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Combination SWOT-AHP analysis for using Blockchain in E-Commerce

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ABSTRACT

The aim of this study is an internal and environmental analysis of e-commerce with a blockchain technology platform to identify and improve the existed status. The technique applied in this study is the use of SWOT analysis and its combination with AHP to quantify the importance of factors and detect their relation. First, the internal and external active factors on SWOT analysis related to the using the blockchain in e-commerce were identified and counted. Moreover, the conditioning and susceptibility of these factors on each other was analyzed by the formation of the SWOT matrix. Then, concerning the multi-criteria and hierarchical problem, the problem was converted to a 3-layer hierarchical structure compared to pairwise comparisons of these factors by using one questionnaire with the Saaty 1-9 method and receiving ten experts' opinions related to blockchain and e-commerce among academic professors and computer engineers. The separated tables presented the results of these pairwise comparisons along with the weight and importance rank of each factor. The related analyses were extracted on the basis of data and comparisons. Based on the results, the opportunity criterion was assigned in the rank 1 with the highest importance, and strength, weakness and threat criterion was ranked in the following. Subsequently, some strategies were defined and determined proportionally to these data and analyses. Indeed, the mentioned strategies can be changed and localized in any organization concerning the mission of the organization, the resources, and the internal and external differences of the organization and so on.
Keywords: E-Commerce, Blockchain, SWOT Analysis, Pairwise Comparison Analysis, AHP

Introduction

Blockchain was initially introduced in 2008 by Satoshi Nakamoto and was presented in the form of a cryptocurrency called Bitcoin. Since then, the researchers and engineers were seeking other applications and used for it, and they are still following this purpose concerning the features and capabilities of this technology. Over time, the blockchain left its position from specialized purpose systems (cryptocurrency). It went to general systems, including applied systems, planning systems, organizational resources, and, more generally, e-commerce and e-business systems. After investigating the factors and important

blockchain criteria and scientific analysis methods and studying, comparing and analyzing these factors, this study was attempted to have a look at the strategies for their usage.

Statement of Research Problem

Blockchain (BC) has been a significant concern recently since major financial institutions around the world announce that they are starting their activities in this regard. As an example, R3CEV and Linux foundation has started projects with many financial institutions and technology companies, including IBM, Intel, and Cisco. Furthermore, many central banks, including Australian, Chinese, Korean, Singapore, US English, have announced their projects to study digital currencies or blockchain-based accounting headlines. Despite the initial stages of development, financial institutions declare that BC technologies can considerably reduce the complexity of bank processing and replace expensive database programs and middleware processing programs [1]. In 2017, around 1.66 billion people in the world purchased their goods through online retailers companies such as Amazon.com, Alibaba.com, and JD.com. In the same year, global sales of e-commerce were over 2.3 US trillion $. Recently, the customers are supposed to purchase on the internet more and more, for example shopping from the highly-known carnival of "Double 11" [2]. But do the combination of these two items (e-commerce and blockchain) result in revolution or at least a considerable progress in e-commerce? This research was aimed at investigating the entry strategy and blockchain usage in e-commerce with the application of the SWOT analysis method. Then, it was supposed to conclude and determine how the role and the entrance of blockchain technology in e-commerce would be based on SWOT analysis in terms of time, context and technology, etc. Finally, some suggestions would exist in this regard.

Theoretical and Scientific Principles

SWOT (Strength Weakness Opportunity Threat) Analysis

SWOT is known as one prevalent tool for analyzing the internal and external environment and determining a systematic approach for decision making. SWOT analysis is a "pre-planning" analytical model and method that takes action in exhibiting the present and discussing future based on four factors in the internal category (strength and weakness) and external category (opportunity and threat). Two pre-planning approaches of conditioning and susceptibility were examined in this model:

1. After combining the strength-weakness and opportunity-threat, the conditioning of internal strength on opportunity threats external factors would be pre-planned.
2. After combining the opportunity-weakness and weakness-threat, the susceptibility of internal strength on opportunity threats external factors would be pre-planned.

AHP (Analytical Hierarchy Process) Analysis

The AHP analysis method, which is called an analytical hierarchy process or pairwise comparison, is one of the broadest decision-making techniques with multiple criteria. Since it provides the possibility of systematic analysis of the problem hierarchically and can consider the different qualitative and quantitative approaches. This method is one multi-indices decision-making method that enables the conduction of the general decision-making process by analyzing elements of a complex problem and converting it into the hierarchical and layered structure of goals. Finally, pairwise comparisons (each pair of criteria together) can lead to the relative importance computation of each criterion in the different layers. Moreover, this method is so appropriate for solving problems that their criteria and sub-criteria of decision-making enjoy hierarchical structure.

Research Methodology

In this research, the conditioning and susceptible factors on the internal and external environment were detected by SWOT analysis. The manner of conditioning and sensitive factors on each other were analyzed through SWOT formation and combination of SW and OT. Since SWOT analysis cannot detect and represent the importance rate of factors quantitatively, the AHP analysis was used.

In this regard, the strengths, weaknesses, opportunities, and threats of blockchain technology in e-commerce were detected and then analyzed with the use of strategic approach:

- **Strength**

S1. Full Chain Transparency: Since blockchain is an entirely transparent chain for stakeholders, it can provide a transparent platform for e-commerce and its resident systems, particularly financial, monetary, supply chain, stocks in hand, financial books, exchange, and so on.

S2. Reduce and Eliminate the Role of Intermediaries: Blockchain can significantly reduce transaction costs by reducing and removing the role of intermediaries and overhead exchange costs [1]. For example, reducing the intermediaries that have unsafe servers through reducing the likelihood of fraud or creating transparency will weaken the need for auditor intermediaries and ultimately reduce the time and cost (clause S.6) of the system.

S3. The Existence of Tracking and Audit Trail: Blockchain makes it possible to record and keep records of data changes, thereby enabling the tracking and auditing of information through files.

S4. Decentralized Approach: Blockchain is one network along with a decentralized and peer-to-peer approach. In this regard, the advantages of decentralized and peer-to-peer networks such as distributed processes and distributed security are transferred to blockchain-based systems.

S5. High Efficiency with Preserving Privacy: Blockchain has high efficiency, especially in terms of private and consortium type [3].

S6. Lower Cost: Blockchain can reduce the cost of creation, continuation, maintenance, and using data and computation by reducing the number of extra and inefficient intermediaries in the network [4] and reducing the cost of storing and computing data through the application of distributed mechanisms [5].

S7. Lower Risk: Concerning the inalterability of blockchain, blockchain-based subsystems of e-commerce cannot make change arbitrary after registering the information. Moreover, all transactions are stored and duplicated in the entire blockchain system and are tractable and hearable. Consequently, destructive behaviors such as financial fraud can be increasingly reduced and lead to lower risk in the whole system [6].

S8. Robustness (no SPOF): Several years passed, and there is still some destruction in the significant online operating systems in use. When the problem goes more in-depth and will be comprehensive profoundly, and all of these are due to "stopping the system function with the emergence of the first fault" (SPOF), Blockchain will solve this problem due to the distributed structure, and therefore add robustness to the e-commerce subsystems.

S9. Creating Trust in the Untrusted Network: Blockchain mediates the creation of trust between members who do not know and trust each other by providing the detection platform of members through authentication by crucial private and genera and … [8], as well as using the information distributed across a network of millions of sites or nodes instead of the existence of a centralized entity that holds information [9].

S10. Preserving Unharmed Privacy: Blockchain can provide confidentiality for all the data or specific sensitive data in which it is stored. [10]. It is conducted through data hashing, robust and irreversible encryption, generating private and general keys, and so on. The other blockchain usage is related to browsers, which hides personal information and allows consumers to remain anonymous and may not be targeted by advertisers due to the use of unwanted search engines. It is these users who choose to receive less but more relevant advertising [11].

S11. Disruptive Technology: As the disruptive technology enters the market, they result in increasing the level of demand and expectation of customers, providing more possibilities and facilities, and finally becoming the latest technologies obsolete. Blockchain is known as one disruptive technology and can appear severe conditions for the survival of existing technologies such as security, business collection, encryption, storage, transparency, reduce mediator, money and capital and bank markets, etc. This can be the most crucial strength of blockchain from a commercialization point of view, but it will be mentioned at the end in order not to create subjectivity in the reader's mind.

- **Weaknesses**
  - **W1. Integration with Legacy Systems**: The integration of blockchain with previous and pre-remaining systems concerning their different structures is one of the blockchain's significant challenges that companies are confronted with today. Thus, blockchain cannot be an intermediary for linking to legacy systems [12].
  - **W2. Lack of Standards**: Despite the existing comprehensive network, there is no universal standard for blockchain programs. Standardization can contribute to reduce costs, create more efficient consensus mechanisms, and introduce interoperability (between networks and blockchain chains). [13]

Although blockchain reduces costs and increases the efficiencies of a universal and smart contract, a lack of standards can have the opposite effect. Criteria are essential for networks concerning the information systems. However, achieving global standards is difficult for them, and it can take some time for organizations to have a shared global chain standard, which the International Standards Organization currently operates on. [14]

- **W3. Scalability**: There are four significant subjects with blockchain scalability: constraint, block size, response time, and high costs. All of these problems should be tackled, since networks are expanding every day, and the number of users is increasing [15]. If the transactions are not confirmed in real-time or in a short period, this matter will influence the technical acceptance of a blockchain. Because some decisions needed to be made quickly in today's fast environments [14].
- **W4. Security against cybercriminals**: Although blockchain certainly improved transparency and security in digital transactions, it is not safe against cybercriminals' attacks. There are several techniques used by cybercriminals. One of these techniques is the "routing attack." In a routing attack, hackers track the data as it is sent to the ISP and divide the computer networks (nodes) into some sections. All sections of the system continue their operations, as usual, unaware of the fact that the newly created parts are still operating. Then, the hacker is capable of producing large amounts of counterfeit transactions in new sections so that these sections result in rejecting the correct deals by network and confirming false transactions [16].

- **Opportunities**
  - **O1. Improved Customer Experience Systems**: Transferring to the blockchain-based system makes rewards transferrable at any point (like real money). This matter not only accelerates the affairs but also potentially allows the customers to use the value of their purchases to receive immediate discounts. Several startups, such as Qiibee and loyall entered the loyal cards based on blockchain into the market to enable the customers to deliver the equivalent value of their coupons to different retailers and trade with it. This can lead to loyalty rewards exchanges, and customers can invest their earned amount in what is required. Generally, this matter will culminate in higher customer satisfaction [17].
  - **O2. Enhancing Security Systems**: Blockchains are inherently safer than many other storage systems because they are designed based on encryption. Moreover, this information is distributed, and no one has central control over the database. The data cannot be deleted randomly and will not be available to anyone who is not allowed to see it. This means that if one uses sensitive data or those data which required to be preserved safe for a long period of time, the blockchain will probably be proper for your goals [17].
  - **O3. Systems Related to Smart Contract**: Smart contracts are an example of blockchain application. These "small programs" automatically perform agreements between the different parties in the realization of specific conditions. Various exchange transactions, real estate transactions, and estate and supply chain management are only a small number of applications for smart contracts. Since smart contracts are automatically performed inside one blockchain, there is no intermediary to manage the transaction or collect the costs. One smart contract can be considered as one legal peer-to-peer contract [18].

- **O4. Systems Related to the Internet of Things (IoT)**: As the IoT devices increased, these devices often would be lack of the authentication standards required to keep user information secure. In the case of influencing the hackers with a wide range of IoT devices, critical infrastructure will be damaged. Authentication is required across all IoT components to make sure of security. Blockchain's distributed architecture can contribute many of this security and trusting challenges to be solved. Blockchain is applied to track the sensor data measurements and prevent duplication with other disruptive data. IoT sensors can exchange data with each other in a trustable and securable way in case of having a blockchain, instead of using a third party for creating trust. Blockchain allows the device autonomy (smart contract), individual identity, and data integrity, and supports peer-to-peer communication by eliminating technical bottlenecks and inefficiency. This issue reduces the costs of establishing and exploiting IoT through blockchain due to a lack of intermediary [18].
- **O5. Insurance Systems**: Insurance industry is one of the commercial programs to use blockchain and is one of the best opportunities to create a disruption (transformation, replace with old technology). Blockchain can easily organize, track, and secure data. It can also perform the agreements. All of these features can be exploited for any type of insurance. There are several advantages that insurance companies are using Blockchains for insurance. Processes are simplified, the rotation time is decreased, and detecting and preventing fraud are greatly improved. Improving productivity and risk management means reducing premiums [18].
- **O6. Food Safety Systems**: Blockchain is an ideal technology for preserving food safe in the world, and this is the reason for blockchain's ability to perform the process adaptation. Indeed, food safety indicates one of the hottest chain business processes, and commercial opportunities of blockchain are prevalent in the food industry. Some examples of cases where blockchain can identify the spoilage in the food supply chain are:

Detecting that a farmer has failed to test soil, detecting that air conditioning is not conducted in a trailer device that provides food to the market, identifying the delay in transporting that reduces the food shelf life, accessing to health inspection reports at a restaurant and other places with the use of smart contracts and IoT technology. Blockchain can reserve records such as fruit records like berries at the time of tree planting up to the clients' table. If safety is violated at each stage, smart contracts will prevent the creation of disruptions and problems [18].

- **O7. Hardware Technology Growth**: Concerning Moore's Law (Gordon Moore, Intel's founder), the number of microprocessor transistors is doubled every 18 months. Gilder's Law (George Gilder, Information Technology Researcher) predicts that the bandwidth of communication systems will rise by 2 to 3 times each year. The development of hardware and communication technologies and information storage, including the room and speed of storage information devices, the storage and speed of memory, the speed and bandwidth of local networks and internet and wireless communications, the rate of microprocessor processing, and other factors, are inclined toward a direction in which there is no concern for systems requiring communication speed, Processing speed, memory storage, capacity of storage media, and others. However, also they imagine having exponential growth for the future.
- **O8. Disrupting advertising models and protecting personal information**: New media platforms and social media are attempting to gather people with common and transparent interest to earn money by introducing them to companies as advertisements. Companies spend an enormous sum of money on advertising on Facebook, Google, and YouTube. In the blockchain-based model, the general goals of third parties and their attention to advertisers are altered with the use of blockchain technology. In this model, decentralized search engines are applied, and consumers earn advertising profits by attaching their personal information to the blockchain. When they search through the search engine, on the other side, the jobs need these people that can directly pay them the cost of access to advertising. The transaction record is visible to all relevant people, the transparency of advertisers will be increased, and they are allowed to understand better where to allocate their budget. In this model, it is the users who choose and receive less but more relevant advertisements.

While the advertiser earns a higher return on investment (ROI) with the purpose of targeted advertising [11].

O9. Other Commercial Systems: Commercial systems used in e-commerce can each use one or more blockchain capabilities at the same time. It seems that with the evolution of technology, new applications of blockchain can be considered for e-commerce systems.

- **Threat**

T1. Environmental Regulations: The risk of global warming has led to a renewed focus on environment-friendly manners. The cost of electricity required to implement large blockchain networks is very high. Currently, bitcoin networks use power more than most countries around the world. With the increase in the use of blockchain, the energy load will be considered even more than before. If more energy sources are not found to run blockchain-based programs, there will probably be much opposition to this large-scale consumption of energy (Katalyse.io, 2018).

T2. 51% Attack: theoretically, the Blockchains are invariable. The strength of this theory increases with the size of the network. Otherwise, any potential blockchain program doesn't enjoy a vast network of members. Therefore, it opens the door for a 51% attack. A 51% attack occurs when a node or group of nodes, which controls 51% of a blockchain's hash, changes the data records by consensus conduction. A successful 51% attack on blockchain can have fateful consequences [19].

T3. Scalability-Security Trade-off Duality: Exponential growth in the size of a blockchain can result in the possibility of scalability-security duality, the duality that is difficult to be conducted and managed. On the one hand, a more extensive blockchain means more security. As the network reaches a certain level, the probability of a 51% attack will be very low. On the other hand, the larger the blockchain, the scalability would decrease. Since the size of data stored in a large chain creates constraints for maintaining information [19].

- **SWOT Matrix**

To provide an appropriate analysis of the interaction manner (conditioning and susceptibility) of identified factors, these factors are localized in one matrix with the dimension of SW (internal) and OT (external) (figure 1). The meeting place of these factors is placing that lead to an interaction (intensification, mitigation, conflict, alignment) between factors.

SW / OT			Full Chain Tranparency	Reduce & Eliminate the Role of Intermediaries	The Existence of Tracking and Audit Trail	Decentralized Approach	High Efficiency with Preserving Privacy	Lower Cost	Lower Risk	Robustness (no SPOF)	Creating Trust in the Untrusted Network	Preserving Unharmed Privacy	Disruptive Technology	Integration with Legacy Systems	Lack of Standards	Scalability	Security against cybercriminals
			Strength											Weakness			
			S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	W1	W2	W3	W4
Improved Customer Experience Systems	Oportunity	O1	S1O1								S9O1	S10O1	S11O1				
Enhancing Security Systems	Oportunity	O2	S1O2		S3O2				S7O2	S8O2	S9O2	S10O2	S11O2				W4O2
Systems Related to Smart Contract	Oportunity	O3	S1O3	S2O3	S3O3				S7O3			S10O3	S11O3				
Systems Related to the IoT	Oportunity	O4		S2O4		S4O4		S6O4	S7O4	S8O4			S11O4				
Insurance Systems	Oportunity	O5	S1O5		S3O5				S7O5				S11O5				
Food Safety Systems	Oportunity	O6	S1O6		S3O6				S7O6		S9O6		S11O6				
Hardware Technology Growth	Oportunity	O7				S4O7	S5O7						S11O7			W3O7	
Disrupting advertising models and protecting personal information	Oportunity	O8		S2O8			S5O8					S10O8	S11O8				
Other Commercial Systems	Oportunity	O9	S1O9	S2O9	S3O9	S4O9	S5O9	S6O9	S7O9	S8O9	S9O9	S10O9	S11O9				
Environmental Regulations	Threat	T1	S1T1		S3T1			S6T1					S11T1				
51% Attack	Threat	T2	S1T2	S2T2	S3T2	S4T2			S7T2							W3T2	W4T2
Scalability-Security Trade-off Duality	Threat	T3				S4T3				S8T3						W3T3	W4T3

Figure 1: SWOT matrix with the location of strengths, weaknesses, opportunities, and threats

Findings Analysis

- **SWOT Matrix Analysis**

S1O1: Opportunities for "customer's experience-based systems" are appeared when they are: A) transparent, reliable and interoperable for the customer, B) open and acceptable to a service provider, C) be visible and touchable for other beneficiaries. Hence, the strength of "full chain transparency" in blockchain can fulfill and realize this opportunity correctly.

S1O2: Sometimes systems, which require security, take action in concealing, walling, closing, and other activities to prevent access to safety creation. But a system that can provide the highest protection while being transparent and in view will be a distinction and a tremendous competitive advantage compared to closed systems.

S1O3: They are smart contracts and based on collaboration between beneficiaries. The beneficiaries of one agreement are service provider, client, the verifier, the guarantor, the evaluator, etc. other recipients should be under control to make a wisdom-based effect in the smart contract. The essential requirement of this control is the transparency of reality, ability, impartiality, and honesty of the beneficiaries, in which the strength of "full chain transparency" can supply this requirement properly and have an empowering effect.

S1O5: This analysis is similar to S1O3 analysis.

S1O6: This analysis is similar to S1O3 analysis.

S1O9: This analysis is similar to S1O3 analysis.

S1T1: The business impact on the environment is a multifaceted impact, which some angles of it or its positive or negative factors are often concealed. Is the X amount of energy (like electricity) to conduct a Y amount of business positive environmentally? It needs to extract all the positive and negative effects of this behavior and compare it with other forms of commerce and business behavior. Therefore, the strength of "full chain transparency" can contribute to environmental decisions: A) can clear the amount of actual work performed against ecological impacts, B) can create transparency-based systems that themselves are supposed to control and exhibit the performance of other systems and being transparent at the same time, C) can economize and cost-effective the production of environment-friendly energies by introducing additional costs and generating value-added in trade.

S1T2: 51% of attacks are conducted by members of a blockchain chain. If the strength of “full chain transparency” can also be extended to members’ behaviors, it can identify members that are destructive and aggressive and allow restrictive or countervailing measures against them.

S2O3: The opportunity of "smart contract" is a distinct and almost complete example of e-commerce, since it has all the factors of a perfectly competitive market such as buyer, customer, competition, demand, intermediary, fair commercial rules and so on. In such a market, some factors will be so crucial and practical, they are cost reduction, time reduction, chain length reduction, product creation, security trusting, transparency, etc. Therefore, the strengths of "reducing and eliminating the role of intermediaries" are useful in terms of cost, safety, and other items.

S2O4: IoT-based systems are associated with valuable, depreciable assets requiring production technology and communication. Their central entity is to increase the speed of the process and reduce the impact of human factors. Hence, the strengths of "reducing and eliminating the role of intermediaries" will have a direct effect on achieving the goal of this opportunity and its practical realization.

S2O9: This analysis is similar to S1O4 analysis.

S2T2: The strengths of "reducing and eliminating the role of intermediaries" should be examined and analyzed from two perspectives:

Reducing and eliminating the role of intermediaries: Since this event reduces network (number of members), it can increase the probability of 51% attacks.

The probability of reducing and eliminating the role of intermediaries: The mention of "probability" makes the analysis utterly different since it is possible to take actions with considerations regarding the intermediary elimination in the chain in case of identification members with destructive behaviors by referring to the S1T2 analysis.

Regarding the two above items, the conduction of this strength should be decided based on the business model.

S3O2: The need for a further explanation does not mean that the strength of “the existence of tracking and audit trail” will have an intensifying effect on "enhancing security systems."

S3O3: Like S2O3, this is one of the active factors on a perfectly competitive market, security, and trust, intensifying and reinforces and realizing with the strength of the "existence of tracking and audit trail."

S3O5: The entity of the "insurance systems" opportunity is in such a way that often needs the double investigation of the process of insurance policy formulation, terms of obligations authentication, honesty or abuse and so on after the appearance of conditions requiring compensation (occurrence of the risks promised in the insurance), in which the strength of “the existence of tracking and audit trail” contributes to these investigations by maintaining records.

S3O6: Since the opportunity of “food safety systems” investigate and controls the A to Z process of pre-planning, planning, pre-planting, planting, growing, harvesting, selection, maintenance and packaging, transportation, sales, etc. into foodstuffs (like organic foodstuffs), the strength of "the existence of tracking and audit trail" has a primary and conditioning effect on it.

S3O9 and S3T1: This analysis is similar to S3O6 analysis.

S3T2: This analysis is similar to S1T2 analysis.

S4O4: Since most members (nodes) in the opportunity of "IoT" are processor-type devices, it is considered as an excellent platform that is reinforced and complemented with the strengths of the "decentralized approach."

S4O7: The opportunity of “hardware technologies growth” will appear the capacity in the future to make possible the process distribution and storage space in a “decentralized approach” with ease and without hardware constraints.

S4O9: This analysis is similar to the S4O7 analysis.

S4T2: Expansion of the network with a "decentralized approach" results in locating the destructive members at a minimum level and not reaching the 51% of the system and thus reducing the probability of a "51% attack".

S4T3: Against S4T2 analysis, expansion of the network with a "decentralized approach" with the effect on the weakness of "scalability-security trade-off duality" heavies the balance toward the "scalability reduction." However, these effects can be mitigated with the combination of S4O7T3.

S5O7: Those analyses that use the O7 opportunity (such as this analysis) are based on compensating the process complexity by increasing processing resources, which are also applicable in this analysis.

S5O9: This analysis is similar to the S5O7 analysis.

S6O4 and S6O9: This analysis is similar to S2O4 analysis.

S6T1: Being bound to "environmental regulations" is usually not only income-generating but also is cost-reducing activity. Hence, the cost-reducing factors add competitive advantage costs and economic justification to the systems.

S7O2: The opportunity of "enhancing security systems" and the weakness of "lower risk" are in line and have an enhanced role.

S7O4: This analysis is similar to S2O4 analysis.

S7O3 and S7O5 and S7O6 and S7O9: This analysis is similar to S3O3 analysis.

S7T2: This analysis is similar to S3T3 analysis.

S8O2: This analysis is similar to S7O2 analysis.

S8O4 and S8O9: This analysis is similar to S2O4 analysis.

S8T3: This analysis is similar to S4T3 analysis.

S9O1: This analysis is similar to S1O1 analysis.

S9O2: This analysis is similar to S1O2 analysis.

S9O6 and S9O9: This analysis is similar to S1O6 analysis.

S10O1: This analysis is similar to S1O1 analysis.

S10O2: This analysis is similar to S1O2 analysis.

S10O3 and S10O9: This analysis is similar to S1O3 analysis.

S11O1 … S11O9, S11T1: Regardless of any other strength, the strength of "disruptive technology" can be one of the essential reasons for the willingness and attention of the market to a new product and blockchain along with other strengths.

W3O7: The weakness of "non-scalability" has a direct relation with existing resources. Hence, the increase in processing and storage and communication capacity can enhance scalability and reduce the impact of this weakness.

W3T2 and W3T3: This analysis is similar to S4T3 analysis.

W4O2: The effect of "security against cybercriminals" weakness can be reformed by empowering the "enhancing security systems" opportunity.

W4T2: If the weakness of "Security against cybercriminals" is followed in the form of network members by the penetration of cybercriminals, it can exacerbate the threat of a "51% attack".

W4T3: This analysis is similar to W4T2 analysis.

- **Combination Analysis of SWOT-AHP**

Now, the AHP analysis is needed to hierarchically analyze the factors identified in the SWOT to A) quantify the importance of each factor, B) determine the importance of the factors to each other, and rank them in terms of importance. At first, the hierarchical structure of SWOT analysis is designed concerning figuring 2.

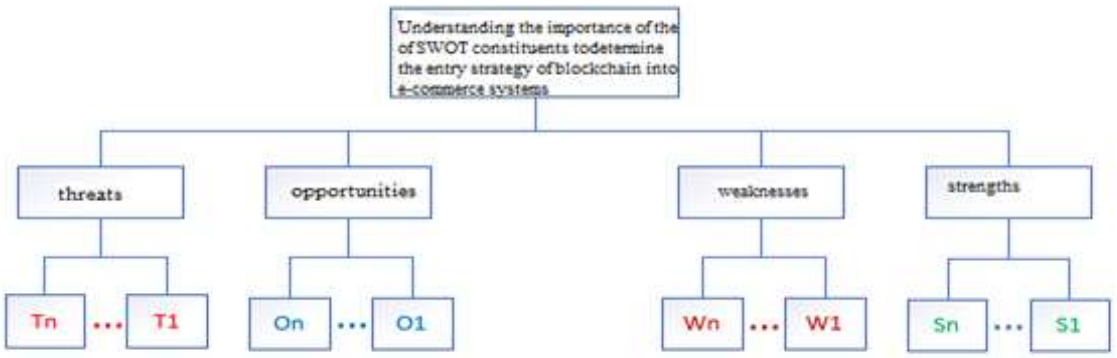
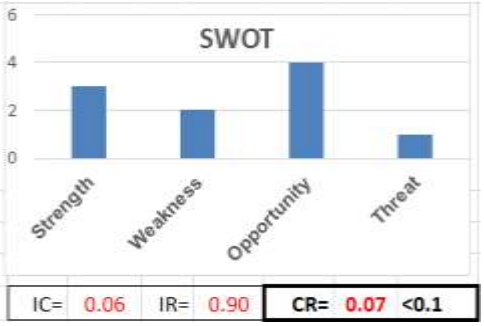


Figure 2: SWOT decomposition structure to AHP hierarchy

In this regard, pairwise comparison (homogeneous) of factors with each other is required. So, a questionnaire was used according to the Saatty1-9 method, and ten experts were adopted to conduct this comparison.

- **Pairwise Comparison of Main Criteria of SWOT**

SWOT	Strength	Weakness	Opportunity	Threat	Weight	Standard Weight	Normalized Weight	Rank
Strength	1.00	4.93	0.71	2.46	1.32	0.33	33.12	2
Weakness	0.20	1.00	0.17	1.84	0.42	0.11	10.56	3
Opportunity	1.41	6.01	1.00	4.04	1.85	0.46	46.28	1
Threat	0.41	0.54	0.25	1.00	0.40	0.10	10.04	4



IC= 0.06 IR= 0.90 **CR= 0.07 <0.1**

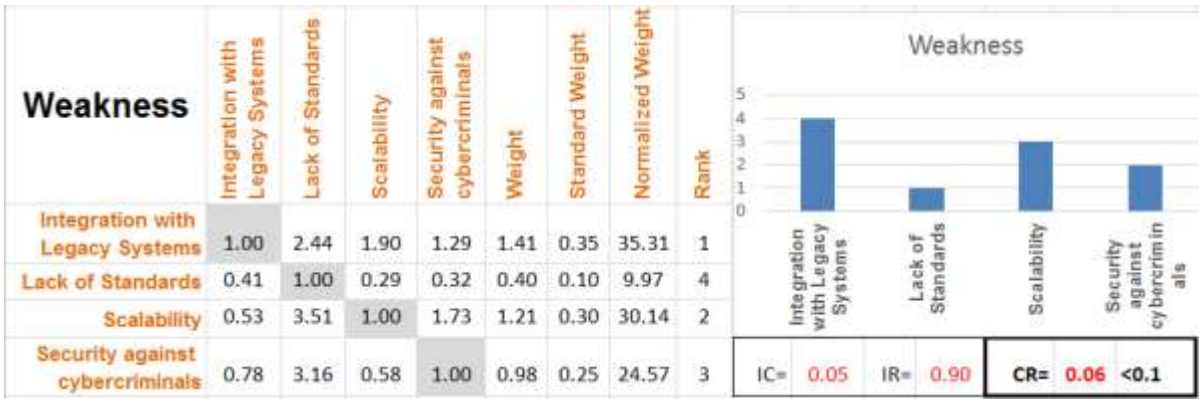
Analysis: According to the table above, the opportunity criteria were ranked first in terms of importance, followed by strengths, weaknesses, and threats, respectively. Also, the inconsistency rate is 0/07 and less than 0/1 and is in stable condition.

- **Pairwise Comparison of Sub-criterion of Strength**

Strength	Full Chain Trancparency	Reduce & Eliminate the Role of	The Existence of Tracking and Audit	Decentralized Approach	High Efficiency with Preserving Privacy	Lower Cost	Lower Risk	Robustness (no SPO	Creating Trust in the Untrusted Network	Preserving Unharmed Privacy	Disruptive Technology	Weight	Standard Weight	Normalized Weight	Rank
Full Chain Trancparency	1.00	0.41	0.85	0.90	0.58	0.18	0.25	0.38	0.26	0.59	0.20	0.35	0.03	3.19	11
Reduce & Eliminate the Role of Intermediaries	2.41	1.00	2.11	3.18	1.46	0.78	1.17	1.60	0.85	1.38	0.20	0.95	0.09	8.63	5
The Existence of Tracking and Audit Trail	1.17	0.47	1.00	1.68	1.62	0.36	0.32	0.45	0.25	1.56	0.23	0.54	0.05	4.92	8
Decentralized Approach	1.12	0.31	0.60	1.00	0.61	0.27	0.30	0.34	0.30	1.27	0.18	0.38	0.03	3.47	10
High Efficiency with Preserving Privacy	1.73	0.69	0.62	1.65	1.00	0.65	0.55	0.59	0.51	2.20	0.27	0.65	0.06	5.89	7
Lower Cost	5.53	1.28	2.82	3.74	1.54	1.00	1.93	1.94	0.82	2.51	0.24	1.30	0.12	11.79	3
Lower Risk	4.02	0.85	3.15	3.32	1.80	0.52	1.00	1.41	0.74	1.57	0.24	1.02	0.09	9.28	4
Robustness (no SPOF)	2.61	0.63	2.21	2.98	1.71	0.51	0.71	1.00	0.24	2.04	0.25	0.82	0.07	7.42	6
Creating Trust in the Untrusted Network	3.86	1.17	3.97	3.34	1.98	1.21	1.35	4.09	1.00	3.03	0.27	1.46	0.13	13.25	2
Preserving Unharmed Privacy	1.71	0.73	0.64	0.79	0.46	0.40	0.64	0.49	0.33	1.00	0.28	0.49	0.04	4.43	9
Disruptive Technology	4.92	4.90	4.34	5.47	3.71	4.20	4.11	3.94	3.75	3.62	1.00	3.05	0.28	27.73	1

Analysis: According to the table above, the disruptive technology criterion was as the first rank of importance, and full chain transparency was considered as the last one. Also, the inconsistency rate is 0/03 and is less than 0/1 and is in stable condition.

- **Pairwise Comparison of Sub-criterion of Weakness**



Weakness	Integration with Legacy Systems	Lack of Standards	Scalability	Security against cybercriminals	Weight	Standard Weight	Normalized Weight	Rank
Integration with Legacy Systems	1.00	2.44	1.90	1.29	1.41	0.35	35.31	1
Lack of Standards	0.41	1.00	0.29	0.32	0.40	0.10	9.97	4
Scalability	0.53	3.51	1.00	1.73	1.21	0.30	30.14	2
Security against cybercriminals	0.78	3.16	0.58	1.00	0.98	0.25	24.57	3

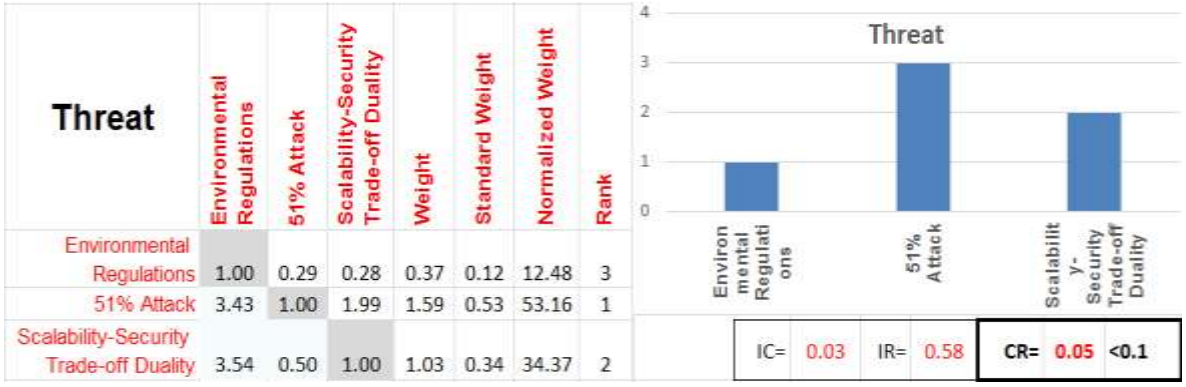
Analysis: According to the table above, the "integration with legacy systems" criterion was at the first rank, and the rule of lack of standard was at the last level of importance. Also, the inconsistency rate is 0/06 and is less than 0/1 and is in stable condition.

- **Pairwise Comparison of Sub-criterion of Opportunity**

Opportunity	Improved Customer Experience Systems	Enhancing Security Systems	Systems Related to Smart Contract	Systems Related to the IoT	Insurance Systems	Food Safety Systems	Hardware Technology Growth	Disrupting advertising models	Other Commercial Systems	Weight	Standard Weight	Normalized Weight	Rank
Improved Customer Experience Systems	1.00	0.46	0.25	0.18	1.93	1.32	0.17	0.52	0.36	0.38	0.10	4.26	8
Enhancing Security Systems	2.16	1.00	0.30	0.20	3.44	1.84	0.24	0.54	0.54	0.59	0.15	6.57	6
Systems Related to Smart Contract	4.04	3.31	1.00	0.37	4.16	3.62	1.46	3.09	1.46	1.57	0.39	17.42	3
Systems Related to the IoT	5.49	4.92	2.69	1.00	3.13	2.16	0.43	3.42	3.42	1.90	0.47	21.06	2
Insurance Systems	0.52	0.29	0.24	0.32	1.00	0.85	0.22	0.28	0.30	0.31	0.08	3.45	9
Food Safety Systems	0.76	0.54	0.28	0.46	1.17	1.00	0.31	0.70	0.39	0.43	0.11	4.82	7
Hardware Technology Growth	5.86	4.10	0.68	2.33	4.49	3.18	1.00	5.16	5.16	2.28	0.57	25.29	1
Disrupting advertising models and protecting personal information	1.93	1.84	0.32	0.29	3.62	1.43	0.19	1.00	0.42	0.64	0.16	7.07	5
Other Commercial Systems	2.78	1.84	0.68	0.29	3.12	2.58	0.19	2.40	1.00	0.91	0.23	10.07	4

Analysis: According to the table above, the "hardware technologies growth" criterion was at the first rank, and the rule of "insurance systems" was at the last level of importance. Also, the inconsistency rate is 0/06 and less than 0/1 and is in stable condition.

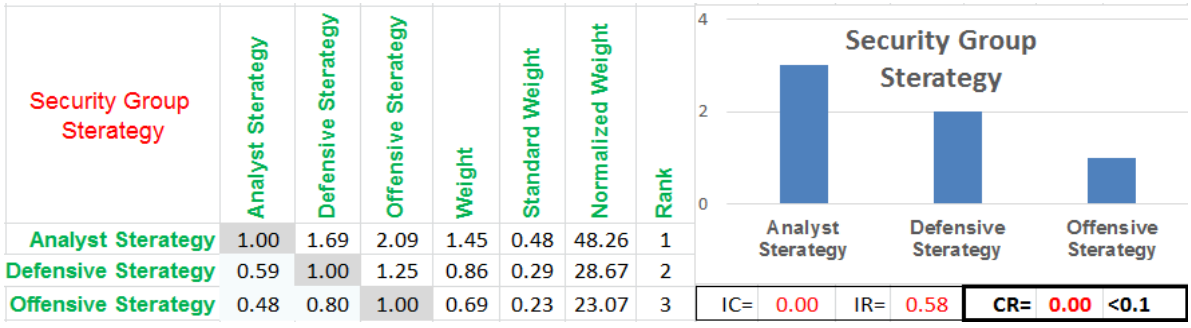
- **Pairwise Comparison of Sub-criterion of Threat**



Threat	Environmental Regulations	51% Attack	Scalability-Security Trade-off Duality	Weight	Standard Weight	Normalized Weight	Rank
Environmental Regulations	1.00	0.29	0.28	0.37	0.12	12.48	3
51% Attack	3.43	1.00	1.99	1.59	0.53	53.16	1
Scalability-Security Trade-off Duality	3.54	0.50	1.00	1.03	0.34	34.37	2

Analysis: According to the table above, the "51% attack" criterion was at the first rank, and the rule of "environmental regulations" was at the last level of importance. Also, the inconsistency rate is 0/05 and less than 0/1 and is in stable condition.

- **Pairwise Comparison of Strategies Related to Security Criteria Group**

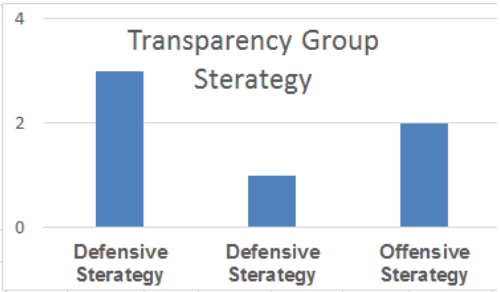


Security Group Sterategy	Analyst Sterategy	Defensive Sterategy	Offensive Sterategy	Weight	Standard Weight	Normalized Weight	Rank
Analyst Sterategy	1.00	1.69	2.09	1.45	0.48	48.26	1
Defensive Sterategy	0.59	1.00	1.25	0.86	0.29	28.67	2
Offensive Sterategy	0.48	0.80	1.00	0.69	0.23	23.07	3

Analysis: According to the table above, the analyst strategy criterion was at the first rank, and the offensive strategy criterion was at the last level of importance. Also, the consistency rate was 0/00, and it was less than 0/1 and was in stable condition.

- **Pairwise Comparison of Strategies Related to Transparency Criteria Group**

Transparency Group Sterategy	Analyst Sterategy	Defensive Sterategy	Offensive Sterategy	Weight	Standard Weight	Normalized Weight	Rank
Defensive Sterategy	1.00	2.83	1.14	1.40	0.47	46.52	1
Defensive Sterategy	0.35	1.00	0.82	0.63	0.21	21.15	3
Offensive Sterategy	0.87	1.21	1.00	0.97	0.32	32.34	2

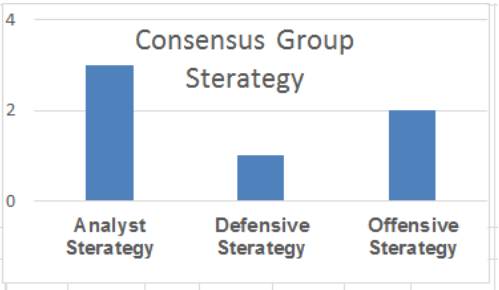


IC=	0.03	IR=	0.58	CR=	0.05	<0.1

Analysis: According to the table above, the analyst strategy criterion was at the first rank, and the defensive strategy criterion was at the last level of importance. Also, the consistency rate was 0/05, and it was less than 0/1 and was in stable condition.

- **Pairwise Comparison of Strategies Related to Consensus Criteria Group**

Consensus Group Sterategy	Analyst Sterategy	Defensive Sterategy	Offensive Sterategy	Weight	Standard Weight	Normalized Weight	Rank
Analyst Sterategy	1.00	4.84	1.16	1.46	0.49	48.83	1
Defensive Sterategy	0.21	1.00	0.27	0.31	0.10	10.47	3
Offensive Sterategy	0.86	3.75	1.00	1.22	0.41	40.70	2



IC=	0.00	IR=	0.58	CR=	0.00	<0.1

Analysis: According to the table above, the analyst strategy criterion was at the first rank, and the defensive strategy criterion was at the last level of importance. Also, the consistency rate was 0/00, and it was less than 0/1 and was in stable condition.

- **Pairwise Comparison of Strategies Related to Distributed Criteria Group**

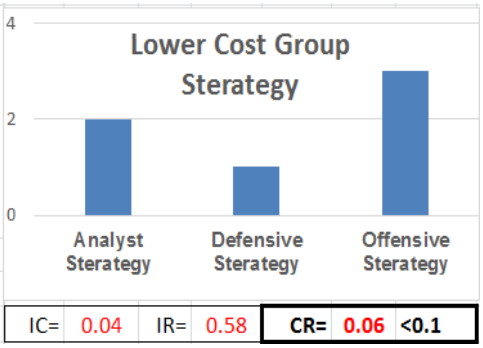
Distribution Group Sterategy	Analyst Sterategy	Defensive Sterategy	Offensive Sterategy	Weight	Standard Weight	Normalized Weight	Rank
Analyst Sterategy	1.00	2.41	1.51	1.45	0.48	48.34	1
Defensive Sterategy	0.42	1.00	0.70	0.62	0.21	20.83	3
Offensive Sterategy	0.66	1.43	1.00	0.92	0.31	30.83	2

IC=	0.00	IR=	0.58	CR=	0.00	<0.1

Analysis: According to the table above, the analyst strategy criterion was at the first rank, and the defensive strategy criterion was at the last level of importance. Also, the consistency rate was 0/00, and it was less than 0/1 and was in stable condition.

- **Pairwise Comparison of Strategies Related to Lower Cost Criteria Group**

Lower Cost Group Sterategy	Analyst Sterategy	Defensive Sterategy	Offensive Sterategy	Weight	Standard Weight	Normalized Weight	Rank
Analyst Sterategy	1.00	4.04	0.28	0.75	0.25	24.94	2
Defensive Sterategy	0.25	1.00	0.15	0.24	0.08	8.13	3
Offensive Sterategy	3.62	6.54	1.00	2.01	0.67	66.93	1



IC=	0.04	IR=	0.58	CR=	0.06	<0.1

Analysis: According to the table above, the offensive strategy criterion was at the first rank, and the defensive strategy criterion was at the last level of importance. Also, the consistency rate was 0/06, and it was less than 0/1 and was in stable condition.

- **Pairwise Comparison of Strategies Related to Increasing the Chain Value Criteria Group**

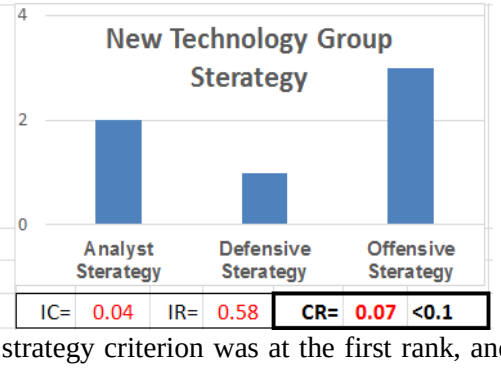
Increasing Chain Value Group Sterategy	Analyst Sterategy	Defensive Sterategy	Offensive Sterategy	Weight	Standard Weight	Normalized Weight	Rank
Analyst Sterategy	1.00	1.54	0.81	1.07	0.36	35.52	2
Defensive Sterategy	0.65	1.00	0.87	0.82	0.27	27.40	3
Offensive Sterategy	1.24	1.15	1.00	1.11	0.37	37.08	1

IC=	0.01	IR=	0.58	CR=	0.02	<0.1

Analysis: According to the table above, the offensive strategy criterion was at the first rank, and the defensive strategy criterion was at the last level of importance. Also, the consistency rate was 0/02, and it was less than 0/1 and was in stable condition.

- **Pairwise Comparison of Strategies Related to New Technology Criteria Group**

New Technology Group Sterategy	Analyst Sterategy	Defensive Sterategy	Offensive Sterategy	Weight	Standard Weight	Normalized Weight	Rank
Analyst Sterategy	1.00	3.50	0.26	0.73	0.24	24.17	2
Defensive Sterategy	0.29	1.00	0.18	0.28	0.09	9.33	3
Offensive Sterategy	3.82	5.57	1.00	1.99	0.66	66.50	1



IC=	0.04	IR=	0.58	CR=	0.07	<0.1

Analysis: According to the table above, the offensive strategy criterion was at the first rank, and the defensive strategy criterion was at the last level of importance. Also, the consistency rate was 0/07, and it was less than 0/1 and was in stable condition.

- **General Comparison Table of SWOT Criteria Based on AHP Weights**

Now, a provisional list of SWOT criteria (figure 3) is provided that is ranked based on AHP weights and makes it possible to identify the more significant criteria.

Group	Groups Weight	Sub-Criterion	Sub-Criterion Weight in the Group	Total Weight of Sub-Criterion	Rank
Strength	0.33	Full Chain Trancparency	0.03	0.01	27
		Reduce & Eliminate the Role of Intermediaries	0.09	0.03	18
		The Existence of Tracking and Audit Trail	0.05	0.02	22
		Decentralized Approach	0.03	0.01	25
		High Efficiency with Preserving Privacy	0.06	0.02	21
		Lower Cost	0.12	0.04	12
		Lower Risk	0.09	0.03	17
		Robustness (no SPOF)	0.07	0.02	20
		Creating Trust in the Untrusted Network	0.13	0.04	11
		Preserving Unharmed Privacy	0.04	0.01	23
		Disruptive Technology	0.28	0.09	5
Weakness	0.11	Integration with Legacy Systems	0.35	0.04	13
		Lack of Standards	0.10	0.01	26
		Scalability	0.30	0.03	16
		Security against cybercriminals	0.25	0.03	19
Oportunity	0.46	Improved Customer Experience Systems	0.10	0.04	10
		Enhancing Security Systems	0.15	0.07	7
		Systems Related to Smart Contract	0.39	0.18	3
		Systems Related to the IoT	0.47	0.22	2
		Insurance Systems	0.08	0.04	14
		Food Safety Systems	0.11	0.05	9
		Hardware Technology Growth	0.57	0.26	1
		Disrupting advertising models and protecting	0.16	0.07	6
		Other Commercial Systems	0.23	0.10	4
Threat	0.10	Environmental Regulations	0.12	0.01	24
		51% Attack	0.53	0.05	8
		Scalability-Security Trade-off Duality	0.34	0.03	15

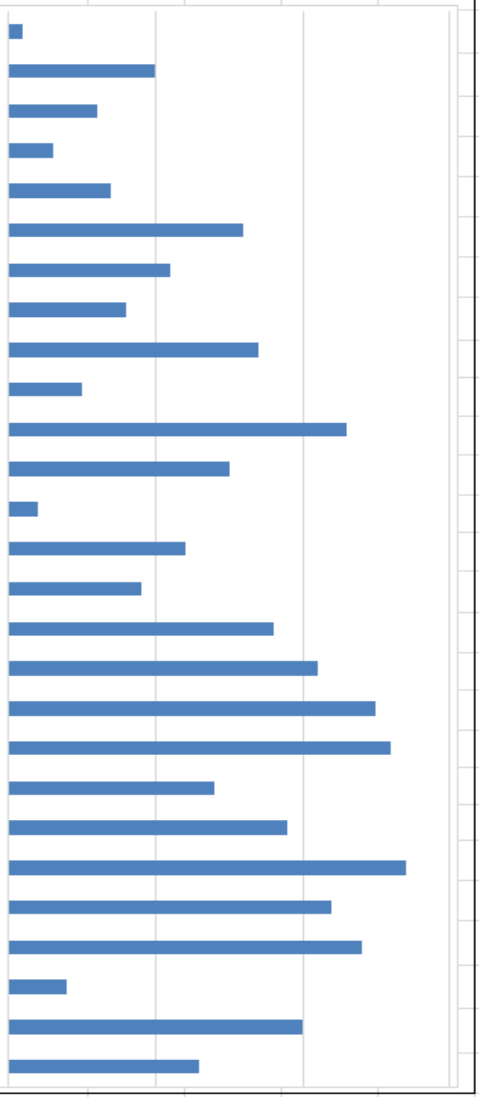


Figure3. Table of total comparison of SWOT criteria based on AHP weights

Analysis: Concerning figure 3, the essential criteria in the opportunities were "hardware technology growth" and "IoT related systems," and the least critical criteria were "full chain transparency" of strengths and "lack of standards" of weaknesses group. This ranking table indicated that many experts of "hardware technology growth" in the future and elimination of constraints such as processing speed, bandwidth, and storage capacity, and so on were the most crucial factor in blockchain's entry into e-commerce. In the researcher's own opinion on the importance of "disruptive technology" blockchain was ranked as 5th.

- **Determining and Analyzing Strategy**

Strategy Types

Macro strategy

The macro strategy of the organization recognizes the primary orientation of the organization regarding the set of environmental and internal factors. Generally, the macro strategy includes the following procedures:

Offensive Strategy

It covers an aspect of the company's strategic orientation that quickly applies resources to improve market position compared to its competitors. This strategy requires considerable investment, and its emphasis is on market share development and flexibility.

Defensive Strategy

It reflects behaviors to protect the market position against any attempt to develop it. Despite the next offensive measures, its emphasis is on cost reduction and more efficiency.

Analyst Strategy

It is one kind of strategy that places between the above two approaches. It is attempted in reaching to a finite set of analysts of goods and services, but it carefully obeys a particular set of new and future development in its industry.

The analysis of pairwise comparisons of strategy number 5.8 to 5.14, which are "security criteria" and "transparency criteria" and "consensus criteria" and "distributed criteria" and "lower cost criteria" and "increasing the chain value criteria" and "new technology criteria," can lead to the following strategies:

Analysis 1: In criteria related to "lower cost" and "increasing the chain value criteria" and "new technology," it is suggested to have an offensive approach. Therefore, the organization should quickly and resourcefully take blockchain technology in effective systems in reducing cost and increasing the value of the chain. These systems are like direct sales, purchasing management and suppliers (brokering reduction), production management and planning (increasing chain value and lower cost), smart contracts, and IoT (brokering reduction and new technology).

Analysis 2: In criteria related to "security" and "transparency" and "consensus" and "distribution of processes," it is suggested to use this technology carefully by selecting one to one systems but with relatively high speed. These systems are exchange, financial system, authentication systems, rights and personnel and customer records, access management, customer experience management, and legal and regulatory systems.

Discussion and Results

At first, the effective factors in blockchain technology and its use in e-commerce in the four SWOT groups were identified. Then the analyses related to the kind of interaction of these factors with each other by a combination of SW and OT matrix. After that, Hierarchical Analysis Process (AHP) and pairwise comparisons were applied to determine the significance of factors compared to each other. Also, the weight of the importance of criteria groups (S, W, O, and T) to each other and sub-criteria of each group to each other was calculated and ranked. By a combination of SW and OT, a ranking of significance ratio was obtained across sub-criteria, which their most important criterion was "hardware technology growth." Moreover, the priority of offensive, analyst and defensive in seven groups of "security criteria" and "transparency criteria" and "consensus criteria" and "distributed criteria" and "lower cost criteria" and "increasing the chain value criteria" and "new technology criteria" were valued and ranked with the use of combination of SW and OT. Having analyzed them, the researcher presented proposed strategies for the organization regarding blockchain application in the field of e-commerce, and especially software systems of three groups of primary, support, and management.

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In the end, I want to like to express my deep sense of gratitude to my dear wife, Eng. Aylar Ghasempour, for her practical and continuous support.

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