective in improving transparency while examining the various fields of application of this technology in marketing. In this regard, Udegbe [35] states that Blockchain technology can lead to improving the confidence and loyalty of customers by improving the effective distribution of information among customers, improving transparency for them, and creating grounds for preventing fraud. But perhaps the most important and serious study conducted in this field is the study done by Da Silva and Moro [10], in which the pioneer and empowering role of Blockchain in building consumer confidence have been taken into consideration based on the text mining of articles in the field of Blockchain technology application in marketing actions. In this study, it was shown that Blockchain technology can be one of the most important motivators of customer confidence through creating transparency. However, the study warns that the researches in this field are extremely limited, especially in areas such as traceability and protecting privacy as important aspects of consumer confidence which have not received the attention of researchers. As can be seen, the scope of knowledge on the role of Blockchain technology in restoring, building, or developing customer confidence in various fields is extremely limited and except for a few introduced studies, the rest of the research emphasizes examining and analysis of this role in future studies. Therefore, considering the existence of little reliable evidence on the effectiveness of using Blockchain technology in building customer confidence in the marketing ecosystem and the high limitation of the existing literature in this area, the present research will try to investigate the factors affecting building customer confidence in the Blockchain-based marketing ecosystem.

Table 7 of the Appendix A section shows confidence-building mechanisms resulting from Blockchain technology in the field of marketing. In this context, the qualitative research of Ghavidast [15] showed that the confidence resulting from the use of Blockchain technology in the marketing ecosystem can be caused by data security, redistribution of power, shopping experience and interaction with the brand, protecting privacy, transparency, the power of technology and user supervision. In the present study, these general dimensions have been considered as the results of the latest and most relevant research in this area. Various security-creating mechanisms have been considered in this field. For example, in the area of data security-based confidence as one of the key confidence-building areas, studies such as Rejeb et al. [31] have emphasized anti-counterfeiting and the impossibility of deleting data as two key security mechanisms, while Golosova and Romanovs [16] consider security approaches and mechanisms such as the existence of distributed systems, the randomness of information distribution and continuous validation of interactions and exchanges as three key security areas resulted from Blockchain technology. On the other hand, Blockchain technology includes mechanisms that lead to the distribution of information power among all the people in the network. In this context, for example, studies such as Gorkhali et al. [17] showed that the removal of ownership of data processing, along with the equality of processing power between the service provider and the client, is one of the factors that create the balance of information power between customers and businesses. Similarly, other confidence-building mechanisms and procedures resulting from Blockchain technology have been presented in Table 1.

On the other hand, the use of Blockchain technology in the marketing ecosystem of businesses can be associated with various outcomes. In this context, the study of Ghavidast [15] showed that these outcomes can be classified into

two categories: financial and non-financial outcomes. The studies conducted in the last few years also emphasize the same point. For example, Peres et al. [29], considered the non-financial outcomes of using Blockchain technology in marketing actions to include increased brand engagement and the ability to track suppliers by the brands. Among the financial outcomes, studies such as Tan and Saraniemi [34] emphasized the outcomes of increasing the income of businesses and creating added value for both company and the customers. Other financial and non-financial outcomes related to the use of Blockchain technology in the field of marketing actions are presented in Table 7 of Appendix A.

3 Research methodology

This research is applied research in nature. The reason for classifying the present study in this group of studies is that the current study seeks to apply the results of the research to improve customer confidence in the marketing ecosystem based on the use of mechanisms and approaches of Blockchain. On the other hand, this is descriptive-correlational research in terms of its nature. It is descriptive because the researcher is looking for a hidden truth in the environment without manipulating the environment and research variables, i.e. the effects of mechanisms and procedures from Blockchain technology in the confidence-building area on the perceived outcomes of using this technology in marketing ecosystems in the insurance industry. It is the country. According to the subject of the research, the statistical population of this research consists of managers and experts in the field of information technology in the insurance industry that they have research and executive records in both academic and industrial sectors, especially in the fields of marketing, and are experts in digital marketing and advanced information technology. In this research and to complete the questionnaires, due to the uncertainty of the population size, a sample size of 385 people was selected based on the Cochran Formula and by determining the appropriate degree of error. Questionnaires were distributed based on convenience sampling. In this way, 385 questionnaires were distributed among the statistical population, and finally, 228 proper questionnaires that were capable of statistical analysis were collected.

Also, in the current research, the CVR index based on experts' opinions and confirmatory factor analysis (based on the collected questionnaires) were used to measure the content validity of the research questionnaire. This method measures the degree of agreement between raters or judges on the "appropriateness or essentiality" of a particular item or question [26]. First, 13 questionnaires were distributed among experts to measure the content validity of the tool. This questionnaire was presented to experts in the form of three options which aims to evaluate the necessity of each of the questions related to each variable. In the next step, the Lawshe ratio of each question was calculated using the following formula:

$$CVR = \frac{\left(ne - \frac{N}{2}\right)}{\frac{N}{2}} \tag{3.1}$$

where CVR was the content validity of each item, N was the total number of experts or judges who were 13 people in this study, and ne was the number of opinions about the necessity of the item from 13 experts compared to the desired item. The obtained ratio was compared with the Lawshe content validity ratio table and the content validity of the instrument was accepted. In this regard, for 13 experts, the Lawshe ratio is equal to 0.54, and the coefficients of all research items were more than this value. To confirm the reliability of the questionnaire, its homogeneity was measured by Cronbach's Alpha, which confirmed the reliability of the entire questionnaire with a value of 87%. The alpha percentage of each variable also shows the appropriate reliability of the used tool. Therefore, it was found that the homogeneity of the questions i.e. the degree of interference of all the questions in terms of measuring a common characteristic, is adequate. The analysis method of the current research is structural equation one.

The structural equation model is one of the new statistical methods and one of the most robust multivariate analysis methods, and its main application is in multivariate subjects. Multivariate analysis refers to a series of analysis methods whose main feature is the simultaneous analysis of several independent variables with several dependent variables. Structural equations are from the multivariate regression family, which allows researchers to test a set of regression equations simultaneously (Eq. (3.2)).

$$n_t = \beta_1 + \beta_2 m_t + \beta_3 g_t + \varepsilon_{1t} \tag{3.2}$$

The model should be named according to the number of parameters of the model and the parameters should be entered into the model (Eqs. (3.3)–(3.8)):

$$n_t = \beta_{11} + \beta_{12} m_t + \beta_{13} p_t + \varepsilon_{2t} \tag{3.3}$$

$$n_t = \frac{\{(\beta_1\beta_{13} - \beta_{11}\beta_3) + \beta_{13}\beta_2 g_t^{-}\beta_3\beta_{12} m_t - \beta_3\beta_{14} n_{t-1} + (\beta_{13}\varepsilon_{1t} - \beta_3\varepsilon_{2t})\}}{\beta_{13} - \beta_3} \tag{3.4}$$

$$p_t = \frac{\{(\beta_1 - \beta_{11}) + \beta_2 g_t^- \beta_{12}\beta_{12} m_t - \beta_{14} n_{t-1} + (\varepsilon_{1t} - \varepsilon_{2t})\}}{\beta_{13} - \beta_3} \tag{3.5}$$

$$erf(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt.$$
$$n = \max(n_1, n_2) \tag{3.6}$$

where:

$$n_1 = \left\lceil 50\left(\frac{j}{k}\right)^2 - 450\left(\frac{j}{k}\right) + 1100 \right\rceil$$
$$n_2 = \left\lceil \frac{2}{2H}\left(A\left(\frac{\pi}{6} - B + D\right) + H + \sqrt{\left(A\left(\frac{\pi}{6} - B + D\right) + H\right)^2 + 4AH\left(\frac{\pi}{6} + \sqrt{A} + 2B - C - 2D\right)}\right)\right\rceil \tag{3.7}$$

where:

$$A = 1 - p^2$$
$$B = parcsin\left(\frac{p}{2}\right)$$
$$C = parcsin(p)$$
$$D = \left(\frac{\delta}{z_1 - \alpha/2 - z_1 - \beta}\right)^2$$

where j is the number of observed variables, k is the number of latent variables, ρ is the estimated Gini correlation for a normal random vector of variables, δ is the predicted effect size, α is the corrected type I error rate, β is the type II error rate, and z is a standard score.

$$F(x; \mu, \sigma^2)\frac{1}{2}\left[1 + erf\left(\frac{x - \mu}{\sigma\sqrt{2}}\right)\right] \tag{3.8}$$

where μ is the mean, σ is the standard deviation, and erf is the error function. Now the same steps can be done using the software.

- Goodness-of-fit tests

  As their name suggests, goodness-of-fit tests are used to determine whether a particular distribution is well-fitted. Calculating goodness-of-fit statistics also helps to rank the fitted distributions according to how well they fit the data.

- The first index- RMESA

$$RMESA = \frac{\sqrt{(X^2 - df)}}{\sqrt{[df(N-1)]}} \tag{3.9}$$

- The second index- GFI

$$GFI = 1 - \frac{F(S, \sum(\acute{\theta}))}{F(S, \sum(.))} \tag{3.10}$$

- The third index – AGFI

$$AGFI = 1 - \frac{k(k+1)}{2d}(1 - GFI) \tag{3.11}$$

4 Data analysis

To analyze the data collected from the questionnaire (this questionnaire contains the items introduced in Table 7 of Appendix A, which were evaluated based on a 5-point Likert scale), inferential statistics and structural equation modeling tools were used in SPSS AMOS 18 Software. The method of structural equation modeling includes two

Table 1: Kolmogorov–Smirnov test

Variables	Dimensions	Significance level	Error level	Test result
Confidence caused by data security	Security due to fundamental features	0.096	0.05	Normal
	Security mechanisms	0.074	0.05	Normal
Confidence caused by redistribution of power	–	0.139	0.05	Normal
Confidence resulting from the shopping experience and interacting with the brand	Improving shopping experience	0.121	0.05	Normal
	Increasing brand engagement	0.103	0.05	Normal
Confidence caused by privacy	–	0.992	0.05	Normal
Confidence caused by transparency	Transparency due to the use of technology	0.089	0.05	Normal
	Transparency due to Blockchain elements	0.267	0.05	Normal
	Transparency due to the nature of technology	0.092	0.05	Normal
Confidence caused by the power of technology	–	0.083	0.05	Normal
Confidence caused by user supervision	–	0.094	0.05	Normal
Non-financial outcomes	–	0.193	0.05	Normal
Financial outcomes	–	0.110	0.05	Normal

parts: the measurement model and the structural model. To verify the use of parametric approaches of SPSS AMOS 18 Software, as well as to measure the necessary conditions for using the structural equation modeling method, tests have been carried out, which are mentioned below. The first test is the Kolmogorov-Smirnov test used to check the normality of data distribution. The results of this test are presented in Table 1.

According to Table 1 and based on the obtained value, the significance level of all variables is greater than the error value. As a result, the data related to each variable of the research follow a normal distribution. Due to the high sample size and close-to-normal distribution of the data, parametric statistics and SPSS AMOS 18 software are used for data analysis. Another primary test implemented on the data is the test related to measuring the basic condition of using the structural equation modeling method, that is, the desirability of correlation between variables. For this purpose, KMO and Bartlett test was implemented. The result of this test can be seen in Table 2.

Table 2: Results of Bartlett's test and KMO index

KMO and Bartlett's Test		
Bartlett's Test	KMO	0.728
	Chi-Square Statistic	1.587
	Degree Of Freedom	78
	Significance Level	0.000

The value of KMO in this research is equal to 0.728. If this index is greater than 70%, the correlation between the variables and the results of the factor analysis will be suitable for the investigated data [28]. According to the value identified for the variables of the present study, the sampling adequacy index is appropriate for the investigated data. In this output, the null hypothesis means that the taken samples are not adequate, and on the other hand, the alternative hypothesis is based on the fact that the samples taken for the factor analysis of the desired variables are adequate. Since the significance level (sig) is less than 5 percent, it can be concluded that the null hypothesis is not confirmed at the 5 percent error level or 95% confidence interval, and therefore, the alternative hypothesis i.e. the adequacy of the model is accepted. Based on the obtained results, the structural equation modeling method in SPSS AMOS 18 Software is used in this research.

4.1 Measurement model

In the methodology of structural equation modeling, it is first necessary to examine the construct validity and reliability to determine whether the indicators selected to measure the desired constructs have the necessary accuracy.

For this purpose, confirmatory factor analysis is used in such a way that the factor loading of each indicator with its construct has a value greater than 0.5. In this case, this indicator has the necessary accuracy to measure that latent construct or characteristic [19]. In Table 3, the first and second-order factor loadings related to the research questions are presented. Based on the results of this table, construct validity is obtained by removing the observable variables whose factor loading is less than 0.5.

Table 3: Factor loading of items in the test model

Variables	**Dimensions**	**Questions**	**First stage factor loading**	**Second stage factor loading**
Confidence caused by data security	Security due to fundamental features	Question 1	0.326	–
		Question 2	0.582	0.464
		Question 3	0.598	0.582
		Question 4	0.760	0.769
		Question 5	0.730	0.743
		Question 6	0.641	0.647
		Question 7	0.385	–
	Security mechanisms	Question 8	0.210	–
		Question 9	0.541	0.279
		Question 10	0.228	–
		Question 11	0.593	0.512
		Question 12	0.592	0.618
		Question 13	0.542	0.566
		Question 14	0.540	0.572
		Question 15	0.764	0.764
		Question 16	0.549	0.528
Confidence caused by redistribution of power	–	Question 17	0.660	0.660
		Question 18	–	–
		Question 19	0.816	0.816
		Question 20	0.754	0.754
		Question 21	0.239	–
		Question 22	0.517	0.517
Confidence resulting from the shopping experience and interacting with the brand	Improving shopping experience	Question 23	0.593	0.594
		Question 24	0.766	0.772
		Question 25	0.761	0.755
	Increasing brand engagement	Question 26	0.436	–
		Question 27	0.581	0.555
		Question 28	0.720	0.751
		Question 29	–	–
		Question 30	0.578	0.600
Confidence caused by privacy	–	Question 31	0.335	–
		Question 32	0.539	0.539
		Question 33	0.817	0.817
Confidence caused by transparency	Transparency due to the use of technology	Question 34	0.616	0.754
		Question 35	0.554	0.585
		Question 36	0.216	–
	Transparency due to Blockchain elements	Question 37	0.308	–
		Question 38	0.730	0.569
		Question 39	0.843	0.538
	Transparency due to the nature of technology	Question 40	0.081	–
		Question 41	0.450	–
		Question 42	0.656	0.684
		Question 43	0.725	0.717
		Question 44	–	–
		Question 45	0.700	0.744
		Question 46	0.721	0.826

Confidence caused by the power of technology	–	Question 47	0.794	0.794
		Question 48	0.983	0.983
		Question 49	0.756	0.756
Confidence caused by user supervision	–	Question 50	0.738	0.738
		Question 51	0.722	0.722
		Question 52	0.812	0.812
Non-financial outcomes	–	Question 53	0.755	0.755
		Question 54	–	–
		Question 55	0.883	0.883
		Question 56	0.789	0.789
		Question 57	0.841	0.841
		Question 58	0.823	0.823
		Question 59	0.075	–
		Question 60	0.020	–
		Question 61	0.510	0.510
Financial outcomes	–	Question 62	0.870	0.870
		Question 63	0.500	0.500
		Question 64	0.615	0.615
		Question 65	0.288	–

As it is clear from Table 3, in the current study, all coefficients of the factor loadings of the questions, except for questions No. 1, 7, 8, 10, 2, 9, 26, 36, 37, 40, 41, 21, 31, 59, 60 and 65 are greater than 0.5. The deleted questions were removed due to not obtaining the appropriate factor loading value and were left out of the analysis process. After achieving the desired level of factor loadings in the measurement model, the second part of the reliability analysis is related to checking the reliability of the items. In Table 4, the reliability of constructs is presented.

Table 4: Reliability of model constructs

Number	Construct	Cronbach's alpha	Composite reliability
1	Security due to fundamental features	0.761	0.781
2	Security mechanisms	0.761	0.756
3	Confidence caused by redistribution of power	0.733	0.785
4	Improving shopping experience	0.747	0.752
5	Increasing brand engagement	0.716	0.773
6	Confidence caused by privacy	0.753	0.797
7	Transparency due to the use of technology	0.706	0.759
8	Transparency due to Blockchain elements	0.750	0.781
9	Transparency due to the nature of technology	0.711	0.832
10	Confidence caused by the power of technology	0.880	0.885
11	Confidence caused by user supervision	0.801	0.0.802
12	Non-financial outcomes	0.786	0.899
13	Financial outcomes	0.733	0.709

Statistical study sources believe that the minimum acceptable value for Cronbach's Alpha is equal to 0.6 and the minimum acceptable value for the composite reliability index is equal to 0.707 [19]. As can be seen in the above table, all research constructs meet these minimum conditions and are even at a much higher level. Therefore, the reliability of model constructs is supported. On the other hand, according to Chin [8], the Average Variance Extracted index (AVE) is a suitable index for determining the convergent validity of model constructs. Based on Chin [8], the minimum acceptable level for this coefficient is 0.5. Examining this index between the constructs of this research shows that in all constructs of the research, the score of this coefficient is much higher than the mentioned threshold, and therefore, the constructs are very good in terms of convergent validity. This review is presented in detail in Table 5.

4.2 Structural model

After ensuring the appropriate measurement of the research constructs, the final model was implemented in the structure of the relationships between Blockchain technology's confidence-building mechanisms in the marketing ecosystem and financial and non-financial outcomes in the software, and the relationships between these factors were studied.

Table 5: Convergent validity of model constructs

Number	Construct	Average Variance Extracted (AVE)
1	Security due to fundamental features	0.523
2	Security mechanisms	0.519
3	Confidence caused by redistribution of power	0.585
4	Improving shopping experience	0.506
5	Increasing brand engagement	0.511
6	Confidence caused by privacy	0.557
7	Transparency due to the use of technology	0.544
8	Transparency due to Blockchain elements	0.549
9	Transparency due to the nature of technology	0.555
10	Confidence caused by the power of technology	0.723
11	Confidence caused by user supervision	0.575
12	Non-financial outcomes	0.603
13	Financial outcomes	0.562

Table 6 shows the results of examining the relationships identified in the model. According to this table, when the t-statistics is more than (1.96) or less than (-1.96), the above relationship is confirmed.

Table 6: Examining the assumed relations

Relations	Route			Standard coefficient	t-statistics	Result
Relation 1	Confidence	>>>>	Financial outcomes	0.645	4.368	Confirmed
Relation 2	Confidence	>>>>	Non-financial outcomes	0.862	6.178	Confirmed
Relation 3	Confidence caused by data security	>>>>	Financial outcomes	0.105	1.312	Rejected
Relation 4	Confidence caused by data security	>>>>	Non-financial outcomes	0.018	0.257	Rejected
Relation 5	Confidence caused by redistribution of power	>>>>	Financial outcomes	0.284	2.694	Confirmed
Relation 6	Confidence caused by redistribution of power	>>>>	Non-financial outcomes	0.057	0.667	Rejected
Relation 7	Confidence resulting from the shopping experience and interacting with the brand	>>>>	Financial outcomes	0.300	2.315	Confirmed
Relation 8	Confidence resulting from the shopping experience and interacting with the brand	>>>>	Non-financial outcomes	0.038	0.446	Rejected
Relation 9	Confidence caused by privacy	>>>>	Financial outcomes	0.294	3.106	Confirmed
Relation 10	Confidence caused by privacy	>>>>	Non-financial outcomes	0.485	4.274	Confirmed
Relation 11	Confidence caused by transparency	>>>>	Financial outcomes	0.203	2.352	Confirmed
Relation 12	Confidence caused by transparency	>>>>	Non-financial outcomes	0.737	4.987	Confirmed
Relation 13	Confidence caused by the power of technology	>>>>	Financial outcomes	0.036	0.406	Rejected
Relation 14	Confidence caused by the power of technology	>>>>	Non-financial outcomes	0.065	0.787	Rejected
Relation 15	Confidence caused by user supervision	>>>>	Financial outcomes	0.491	2.692	Confirmed
Relation 16	Confidence caused by user supervision	>>>>	Non-financial outcomes	0.287	2.279	Confirmed

As the results in Table 6 show, among the 16 relations on the role of mechanisms and approaches from Blockchain

technology in the confidence-building area among customers in the insurance industry to shape the consequences of this confidence, 10 hypotheses are confirmed while 6 hypotheses were rejected. This means that based on the taken sample and the collected and analyzed opinions, it can be concluded that confidence using mechanisms and approaches based on Blockchain technology can lead to favorable financial and non-financial outcomes for businesses. But in more detail, the results showed that confidence caused by data security (resulting from the use of Blockchain technology) had no significant relationship with both financial and non-financial outcomes, and confidence caused by redistribution of power was significantly related only to financial outcomes. Similarly, confidence resulting from the shopping experience and interacting with the brand is only related to financial outcomes, but confidence caused by privacy has significant relationships with both financial and non-financial outcomes variables, which shows the high importance of this type of confidence for customers. The same issue is true for the relationships between confidence caused by transparency and confidence caused by user supervision with financial and non-financial outcomes, and both of these mechanisms have significant relationships with financial and non-financial outcomes. Finally, according to the obtained results, confidence caused by the power of technology has no significant relationship with both variables of financial and non-financial outcomes. But among the relationships whose significance has been confirmed, the relationship between confidence caused by transparency and non-financial outcomes was identified as the most powerful relationship, which shows the importance of the capabilities and mechanisms of Blockchain technology in the field of creating transparency in relationships and interactions to build confidence and the role of such confidence in achieving non-financial outcomes for businesses due to customer confidence in business.

5 Discussion and conclusion

In this research, to measure the factors affecting customer confidence in the Blockchain-based marketing ecosystem, a quantitative approach and structural equation modeling method were used in the form of two parts: confirmatory factor analysis and structural modeling. The final output of these two phases includes the evaluation of the quality and adequacy of the research items to measure the research variables and evaluate the significance of the relationship between confidence-building mechanisms based on Blockchain technology in marketing ecosystems in the insurance industry with the outcomes of customer confidence in these ecosystems. Based on the structural equation modeling method and using a standard questionnaire tool, the required data was collected based on a sample of 228 digital marketing experts and advanced information technology experts in the country's insurance industry. The results of the structural equation modeling and test related to it showed that among the variables of the research, the three variables including confidence caused by privacy, confidence caused by transparency, and confidence caused by user supervision are the most important confidence-building mechanisms based on Blockchain technology because all three variables have significant relationships results with both financial and non-financial outcomes.

Based on the results of this research, Blockchain technology's confidence-building mechanisms can lead to various financial and non-financial outcomes related to customer confidence in the country's insurance industry business. Blockchain technology can transform many old and inefficient infrastructures of current insurance and redesign and rebuild data recording, transactions, processes or validation and authentication, and even payment and pricing solutions in the marketing ecosystem and change it unbelievably. Nevertheless, in recent years, a significant number of technology-based innovations have emerged, which were able to change the infrastructure of financial services and improve many financial processes. The emergence of a large number of Fintech companies that have questioned even the historical governance of banking systems and government financial institutions indicates the growing trend of this innovation in various industries. Interactions between customers and brands are based on trust, and now Blockchain technology can guarantee this confidence, customer requests are responded to with high confidence and security, and providers keep their promises in long-term and short-term adherence. Obviously, with the transparency provided by Blockchain technology, security, information protection, and confidence will be provided in the best possible way. Unfortunately, in the current marketing ecosystem of the country, despite having a long history, many of its laws are outdated. On the other hand, the possibility of human error and misuse of information can lead to risks in which information can be lost, manipulated, and even misjudged. For this reason, Blockchain can solve these problems in terms of security, efficiency, and customer satisfaction. While Blockchain technology can improve marketing in terms of accuracy, efficiency, privacy, and other dimensions, it is important to understand that any brand that embraces Blockchain must agree to meet ethical standards. Standards and processes must be aligned so that Blockchain provides better tools for collaboration, data sharing, and reducing related problems.

Based on the obtained results, one of the most important practical aspects and Blockchain technology-based key confidence-building mechanisms are confidence-building mechanisms in the privacy area. These mechanisms and procedures include 3 items: maximum protection of users' personal information, customer power at the level of disclosure of personal information and reducing malicious advertising practices, and the use of Blockchain technology

in the insurance industry through these three mechanisms will be able to lead to achieve customer confidence due to the reduction of their concerns in the privacy area, and as a result, it has provided the necessary bases for creating favorable financial and non-financial outcomes for businesses. Factor analysis results of items of the research showed that among these 3 items, reducing malicious advertising practices is the strongest indicator for measuring confidence caused by privacy, which confirms the importance of this confidence-building mechanism for customers to believe in the power of Blockchain technology in protecting their privacy; because malicious advertisements are capable to create privacy-related concerns in users through actions such as collecting user data and customizing or personalizing advertisements or providing malicious spam.

Based on the obtained results, another important aspect of the application and Blockchain technology-based key confidence-building mechanisms is confidence-building mechanisms in the field of transparency. These mechanisms and procedures include three components: transparency due to the use of technology, transparency due to Blockchain elements, and transparency due to the nature of technology, which in total they contained 11 items or confidence-building mechanisms. Based on the results, the use of Blockchain technology in the insurance industry through these mechanisms will be able to lead to customer confidence by reducing their concerns about the lack of transparency, and accordingly, the necessary bases to create favorable financial and non-financial outcomes for businesses will be provided. The results of the factor analysis of the research components showed that among these three components, the item having constant access to the network from the transparency due to the nature of the technology subcategory is the strongest indicator of measuring confidence caused by transparency, which confirms the importance of this confidence-building mechanism for customers believe in the power of Blockchain technology in the field of protecting and developing transparency in interactions and communications; because Blockchain technology, due to its capabilities and features, can provide the basis for the permanent presence of participants in blockchains in all exchanges and interactions through continuous and permanent access to the network, and thus virtually no concealment or opaque exchanges will not occur in the network.

Based on the obtained results, one of the most important practical aspects of Blockchain technology-based key confidence-building mechanisms is confidence-building mechanisms in the user supervision area. These mechanisms and procedures include 3 items receiving and providing maximum feedback, the ability to track the origin of data by the customer and the ability to control the viewing of advertisements by the user, and the use of Blockchain technology in the insurance industry through these three mechanisms will lead to customer confidence by reducing their concerns regarding the lack of supervision of the behavior and actions of insurance companies, and as a result, it has provided the necessary bases for creating favorable financial and non-financial outcomes for businesses. Factor analysis results of research items showed that among these 3 items, the ability to control the viewing of advertisements by the user is the strongest indicator of measuring confidence caused by user supervision, which confirms the importance of this confidence-building mechanism for customers to believe in the power of Blockchain technology in the field of creating supervisory power for customers and users in the Blockchain-based network; because through measures such as collecting user data and personalizing advertisements, the advertisement can provide people with a sense of insecurity and the power of the user in terms of what level of information about him can be available on the network or not and basically, at what level the advertising processes and marketing actions can focus on him as a target customer can improve users' perceptions in the field of control over advertisements.

6 Suggestions and limitations

- In the current study, the researcher's focus is on the identification of significant relationships between confidence-building mechanisms and approaches caused by Blockchain technology in the marketing ecosystem of the insurance industry, and on the outcomes of customer confidence in this ecosystem. It is suggested that to develop the present study, future research should be focused on identifying confidence strategies in the marketing ecosystem based on Blockchain technology, as well as the environmental causes and factors affecting this confidence. Because there is a need to investigate based on what strategies or mechanisms the confidence process can be improved more effectively according to the existing mechanisms. In addition, the present study did not pay attention to the many environmental factors (factors outside of technical issues and Blockchain technology's confidence-building mechanisms) affecting confidence in Blockchain technology-based marketing actions.

- According to the findings of this research and the existing limitations, it is suggested that in line with the findings of this research, future studies should seek to expand the range of factors identified in the field of customer confidence in the marketing ecosystem based on Blockchain technology in the study. Because the model introduced in the current study was designed by focusing on the structures, features, and capabilities of Blockchain technology and naturally based on the essential differences between this technology and other new technologies used in

marketing and branding such as artificial intelligence, internet of objects, Metaverse, etc., these dimensions need to be developed or adjusted according to these different technologies from Blockchain technology. The important point is to focus on the pathology of these relationships. Because predicting the damage facing confidence from an organization or group of organizations can lead to a more effective implementation of confidence in various industries and fields. For example, Blockchain technology and the mechanisms and functional features of this technology also contain shortcomings and negative points that it is necessary to investigate the effects of these items on customer confidence, specifically in the insurance industry.

A Appendix

Table 7: Mechanisms and confidence-building capabilities of Blockchain technology and the consequences of customer confidence in the brand

Variable	Dimensions	Items	Reference
Confidence caused by data security	Security due to fundamental features	Data invariability	[3]
		Anti-counterfeiting	[31]
		Unable to delete data	[31]
		Impossibility of manipulating registered data	[3]
		The security-creating nature of the network instead of the individual	[15]
		High costs of hacking the system	[17]
		The existence of distributed systems	[16]
	Security mechanisms	Continuous validation of identity information	[22]
		Continuous validation of interactions and exchanges	[16]
		Increasing security by providing a source of information	[17]
		Ability to create a digital signature	[3]
		Using information chain links	[15]
		The randomness of information distribution	[16]
		Decentralized storage	[15]
		Continuous encryption of data	[3]
		Data security control in each node	[1]
Confidence caused by redistribution of power	–	Functional independence of elements	[12]
		Equality of processing power between the service provider and the client	[17]
		Removal of ownership of data processing	[17]
		No need for a single monitoring system	[1]
		Decentralization of the system	[12]
		The existence of collective agreement law	[15]
Confidence resulting from the shopping experience and interacting with the brand	Improving shopping experience	Reducing the possibility of fraud and forgery in products	[20]
		Reducing click fraud	[31]
		Reducing purchase costs	[36]
	Increasing brand engagement	The possibility of earning income through personal information	[20]
		Creating a fair reward system	[36]
		Strengthening the relationship between the customer and the brand	[15]
		High speed of settlement	[15]
		End-to-end technology capability	[16]
Confidence caused by privacy	–	Maximum protection of users' personal information	[3]
		Customer power at the level of disclosure of personal information	[20]
		Reducing malicious advertising practices	[13]

Confidence caused by transparency	Transparency due to the use of technology	Maximum transparency of data	[31]
		Elimination of intermediaries in the market structure	[20]
		Full access of all members to all exchanges	[13]
	Transparency due to Blockchain elements	Smart contracts	[22]
		The existence of a ledger	[31]
		Shared blockchains	[13]
	Transparency due to the nature of technology	Sharing data across the entire system	[15]
		The visibility of product quality changes for all members	[15]
		Ability to instantly view all approved transactions	[15]
		Permanent recording of data in the entire system	[13]
		Transparency of information processing	[29]
		Peer-to-peer communication	[34]
		Permanent access to the network	[20]
Confidence caused by the power of technology	–	Creating fields of information symmetry	[29]
		Creating a space with the maximum possibility of inspection	[15]
		More efficient data processing	[29]
Confidence caused by user supervision	–	Receiving and providing maximum feedback	[25]
		The ability to track the origin of data by the customer	[34]
		The ability to control the viewing of advertisements by the user	[25]
Non-financial outcomes	–	Improving customer loyalty programs	[34]
		Improving service responsiveness	[29]
		Improving verbal advertisement by customers	[34]
		Encouraging customers to share experiences	[15]
		Developing f new businesses	[15]
		More involvement of customers with the brand	[29]
		Customer satisfaction with the service	[34]
		Ability to track suppliers from the company	[29]
		Better market targeting	[29]
Financial outcomes	–	Increasing the income of businesses	[34]
		Creating added value	[34]
		Paying fair compensation to customers' advertising actions	[13]
		Reducing the marketing costs of companies	[15]

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