Journal of Information Technology Management

Print ISSN: 2008-5893

Online ISSN: 2423-5059

Trust in Blockchain-Based Advertising: A System Dynamics Approach

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Abstract

As an emerging technology, blockchain can be used in all areas of e-commerce, one of which is advertising. The present study has been designed to identify a dynamic model of trust in blockchain-based advertising and acceptance of this type of advertising. In order to achieve the purpose of the research, the required information was collected by literature, background review and experts opinions. In the next step, the research information was analyzed using systems dynamics methodology (Sterman approach) and a dynamic research model was presented. After model validation and examining the causal relationships, simulations and scenario analysis were performed using Vensim software. The results show the positive effect of the audience, advertiser and advertising characteristics on trust in blockchain-based advertising and, consequently, the improvement of the audience loyalty coefficient. Also, the results of scenarios indicate an ascending growth (Pessimistic: about %60, Optimistic: about %80) in audience loyalty. Finally, practical suggestions were presented in accordance with the research results.

Keywords: Blockchain; Trust in Advertising; Blockchain-Based Advertising; Dynamic Model; System Dynamics

Journal of Information Technology Management, 2022, Special Issue, pp. 62-82
Published by University of Tehran, Faculty of Management
doi: https://doi.org/ 10.22059/jitm.2022.87841
Article Type: Research Paper

Received: 30 July 2021
Received in revised form: 30 October 2021
Accepted: 30 November 2021
Published online: 26 June, 2022

Introduction

Blockchain technology, as a globalization Characteristic in today's world, facilitates e-commerce by decentralizing power in transactions (Bamakan et al, 2021; Cavalic et al, 2019). This technology has been widely welcomed in various fields such as digital advertising (Chen et al, 2018) due to its features such as distributivity, decentralization, transparency and immutability (Gleim & Stevens, 2021; Auinger & Riedl, 2018; Tsilidou & Foroglou, 2015). Misleading information, inefficiency and lack of transparency are always the most serious problems of digital advertising (Chen et al, 2018). Therefore, digital advertisers and marketers should look for solutions to reduce security, privacy, and quality concerns in order to increase online trust (Benmamoun et al, 2019).

Trust is defined as a mental perception of various topics, objects, and contexts (Ren et al, 2020), and underlies customer loyalty, commitment, product acceptance, and long-term relationships with companies and brands (Da Silva & Moro, 2021). This is also true in IT-based business relationships (Dehbasteh et al, 2019). Online distrust is recognized as a major obstacle to the growth of e-commerce (Gao & Wu, 2010). In this regard, a global blockchain-based advertising platform helps to overcome this barrier through equitable distribution of information (Gleim & Stevens, 2021). In this way, blockchain transparency will reassure consumers in protecting their information and trust-building (Da Silva & Moro, 2021).

Customer trust in online and digital advertising such as video advertising, search advertising, social media advertising, etc. is usually low and awareness of the factors that determine consumer trust in advertising, brings constant benefit and continuous effectiveness (Leong et al, 2020). Unlike centralized networks, the most important feature of peer-to-peer networks such as blockchain, is the lack of hierarchy in service delivery. The concept of trust in today's business age has often been based on a centralization in trading. However, blockchain provides trust in a peer-to-peer network by enabling decentralized information exchange. Along with the development of blockchain technology, organizations are expected to more investment in providing services with the support of this technology and their business model will undergo many changes in the coming years (Dehbasteh et al, 2019).

The formation of future changes and developments requires understanding the causes of past changes and recognizing the structures and relationships that create this changes. System dynamics method had been invented for this purpose. To make effective decision-making and learning in a world of constant dynamic complexities, we need to have systemic thinking so

that we can develop the boundaries of our mental models and create tools that can be used to understand the structure and behaviour of complex systems (Sterman, 2000). System dynamics have a long history of analyzing complex problems in areas ranging from public policy, corporate strategy, security, healthcare and operations management to management change. However, its application in the marketing literature should be given more attention. The characteristics of the marketing environment (such as multiple inputs and outputs, latency, and nonlinearity) are not exactly recognizable to managers. Thus, the system dynamics approach provides cognitive support for marketing managers in planning, policy analysis, and strategic decision making (Richardson & Otto, 2008). On the other hand, according to previous studies, despite the proven application in the above areas (Yli-Huumo et al, 2016), blockchain technology has rarely been considered in the field of systems dynamics (Lasi & Saul, 2020).

By the way, it can be said that marketers are always eager to learn more about blockchain-based advertising. In fact, this type of advertising provides numerous research opportunities around cryptocurrencies, digital operating systems, supply chain, and market research. On the other hand, information related to customers' experiences and their reactions to this type of advertising is also very important. According to the extensive literature review, most research has focused on the intrinsic aspects of blockchain technology and its characteristics, and there is a lack of business models based on this technology. In fact, the present study seeks to answer the question of whether trust in blockchain-based advertising technology affects exposure rates and ultimately audience loyalty. Thus, the purpose of the present study is to identify the concept of trust and its determinants in the field of blockchain technology. In fact, the role of blockchain technology in customer response to advertising have been explored. In the rest of the present paper, the theoretical literature and empirical background of blockchain technology and trust issues in business and marketing will be reviewed. Then, in the methodology, results and conclusions section, the process of achieving the research objectives have been described.

Literature Review

Trust in Advertising

Trust has long been recognized as an integral part of buyer-seller exchanges and is essential for understanding interpersonal behavior and business relationships. In social psychology, trust is considered as the equivalent of expected behavior from other people (Yousafzai et al, 2003). According to Soh et al (2009), trust in advertising is defined as: "confidence that advertising is a reliable source of product/service information and willingness to act on the basis of information conveyed by advertising." According to this definition, trust can be composed of three dimensions: cognitive, emotional and behavioral. Online and electronic trust and offline trust are different in terms of service content. In traditional exchanges, customers gain reassurance through direct observation. In contrast, in online services,

communication between two parties is created through technology. Various studies show that trust will lead to important consequences such as customer satisfaction and loyalty and thus, plays a very important role in the behavioral goals of the audience in the field of online and digital services (Chang & Chang, 2011). McNight et al. (2011) state that in digital relationships, in addition to sellers, buyers, and agents (e.g., operators and intermediaries), audiences trust to technology. In the field of technology, decisions about trust and its ethical risks are usually left to users. However, technologies such as blockchain are an exception (Marella et al, 2020). As such, the determinants of trust in technology have always been ambiguous.

Blockchain and Trust

The blockchain is a network of information that allows users to share information without intermediaries. Bitcoin cryptocurrency (electronic cash and peer-to-peer system as an alternative means of payment) is the first major blockchain system that had been introduced in 2008. However, the role of blockchain has been shifted from the mechanism of authentication of cryptocurrencies to a wide range of economic and trade programs (Hawlitschek et al, 2018). Blockchain can be defined as a distributed structure consisting of peer-to-peer nodes, which relies on security features such as "encryption hash, digital signature, and distributed consensus mechanism" (Hebert & Di Cerbo, 2019). Blockchain infrastructure has the following benefits for customers: low transaction costs; Accelerate transaction time; And reducing coordination issues (Grover et al, 2018). Blockchain builds trust by providing features such as block immutability, encryption signature, and transparency of information provided by tracking information in a decentralized network (Da Silva & Moro, 2021; Wüst & Gervais, 2018). Trust management in blockchain includes: (1) evaluating the performance of information nodes, (2) the credibility or reliability of the information source, (3) privacy, (4) operational capacity, (5) transparency, (6) Traceability and (7) security (Kochovski et al, 2019). According to Atlam and Wills (2019), blockchain has features that make it a distinctive technology for building trust and integrity. The most important are: decentralization (processability for all network users), immutability (ability to ensure transaction integrity), transparency (no need for a third party, sharing transaction details among all participants), better security (data protection against Destructive actions) and efficiency (cost efficiency, settlement speed and risk management). Trust from the above features, enables potential users and customers to identify the original content from the fake content and receive appropriate feedback from the ads (Nejati Rashtabadi et al, 2021).

Research Background

Despite the importance and dynamism of the concept of trust and the increasing development of blockchain technology in business, few research has been conducted in these areas. However, In order to clarify the issue, reviewing some of the most relevant blockchain research, blockchain-based advertising, and trust is not without merit.

In order to understand blockchain technology and its relevance with consumer trust, Da Silva and Moro (2021), designed a study using a text mining literature analysis from published articles in the Scopus database. Their analysis highlights the multidisciplinary nature of blockchain and consumer trust. Their findings indicated an association between some blockchain features such as traceability and privacy with consumer trust. For this reason, marketing, social, and economics researchers are advised to focus on using blockchain to improve consumer trust. Also in their research, Auinger and Reidl (2018), sought to identify the nature of trust in blockchain technology. The results of their analysis showed that there are three important research areas related to trust in the literature of the blockchain: "Trust in algorithms", "Technological mechanisms and trust", and "Substitution of intermediaries and trust". Finally, they argued that the assumption that blockchain technology does not need to trust-building is incorrect. In fact, both traditional determinants of trust (i.e., ability, benevolence, integrity) and factors known in the online setting (e.g., third-party institutional mechanisms) are essential to trust-building in the blockchain. In his study, Ostern (2018), presented a conceptual model of trust in blockchain technology by using an exploratory approach. This two-sided model contains considerations that may have a positive or negative effect on trust relationships. After the data analysis by using the coding process, three main categories affecting trust (positive or negative) in blockchain technology were identified. These concepts include: technology-related factors (perceived security, technological development, dis-intermediation & decentralization, data protection & privacy), usage-related factors (perceived ease of use & convenience) and, personal factors (personal innovativeness, lack of knowledge & experience). Dehbasteh et al (2019) in their research examined the changes in the business model of organizations' readiness in order to facing the blockchain in the future. To achieve this goal, they used a qualitative method of content analysis and systems dynamics. The results show the classification of determinants of blockchain-based business model with a collaborative approach. In this approach, all stakeholders in the value chain share their values. On the other hand, applying the system dynamics method to the determinants of blockchain shows that changing factors such as registration fee or transaction tax in the network, can lead to increased cooperation in resource sharing and total value.

In order to identify the influential variables in the field of the role of Internet advertising on the industrial market, Radfar and Shahabi (2015) used the Delphi method and literature and the fuzzy dimatel technique was used to determine the effect of variables. According to the research results, there is a strong two-way relationship between Internet advertising and the development level of the industrial market that this process can be strengthened as a dynamic cycle over time. Also, the factors of industrial market development, the development level of the online advertising website, profit and user participation, have the most impact. Finally, a dynamic model was presented to better understand the relationships using the system dynamics modeling approach and to draw causal diagrams. Bruce et al (2017) in their study examined the effects of format and message content and targeting on the performance

of digital advertising in the form of a dynamic model. They got the information they needed from a retailer in the United States. The results show that the transfer rate for dynamic formats is higher than static forms. Also, targeted re-advertising is only effective if it contains price incentives. Chang et al (2013) designed and conducted a study to determine the mediating role of trust in e-service recovery. The method used is system dynamics and subsequently simulation was used to evaluate the performance of service recovery. As expected, the results show the essential effect of trust in the successful recovery of services and the guarantee of profitability. On the other hand, the quality of perceptual services by customers improves electronic trust. Abzari et al (2011) in their research, evaluated the factors affecting the trust of Internet users. In this regard, a model has been presented to show the important factors and variables affecting the creation of trust in the Internet using the Analytic Hierarchy Process (AHP) technique. Based on the results of questionnaire data analysis; Factors affecting the creation of trust in the Internet environment based on the importance are: factors related to technology, the existence of conditions for the formation of institutional trust, high quality of information, high quality of electronic exchange, behavioral characteristics of Internet buyers, and finally, the capabilities of the company offering the product or service over the Internet.

Methodology

The main method that used in the present study, is the systems dynamics. The reason for choosing this method in research for reasons such as the long time period of the research problem, the existence of different types of variables affecting system behavior and the existence of many nonlinear relationships (Hosseini & Shakouri, 2016). Thus, in this study, the concept of trust in blockchain-based advertising, as a dynamic and changing concept over time, in the field of blockchain (as an emerging technology in advertising) have been examined. The systems dynamics method was first proposed by J. Forrester, assuming that all systems are variable. System dynamics involves causal relationships and uses feedback systems as the basis for causal feedback loops. In addition, researchers can define problems with the use of causal relationships. Consequently, complex problems can be presented concisely and systematically to help managers solve them (Chang & Chang, 2011). In summary, the system dynamics model provides multiple feedback loops that underlie the internal behavior of a particular problem (Richardson & Otto, 2008). According to Sterman (2000), problem solving is performed by the system dynamics model in the following 5 steps (Kazemi & Hosseinzadeh, 2013): (1) problem identification and definition; (2) constructing a conceptual model (causal circle diagrams); (3) building a mathematical model (drawing a state-flow diagram); (4) model simulation and validation; (5) Defining different scenarios, selecting and implementing the appropriate solution.

Results and Discussion

Implementation of a Dynamic Blockchain-based Ad Acceptance Pattern

The purpose of the present study is to investigate the role of blockchain as a new tool in advertising. In order to achieve this goal, the five-step Sterman method is used according to the following steps (Figure 1).

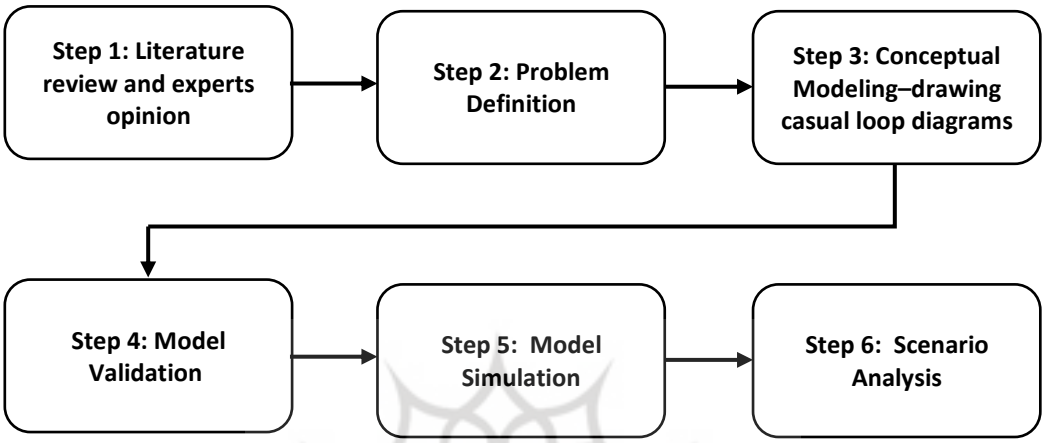

Figure 1 . Research Steps

Problem Definition

The main issue of the present study is to recognize the process of dissemination of blockchain-based advertising as a type of advertising innovation and the intensity of the impact of related variables (factors determined using qualitative methods and expert opinion polls) on consumer trust. In order to modeling, the Bass diffusion model (1969) has been used. According to this model, in the process of influencing the related variables, two factors of word of mouth and media advertising are considered. Thus, the goal of researchers is to answer this problem by modeling and entering other variables based on the method of systems dynamics.

Conceptual Modeling

As shown in Figure 2, the adoption of blockchain-based advertising technology is affected by four subsystems. These subsystems are the result of a combination of a bass diffusion model and expert opinions. In this regard, the opinions of 10 experts in the fields of information and communication technology, management and marketing were collected through in-depth interviews. The information obtained from the interviews was analyzed by the qualitative method of Grounded theory (Strauss & Corbin approach) (Nejati Rashtabadi et al., 2021). At the end of the data analysis, three factors had been identified: the audience characteristics or nature, the advertising characteristics or nature and the advertiser characteristics or nature as causal conditions affecting the audience's trust in blockchain-based advertising (as shown in Figure 2). Also, another part of the research model is the bass diffusion model (one of the

basic models in the field of innovation dissemination). In this model, it is assumed that the potential customers of a product become actual customers under the influence of only two factors: recommended purchase and purchase through media advertising.

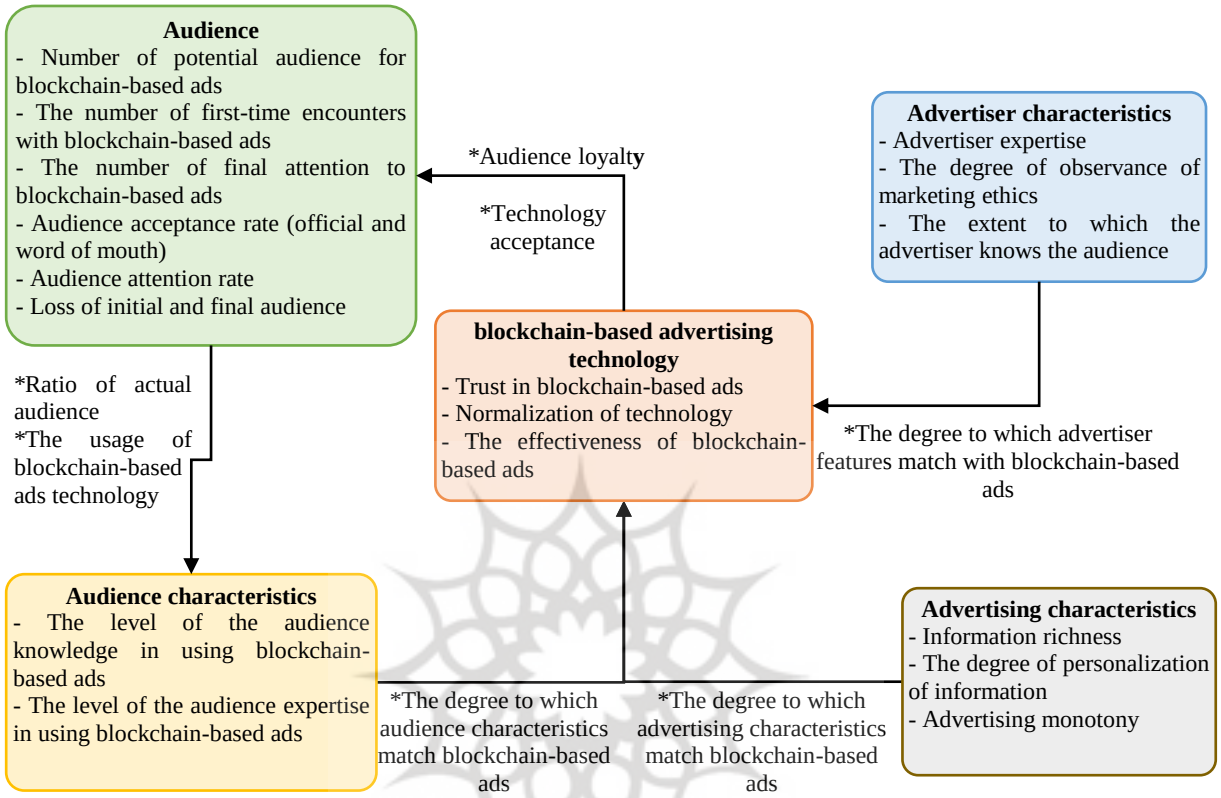

Figure 2 . Model Subsystems

The audience subsystem is related to the Bass diffusion model , which includes the variables of the number of potential audience contacts, the number of first encounters with ads, the number of final attention to ads, audience acceptance rate (word of mouth and official ads), audience attention rate and initial and final audience loss. The second category of variables, ie the characteristics of the advertiser, consists of the advertiser expertise, the degree of observance of marketing ethics, and the degree of knowing of the audience. The third category of variables is related to the characteristics of the audience and refers to the knowledge and expertise of the advertising audience. Finally, the characteristics of advertising are: the amount of information richness, the amount of personalization of information and the degree of uniformity of advertising.

Casual Loop Models

As mentioned earlier, the purpose of this study is to identify the acceptance of blockchain-based ads technology by users and audiences. Thus, the ultimate purpose of a research model is to achieve a high level of audience loyalty over time and improve their attention to this type of advertising, which has been possible only by gaining the trust of users. Thus, some of the most important relationships in the model are expressed in the form of causal models.

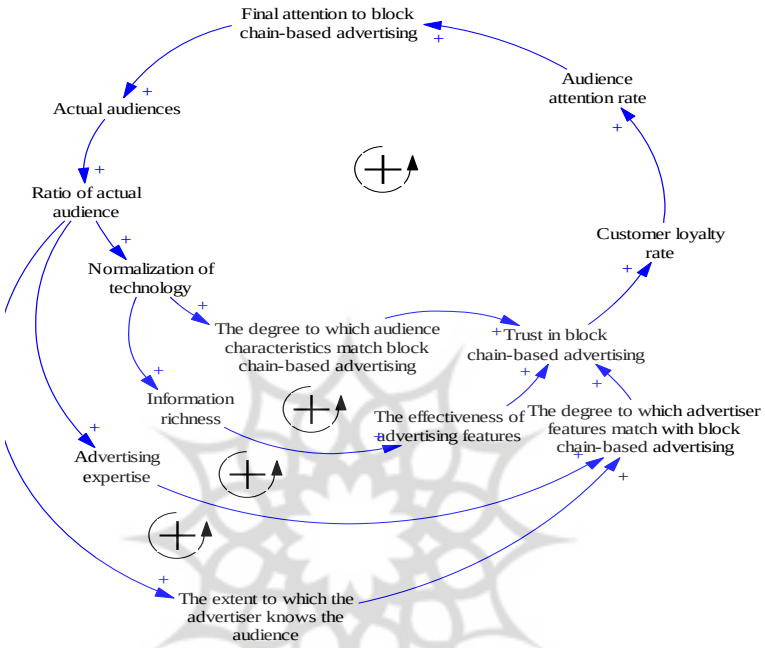

Figure 3 . Factors Affecting Trust in Block chain-Based Advertising (Source: Research Findings)

Table 1. Components of factors affecting trust

Loops	Loop Factors
Loop 1	Customer loyalty rate, Audience attention rate, Final attention to blockchain-based advertising, Actual audiences, Ratio of actual acceptence, Normalization of technology, The degree to which audience characteristics match blockchain-based advertising
Loop 2	Customer loyalty rate, Audience attention rate, Final attention to blockchain-based advertising, Actual audiences, Ratio of actual acceptence, Normalization of technology, Information richness, The effectiveness of advertising features
Loop 3	Customer loyalty rate, Audience attention rate, Final attention to blockchain-based advertising, Actual audiences, Ratio of actual acceptence, Advertiser expertise, The degree to which advertiser features match with blockchain-based advertising
Loop 4	Customer loyalty rate, Audience attention rate, Final attention to blockchain-based advertising, Actual audiences, Ratio of actual acceptence, The extent to which the advertiser knows the Audience, The degree to which advertiser features match with blockchain-based advertising

Figure 3 and Table 1 shows the factors affecting audience trust in blockchain-based advertising. According to the figure, trust in blockchain-based advertising is influenced by three factors: audience characteristics, advertising characteristics, and advertiser characteristics. The positive effect of these variables has been proven in some previous researches. In general, research related to customer trust in e-commerce, have been divided factors affecting trust in different categories, including: audience skill factors (Khodadadhosseini et al, 2009), company-related factors (specifically in this study: Advertiser) (Agag & Almasry, 2016; Oliveira et al, 2017), personality factors (Oliveira Santini, et al 2020; Marbach et al, 2019; Oliviera et al, 2017; Zhuo et al, 2011) and audience experience and cognition (Rather et al 2019; Agag & Almasry 2016; Punyatoya, 2018). On the other hand, according to the model, trust in blockchain-based advertising increases the audience loyalty rate (Hong & Cho, 2011). Along with the number of loyal audiences, the acceptance rate, the final attention of the audience, and final audience ratio has been developed. Finally, increasing the proportion of actual audiences through the three paths of technology normalization, audience experience, and the extent to which the advertiser knows the audience will affect advertising trust, and this cycle will be repeated.

Also, in Figures 4 and 5, the audience loyalty rate and the factors affecting the final attention of the audience have been presented. As shown in the figures; Audience loyalty rate is affected by two factors: the cost-effectiveness of using blockchain-based advertising and trust in these ads. Increasing the audience's loyalty rate improves the audience's attention rate. It is important to note that as the audience's attention rate increases, the number of first-time exposure to advertising decreases. In this way, the higher the audience's attention rate, the more they will ultimately pay attention to blockchain-based advertising. Following this change, the number and proportion of actual audiences for this type of advertising has been increased. Finally, audience loyalty will be enhanced through the two paths of blockchain-based advertising and technology normalization. Finally, some of the most important mathematical equations used to create causal models are presented in Table 2. In general, the model formulas consist of two parts, one part is based on the bass diffusion model and the other part is based on research findings.

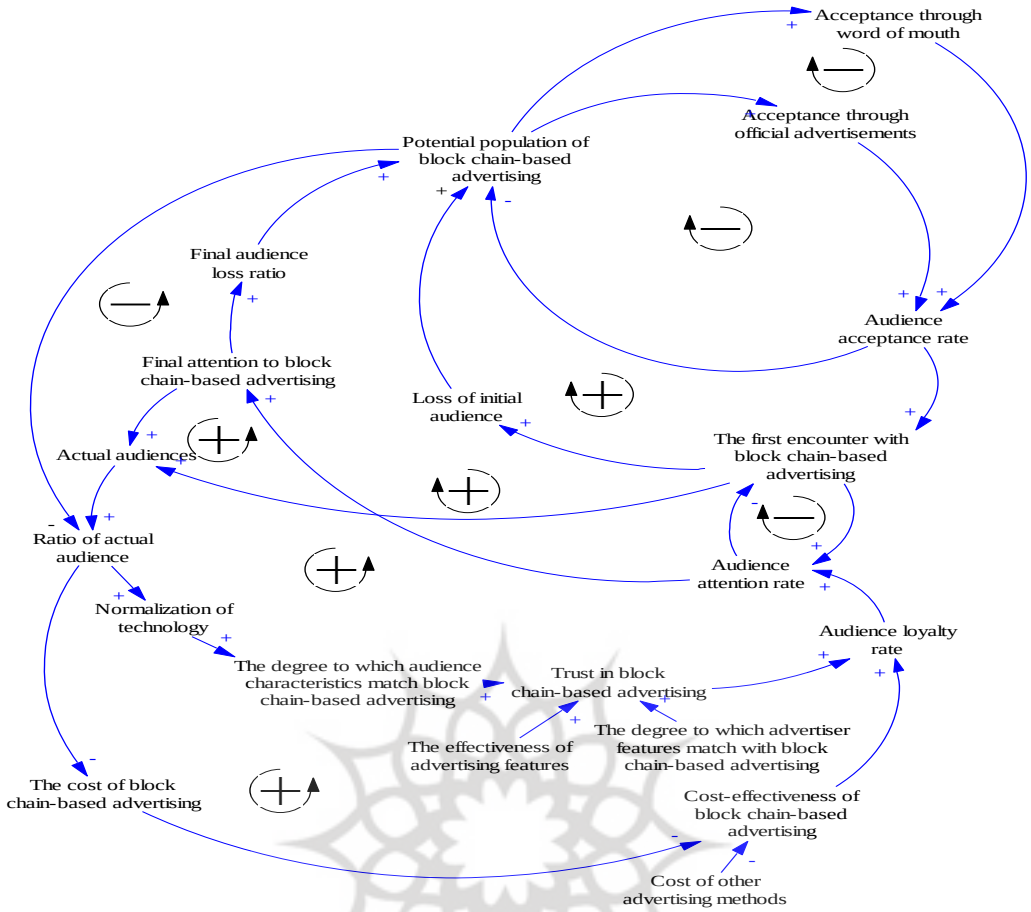

Figure 4 - Causal relationships of factors affecting audience loyalty coefficient (Source: Research Findings)

Table 2. Equations (Source: Bass Diffusion Model & Research findings)

Equations	Components
$\mathrm{AWM_t} = \frac{\mathrm{FEBCA_t} \times \mathrm{PPBA_t} \times \mathrm{AR_t} \times \mathrm{CR}}{\mathrm{TP}}$	AWM= Acceptance through word of mouth, FEBCA= The first encounter with blockchain-based advertising, PPBA= Potential population of blockchain-based advertising
$\mathrm{AOA} = \mathrm{PPBA} \times \mathrm{OAE}$	AOA= Acceptance through official advertisements, PPBA= Potential population of blockchain-based advertising, OAE= Official advertising effectiveness
$\mathrm{AR} = \mathrm{AWM} \times \mathrm{AOA}$	AR= Audience acceptance rate, AOA= Acceptance through official advertisements, AWM= Acceptance through word of mouth
$\mathrm{AAR} = \mathrm{PPBA} \times \mathrm{ALR}$	AAR= Audience attention rate, PPBA= The first encounter with blockchain-based advertising, ALR= Audience loyalty rate
$\mathrm{LIA} = \mathrm{FEBCA} \times \mathrm{PALR}$	FEBCA= The first encounter with blockchain-based advertising, LIA= Loss of initial audience, PALR= Primary audience loss ratio
$\mathrm{LFA} = \mathrm{FEBCA} \times \mathrm{FALR}$	LFA= Loss of the final audience, FEBCA= The first encounter with blockchain-based advertising, FALR= Final audience loss ratio

$TBA = (DAMBA \times W1) + (EAF \times W2) + (DAFMBA \times W3)$	TBA= Trust in blockchain-based advertising, DAMBA= The degree to which audience characteristics match blockchain-based advertising, EAF= The effectiveness of advertising features, DAFMBA= The degree to which advertiser features match with blockchain-based advertising
$ALR = (TBA \times W4) + (CEBA \times W5)$	ALR= Audience loyalty rate, CEBA= Cost-effectiveness of blockchain-based advertising, TBA= Trust in blockchain-based advertising
$DAFMBA = (EaKA \times W24) + (DOME \times W25) + (AE \times W26)$	DAFMBA= The degree to which advertiser features match with blockchain based advertising, AE= Advertising expertise, DOME= The degree of observance of marketing ethics, EAKA= The extent to which the advertiser knows the audience
$EAF = (AM \times W12) + (DPI \times W13) + (IR \times W14)$	EAF= The effectiveness of advertising features, IR= Information richness, DPI= The degree of personalization of information, AM= Advertising monotony
$DAMBA = (AEIUBA \times W6) + (AEIBA \times W7)$	DAMBA= The degree to which audience characteristics match blockchain-based advertising, AEIBA= Audience experience in using blockchain-based advertising, AEIUBA= Audience expertise in using blockchain-based advertising

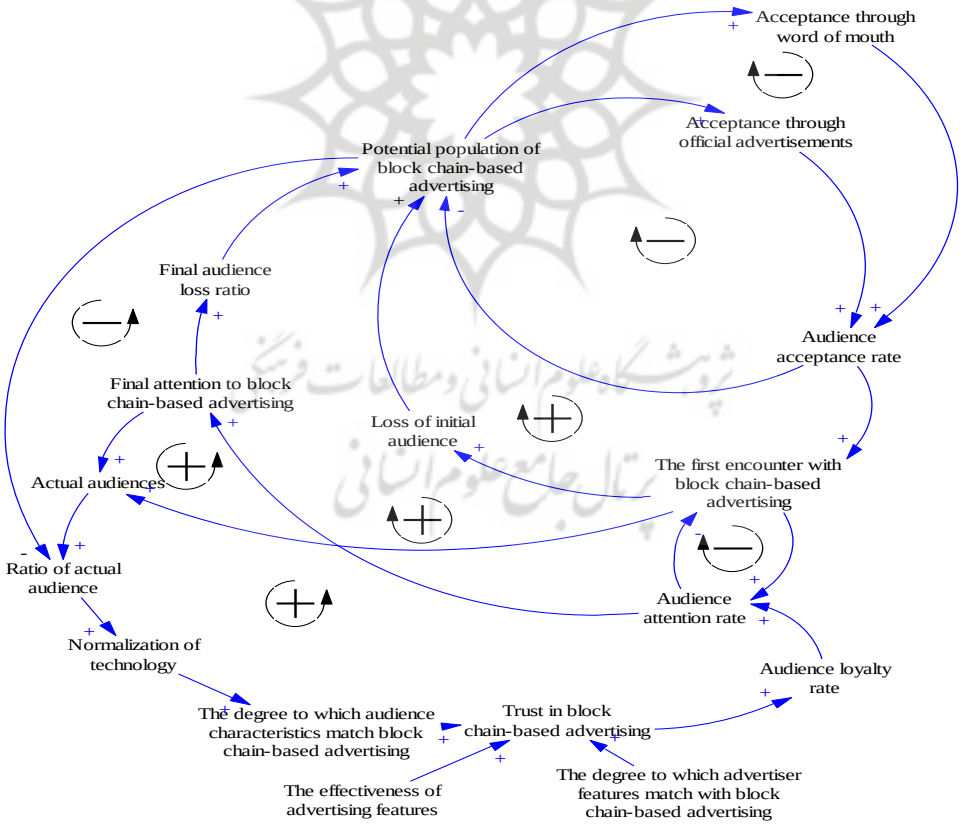

Figure 5. Factors Affecting the Final Attention of Blockchain-Based Advertising Audience (Source: Research Findings)

Stock-Flow Diagram

The flow-state diagram is an accurate view of the model and another way to represent causal models (Bastan et al, 2020). As shown in Figure 6, the stock and flow diagram of the present study consists of a bass technology diffusion model. Thus, some variables such as trust in blockchain-based advertising and the factors affecting it have been added to the model. In such diagrams, there are three types of variables: stock or level variables that indicate the state of a system. For example, in the present model, the variables of the number of actual audiences and the number of potential audiences fall into this category. The second variables arise from the accumulation of flow or rates, such as the acceptance rate of ads. The third category is auxiliary variables that are used to model the relationships between the two types of previous variables. Such as acceptance through official ads, acceptance through word of mouth, the effectiveness of ad features, the degree to which advertiser features match blockchain-based ads, and the extent to which audience characteristics match blockchain-based ads. It should be noted that some variables, such as the cost of blockchain-based advertising, with a fixed value are considered as auxiliary variables in modeling.

Table 3 - Fuzzy Dimatel Technique

Variables	**Dimatel Outcome**				**Normalization**			
Outcome	R	J	R+J	R-J	R	J	R+J	R-J
W6= Audience expertise in using blockchain-based advertising	1	0	1	1	0/53	0	0/27	
W7= Audience Knowledge in using blockchain-based advertising	0/87	0	0/87	0/87	0/47	0	0/23	
Audience Characteristics	0	1/87	1/87	-1/87	0/00	1	0/50	
Total	1/87	1/87	3/75	0	1/00	1/00	1/00	0/00
Outcome	R	J	R+J	R-J	R	J	R+J	R-J
W12= Advertising Monotony	1	0	1	1	0/36	0	0/18	
W14= The degree of personalization of information	0/94	0	0/94	0/94	0/34	0	0/17	
W13= Information richness	0/84	0	0/84	0/84	0/30	0	0/15	
Advertising Characteristics	0	2/79	2/79	-2/79	0	1	0/50	
Total	2/79	2/79	5/58	0	1	1	1	0
Outcome	R	J	R+J	R-J	R	J	R+J	R-J
W24= The extent to which the advertiser knows the Audience	1	0	1	1	0/37	0	0/18	
W26=Advertiser expertise	0/92	0	0/92	0/92	0/34	0	0/17	
W25= The degree of observance of marketing ethics	0/81	0	0/81	0/81	0/30	0	0/15	
Advertiser Characteristics	0	2/73	2/73	-2/73	0	1	0/50	

Total	2/73	2/73	5/47	1E-04	1	1	1	0
Outcome	R	J	R+J	R-J	R	J	R+J	R-J
W1= The degree to which audience characteristics match blockchain-based advertising	1	0	1	1	0/35	0	0/17	
W2= The effectiveness of advertising features	0/94	0	0/94	0/94	0/33	0	0/17	
W3= The degree to which advertiser features match with blockchain-based advertising	0/92	0	0/92	0/92	0/32	0	0/16	
Trust	0	2/87	2/87	-2/87	0	1	0/50	
Total	2/87	2/87	5/74	0	1	1	1	0
Outcome	R	J	R+J	R-J	R	J	R+J	R-J
W4= Trust in blockchain-based advertising	1	0	1	1	0/53	0	0/26	
W5= Effectiveness of blockchain-based advertising	0/89	0	0/89	0/89	0/47	0	0/24	
Audience Loyalty	0	1/89	1/89	-1/89	0	1	0/50	
Total	1/89	1/89	3/78	0	1	1	1	0

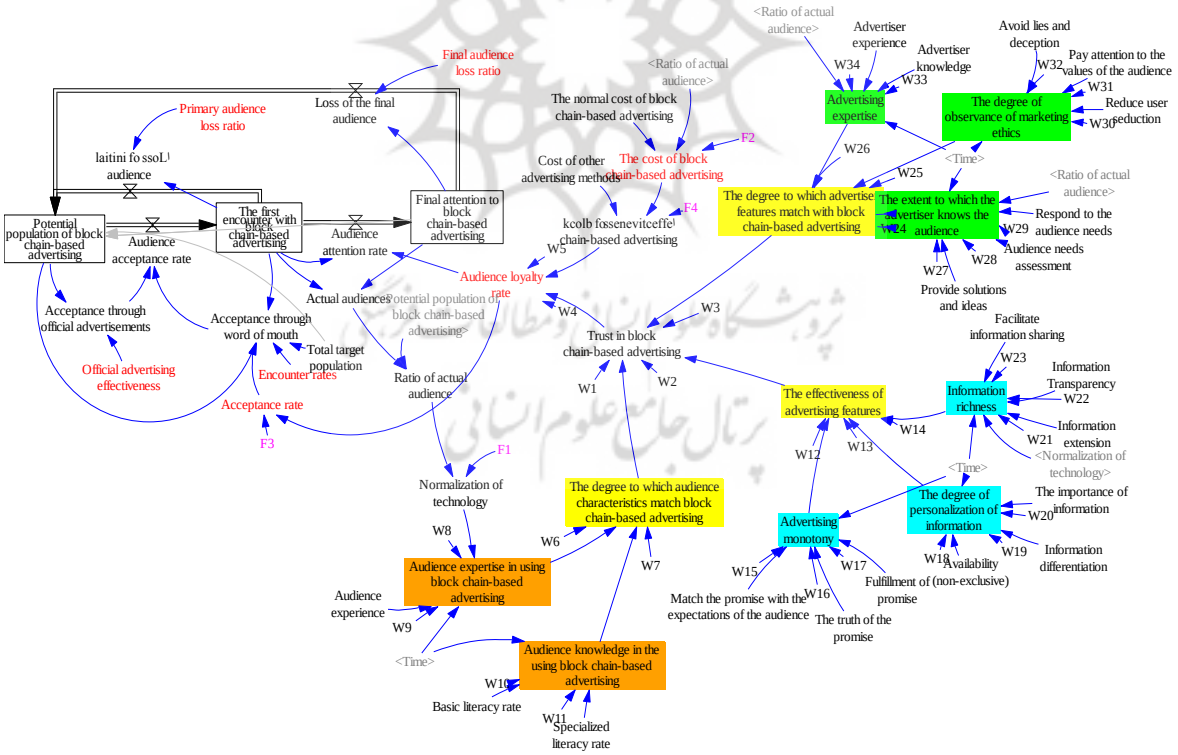

Figure 6 – Stock-Flow Diagram (Source: Research Findings)

According to the model, the main goal of the system is to increase the loyalty factor and, finally, the final acceptance rate of the audience. Audience loyalty is affected by trust in blockchain-based advertising. Audience trust, in turn, is influenced by three factors: audience characteristics, advertiser characteristics, and advertising characteristics. According to Table 3 and using the fuzzy dimatel technique and based on the opinions of 10 experts, the intensity of the impact of each of the components associated with each variable has been calculated. This technique has been used to reflect the interrelationships between the components, so that specialists and experts are able to express their views on the effects between the factors with more mastery. It should be noted that the matrix obtained from the Dimetel technique on the one hand shows the cause-and-effect relationship between the factors and on the other hand shows the effectiveness of the variables. According to Table 3, the elements with the highest impact on their respective variables were identified as: component (W6) most impact on the variable of audience characteristics, component (W12) most impact on the variable of advertising characteristics, component (W24) most impact On the advertiser characteristics, component (W1) has the greatest effect on the variable of trust in blockchain-based advertising and finally, component (W4) has the greatest effect on the variable of audience loyalty coefficient.

Model Validation

The present model have been designed and implemented based on one of the most popular models for the growth of new products and technologies. Bass (1969) developed a model for disseminating innovation that was initially introduced as a means of predicting sales of new products. With the passage of time and new research, the bass diffusion model has been used totaly in various fields of science. Therefore, in the present study, the model structure has a valid reference. In the present model, all factors affecting trust in blockchain-based advertising have been collected from experts in this field, and in analyzing and evaluating these factors, the researcher has always considered the opinion of experts and has been extremely neutral in the process of collecting and analyzing data. The general behavior of the model and its outputs are consistent with the experts opinion and no discrepancy was observed in the general results of the research with the opinions of experts, and it can be claimed that with the current knowledge and experience, the results of the model are consistent with experts.

Model Simulation & Scenario Analysis

The following results were obtained in designing a dynamic model of trust in digital advertising with two scenarios of optimistic or pessimistic or comparing it with the data obtained from an expert survey. From the expert perspective, the model outputs show that the degree of adaptation of audience characteristics to blockchain-based advertising has the greatest impact on trust in blockchain-based advertising and should be considered for successful advertising. In the optimistic scenario, as the contact rate increases, the advertising monotony and the accuracy of the promise will increase. In this way, the audience's

expectations will increase and eventually trust in blockchain-based advertising will be developed (Figure 7).

It was also observed that in different scenarios implemented, the audience loyalty coefficient is associated with ascending growth and in the pessimistic state will cover less than 60% of the actual audience population. But in the optimistic case, this amount is close to 80% of the actual audience, and in the case of experts, in a period of 100 months, this number will cover more than 60% of the actual audience (Figure 8).

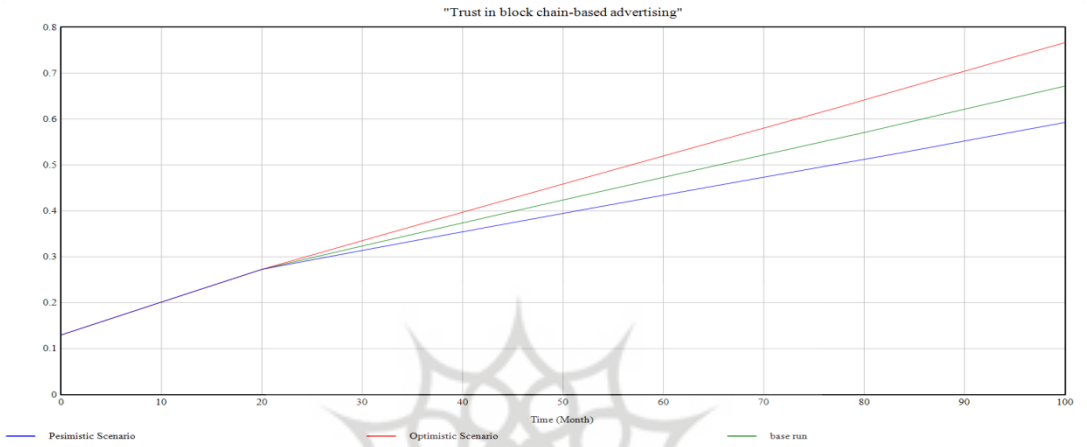

Figure 7 – Model Simulation (A)

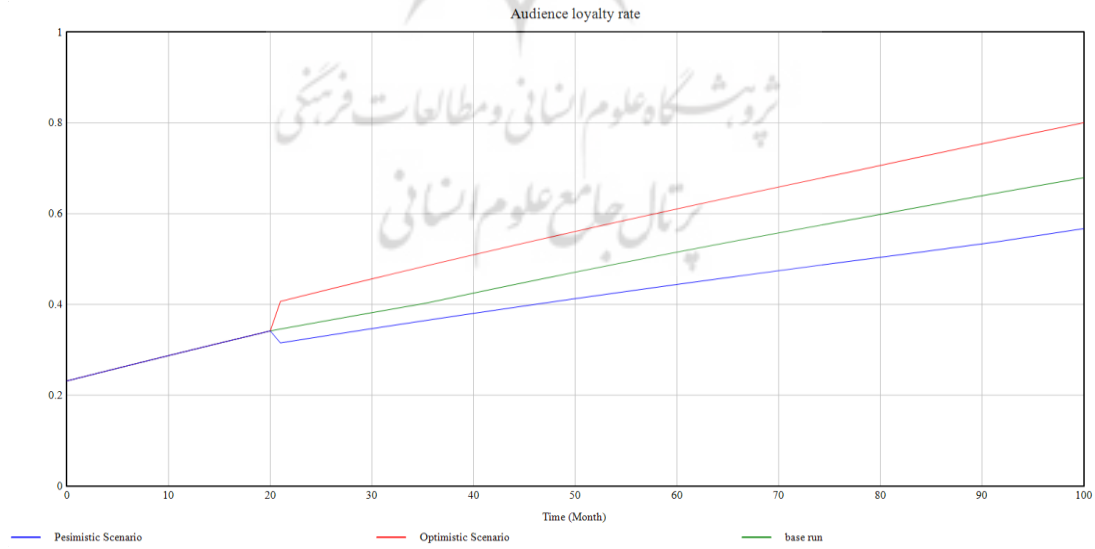

Figure 8 – Model Simulation (B)

In the present study, assuming the cost of other advertising methods is constant, the simulation results show a reduction in blockchain-based advertising cost (slight downward slope) in the long run and the largest decrease in the optimistic scenario will be from the end of the 40th month (Figure 9).

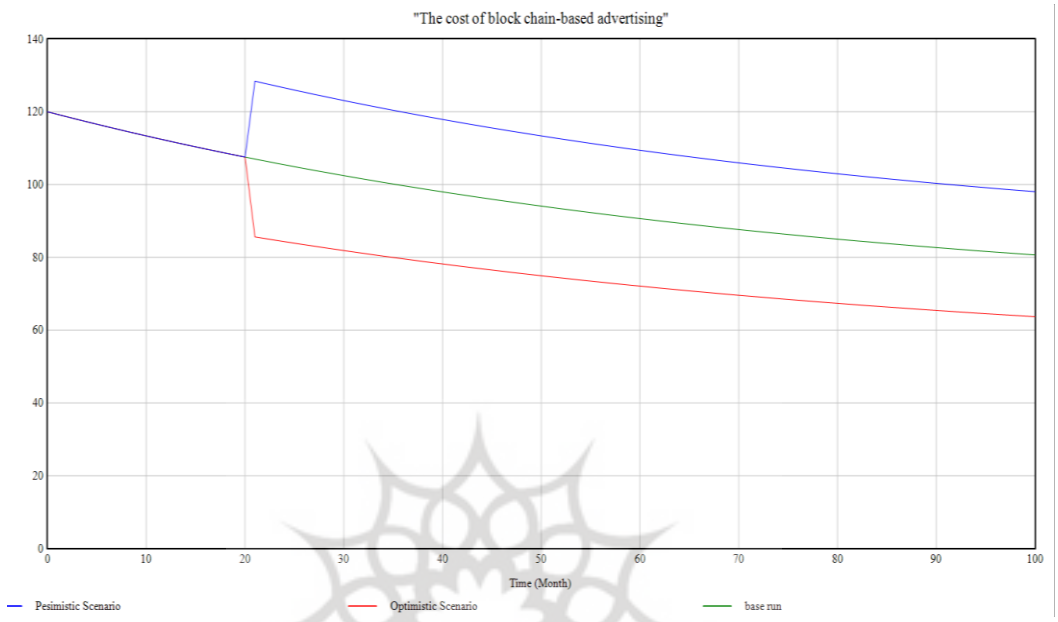

Figure 9 – Model Simulation (C)

Conclusion

The present study was designed and developed with the aim of creating and implementing a blockchain-based advertising trust model and accepting this type of advertising, using the systems dynamics approach. Using this approach, the issue of acceptance and trust in blockchain-based advertising can actually be analyzed over a long-term horizon. The proposed research model consists bass diffusion model and trust in the acceptance of blockchain-based advertising. Of course, it should be noted that before designing the model, the theoretical foundations and research background were thoroughly examined and the experts opinions were used. The examination of ofcausal models of the study shows the positive effect of trust in blockchain-based advertising on audience loyalty and ultimately increase the audience's attention rate. The results of simulation and scenario analysis using software (Vensim) show that among the factors affecting trust, audience characteristics in pessimistic and optimistic scenarios (100-month period) had the greatest effect on building trust in blockchain-based advertising. Therefore, advertisers who use this type of advertising for the first time should focus on the audience characteristics. This means that companies must be diligent in selecting a target audience who have sufficient knowledge and experience in using blockchain. In general, the target audience may be divided into those who are familiar and unfamiliar with blockchain-based advertising technology. Therefore, it is better

that in the first step, advertisers (who may use blockchain in the long run due to the stability or reduction of advertising costs and its convenience) provide the necessary training to get acquainted with this technology and advertising based on it. In another part of the results, it was found that along with the development of advertising monotony, the degree to which the advertising characteristics match with blockchain-based ads will be increased. This relationship means that advertisers need to focus more on the content of their ad. Because transparent content in the long-term, will increase the loyalty and acceptance rate of the audience. In the advertiser characteristics section, the most effective component will be the extent to which the advertiser knows the Audience, which is necessary to meet their needs. In order to know the audience accurately, companies can have a better understanding of the audience characteristics by creating rich databases consisting of customer information (with marketing ethics). Adopting this approach, in turn, facilitates the personalization of advertising information for different customer classes and, as a result, increases their loyalty factor and their final attention to advertising. Totaly, companies, can use strategies such as customer orientation and customer relationship management, the use of incentive and promotion systems to encourage audiences to consider this type of advertising, and the development of physical and skill infrastructure.

Considering the design of a dynamic model for trust in digital advertising and creating different scenarios, it is suggested that digital marketing activists use this powerful tool in the field of digital marketing in order to achieve better results. In this way, marketers can use this powerful tool in the field of digital marketing firstly by informing their customers and audiences and benefit from its numerous benefits. Then, new age marketing is expected to be prepared to synchronize with blockchain systems and embrace a new form of transparent and efficient communication (less cost and less time) based on blockchain.

Although today's blockchain-based advertising organizations and companies will be market leaders in the field in the near future, the issue of trust has always been a serious challenge for consumers and sellers in digital markets. Therefore, it is expected that with the development of blockchain-based systems and the proper and coordinated use of other components related to this technology, such as the Internet of Things based on blockchain and blockchain-based cryptocurrencies, a bright future free of unhealthy financial and administrative relationships is expected for the world's digital markets.

Conflict of interest

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article

References

Abzari, M., Ghorbani, H., Zadeh, K., Makinian, E. (2011). A AHP Methodology for Ranking the Factors Influencing Trust in the Internet. Journal of Information Technology Management, 3(7), 1-18.

Agag, G. M., & El-Masry, A. A. (2017). Why do consumers trust online travel websites? Drivers and outcomes of consumer trust toward online travel websites. Journal of Travel Research, 56(3), 347-369.

Atlam, H. F., & Wills, G. B. (2019). Technical aspects of blockchain and IoT. In Advances in Computers (Vol. 115, pp. 1-39). Elsevier.

Auinger, A., & Riedl, R. (2018). Blockchain and trust: Refuting some widely-held misconceptions.

Bamakan, S. M. H., Faregh, N., & ZareRavasan, A. (2021). Di-ANFIS: an integrated blockchain–IoT–big data-enabled framework for evaluating service supply chain performance. Journal of Computational Design and Engineering, 8(2), 676-690.

Bastan, M., Zarei, M., Tavakkoli-Moghaddam, R., & Shakouri, H. (2021). A new technology acceptance model: a mixed-method of grounded theory and system dynamics. Kybernetes.

Bastan, M., Abbasi, E., Ahamadvand, A., Ramazani K, R. (2018). A Simulation Model of Mobile Banking Acceptance by Bank Customers Using the System Dynamics Approach. Industrial Management Studies, 16(50), 257-284.

Benmamoun, M., Singh, N., & Sobh, R. (2019). How advertisers can target Arab e-consumers more effectively: A framework for localizing digital advertising and marketing content to Arab e-consumers. Journal of Advertising Research, 59(2), 171-184.

Bruce, N. I., Murthi, B. P. S., & Rao, R. C. (2017). A dynamic model for digital advertising: The effects of creative format, message content, and targeting on engagement. Journal of marketing research, 54(2), 202-218.

Čavalić, A., Čabro, S., & Hadžić, F. Cryptocurrencies: A critical review of concepts and definitions. Economics of Digital Transformation, 633.

Chang, W. L., Chang, H. C., & Chang, T. M. (2013). A System Dynamics Approach to E-Service Recovery and E-Trust. Journal of Information Management, 20(2), 193-218.

Chang, W. L., & Chang, H. C. (2011). A dynamic system of e-service failure, recovery and trust.

Chang, M. K., Cheung, W., & Tang, M. (2013). Building trust online: Interactions among trust building mechanisms. Information & management, 50(7), 439-445.

Chen, W., Xu, Z., Shi, S., Zhao, Y., & Zhao, J. (2018, December). A survey of blockchain applications in different domains. In Proceedings of the 2018 International Conference on Blockchain Technology and Application (pp. 17-21).

da Silva, C. F., & Moro, S. (2021). Blockchain technology as an enabler of consumer trust: a text mining literature analysis. Telematics and Informatics, 101593.

de Oliveira Santini, F., Ladeira, W. J., Pinto, D. C., Herter, M. M., Sampaio, C. H., & Babin, B. J. (2020). Customer engagement in social media: a framework and meta-analysis. Journal of the Academy of Marketing Science, 48, 1211-1228.

Dehbasteh, K., Pourebrahimi, A., Valmohammadi, C., & Kazemi, M. A. A. (2019). Identification of the determinants of Blockchain-based business model using hybrid method: Content analysis & System

Dynamics. Romanian Journal of Information Technology and Automatic Control, 29(4), 17-34.

Foroglou, G., & Tsilidou, A. L. (2015, May). Further applications of the blockchain. In 12th student conference on managerial science and technology (pp. 1-8).

Gao, Y., & Wu, X. (2010). A cognitive model of trust in e-commerce: evidence from a field study in China. Journal of Applied Business Research (JABR), 26(1).

Gleim, M. R., & Stevens, J. L. (2021). Blockchain: a game changer for marketers?. Marketing Letters, 32(1), 123-128.

Grover, P., Kar, A. K., & Ilavarasan, P. V. (2018, October). Blockchain for businesses: A systematic literature review. In Conference on e-Business, e-Services and e-Society (pp. 325-336). Springer, Cham.

Hawlitschek, F., Notheisen, B., & Teubner, T. (2018). The limits of trust-free systems: A literature review on blockchain technology and trust in the sharing economy. Electronic commerce research and applications, 29, 50-63.

Hebert, C., & Di Cerbo, F. (2019). Secure blockchain in the enterprise: A methodology. Pervasive and Mobile Computing, 59, 101038.

Hong, I. B., & Cho, H. (2011). The impact of consumer trust on attitudinal loyalty and purchase intentions in B2C e-marketplaces: Intermediary trust vs. seller trust. International journal of information management, 31(5), 469-479.

Hosseini, S. H., Shakouri, H., Kazemi, A., Zareayan, R., & Mousavian, M. (2019). A system dynamics investigation of project portfolio management evolution in the energy sector: case study: an Iranian independent power producer. Kybernetes.

Hosseini, S. H., & Shakouri, H. (2016). A study on the future of unconventional oil development under different oil price scenarios: A system dynamics approach. Energy Policy, 91, 64-74.

Kazemi, A., Hosseinzadeh, M. (2016). Selecting the Best Scenario to Increase the Government's Foreign Exchange Income in Energy Sector: An Application of System Dynamics Approach. Journal of Production and Operations Management, 7(2), 63-82.

Khodadad Hosseini S H, Shirkhodaie M, Kordnaeij A. (2009). The Effective Factors on Customer Trust in E-Commerce (B2C Model). IQBQ, 13 (2), 93- 118.

Lasi, D., Saul, L. (2020). A System Dynamics Model of Bitcoin: Mining as an Efficient Market and the Possibility of" Peak Hash.

Leong, L. Y., Hew, T. S., Ooi, K. B., & Dwivedi, Y. K. (2020). Predicting trust in online advertising with an SEM-artificial neural network approach. Expert Systems with Applications, 162, 113849.

Marbach, J., Lages, C., Nunan, D. and Ekinci, Y. (2019), "Consumer engagement in online brand communities: the moderating role of personal values", European Journal of Marketing.

Marella, V., Upreti, B., Merikivi, J., & Tuunainen, V. K. (2020). Understanding the creation of trust in cryptocurrencies: the case of Bitcoin. Electronic Markets, 1-13.

Nejati Rashtabadi, H., Akbari, M., Delafrooz, N., Gholipour Soleimani, A. (2021). Identifying the concept of customer trust in blockchain-based digital advertising: Model development with grounded theory. Journal of Business Management Perspective, 20(45), 92-119.

Oliveira, T., Alhinho, M., Rita, P., & Dhillon, G. (2017). Modelling and testing consumer trust dimensions in e-commerce. Computers in Human Behavior, 71, 153-164.

Ostern, N. (2018). Do you trust a trust-free transaction? Toward a trust framework model for blockchain technology.

Punyatoya, P. (2018). Factors affecting trust towards online retailers in India: an empirical study. International Journal of Business Innovation and Research, 17(3), 342-360.

Radfar, R., Shahabi, A. (2015). Analyzing the Effect of Internet Advertising on Iran's Industrial Market, Using Fuzzy Dematel Method and a Systemic Approach. Jounal of Marketing Management, 10(28), 107-124.

Rather, R. A., Tehseen, S., Itoo, M. H., & Parrey, S. H. (2019). Customer brand identification, affective commitment, customer satisfaction, and brand trust as antecedents of customer behavioral intention of loyalty: An empirical study in the hospitality sector. Journal of Global Scholars of Marketing Science, 29(2), 196-217.

Ren, Y., Zhu, F., Zhu, K., Sharma, P. K., & Wang, J. (2021). Blockchain-based trust establishment mechanism in the internet of multimedia things. Multimedia Tools and Applications, 80(20), 30653-30676.

Richardson, G. P., & Otto, P. (2008). Applications of system dynamics in marketing. Journal of Business Research, 61(11), 1099-1101.

Sterman, J. (2002). System Dynamics: systems thinking and modeling for a complex world.

Soh, H., Reid, L. N., & King, K. W. (2009). Measuring trust in advertising. Journal of advertising, 38(2), 83-104.

Wüst, K., & Gervais, A. (2018, June). Do you need a blockchain?. In 2018 Crypto Valley Conference on Blockchain Technology (CVCBT) (pp. 45-54). IEEE.

Yli-Huumo, J., Ko, D., Choi, S., Park, S., & Smolander, K. (2016). Where is current research on blockchain technology?—a systematic review. PloS one, 11(10), e0163477.

Yousafzai, S. Y., Pallister, J. G., & Foxall, G. R. (2003). A proposed model of e-trust for electronic banking. Technovation, 23(11), 847-860.

Bibliographic information of this paper for citing:

Nejati Rashtabadi, Hojjat; Akbari, Mohsen; Delafrooz; Narges & Gholipour Soleimani, Ali (2022). Trust in Blockchain-Based Advertising: A System Dynamics Approach. *Journal of Information Technology Management*, Special Issue, 62-82. https://doi.org/ 10.22059/jitm.2022.87841