Conceptual Framework for Blockchain Business Success Factors with Fuzzy Analytic Hierarchy Process Model

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Abstract. Blockchain technology is gaining popularity globally, and adoption is on the rise in Malaysia. The success of blockchain business in Malaysia depends on many key factors. By identifying the most influential factors, businesses can make informed strategic decisions that improve their chances of success in the market. Policymakers can also benefit from this research as it can guide them in creating an enabling environment for the growth and advancement of the blockchain industry in Malaysia. As a result, critical success factors are needed to be determined in order to accelerate the implementation of blockchain in organizations. Thus, a conceptual framework to identify the business success factors by using the Fuzzy Analytic Hierarchy Process model is proposed in this study. This research study is significant as the business success factors can be determined by the conceptual framework based on the Fuzzy Analytic Hierarchy Process model. The identification of business success factors for implementing blockchain is very crucial as it can guide policymakers and practitioners in comprehending the significance and importance of business success factors. Hence, viable strategies can be developed to make blockchain technology adoption in various sectors becomes successful.
Keywords: Blockchain, conceptual framework, Fuzzy Analytic Hierarchy Process, business success factors

1 Introduction

The decentralization, transparency and security attributes of blockchain technology have applications in finance, supply chain and governance. The Malaysian government and private sector have shown strong interest in using blockchain to enable innovation and improve efficiency. Understanding the factors that influence the success of a blockchain business is critical to long-term sustainability. Smart decisions based on these factors can drive growth and competitiveness [1].
Mastering the key success factors enables businesses to adapt and lead blockchain innovation. Leveraging the decentralization and security of blockchain, Malaysian businesses can enhance operations, transparency and stakeholder trust [2]. Strategic implementation of blockchain solutions is critical to shaping the future of businesses and fostering widespread adoption across industries.

Malaysia's embrace of blockchain reflects a growing interest in improving processes and overcoming challenges through technological advancement. The decentralized nature of blockchain

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enables trustless interactions and enhances data security without intermediaries. In finance, blockchain shows the potential to revolutionize cross-border transactions, making them faster, safer and more cost-effective. Additionally, it promotes financial inclusion and serves underserved populations. Simplified money transfers via blockchain benefit individuals and businesses, making transactions more efficient [3].

The impact of blockchain on supply chain management is noteworthy as its immutable records enable transparent traceability of product provenance and reduce fraud, thereby increasing efficiency [4]. Skilled professionals are critical to successful blockchain application development, ensuring effective implementation and understanding of the underlying technology. Identifying market needs and tailoring blockchain solutions to real-world problems is critical to gaining a competitive advantage, attracting more customers, and maintaining market leadership.

Ultimately, the presence of skilled professionals, focus on meeting market needs, and collaborative efforts are all essential components to the success of the blockchain industry [5]. By leveraging these factors, businesses can position themselves as industry leaders and contribute to the development and advancement of blockchain technology in various fields.

2 Literature Review

Kayikci, et al. conducted a study in identifying the critical success factors for the implementation of the blockchain-based circular supply chain [6]. There is a total of ten critical success factors are identified in this study. The ten critical success factors are as follows: environmental performance and global resource deployment, data ownership and control, product life cycle visibility and audit, shared circular economy toolbox, open innovation and co-creation platform, sustainability and circularity behavior, regulations for incentives, recognition, and rewards, technology standardization, many-to-many supply chain connectivity, and network collaboration. The methods such as fuzzy best-worst method and integrated fuzzy cognitive mapping are used to examine the critical success factors for the blockchain-based circular supply chain. The results of this study show that the shared circular economy toolbox is the worst critical success factor, whereas the best critical success factor is network collaboration.

Park, et al. evaluated the business success factors of blockchain technology by using the Analytic Hierarchy Process (AHP) model [7]. The factors for the blockchain business model are interoperability, extensibility, scalability, key management, cryptography, smart contract, anonymity, immutability, transparency, peer-to-peer network, and decentralization. AHP model is able to reveal the weight of each factor. Based on the findings, the top three main success factors are cryptography (0.2828), transparency (0.1244), and key management (0.1228). The significance of this study is expected to enable the decision makers to support investment strategies and sustainable business models.

Grida, et al. proposed the hierarchical Decision Making Trial and Evaluation Laboratory (DEMATEL) method to determine and prioritize the critical success factors that are influencing the blockchain's adoption [8]. In this research, fourteen critical success factors are considered, including competitive pressure, laws and policy, adequate resource, financial constraints, organizational culture, top management support, training facilities, lack of experience and knowledge, distributed design, immaturity of technology, compatibility, complexity, infrastructural facility, and scalability. DEMATEL method is utilized to rank the success factors according to the degree of prominence and relationships of the factors. This study demonstrates that the two most significant factors for successful blockchain adoption are laws and policy, and competitive pressure. The third ranking is achieved by the factor of scalability, followed by adequate resource, top management support, financial constraints, and training facilities. The last ranking is obtained by the factor of lack of experience and knowledge.

Bali, et al. analyzed the critical success factors for implementing blockchain technology in the healthcare sector with the proposed DEMATEL technique [9]. There is a total of 21 critical success factors are taken into consideration in this research study. The critical success factors consist of government support, process simplification, enhanced collaboration, green initiatives, paperwork reduction, creating detailed road-map, appropriate team leadership, management stability, top management support, effective claim management, training and skill up-gradation cost, reduced manpower cost, implementation cost, immutable, process improvement, trust, track and traceability, security, reliability, real-time processing, and transparency of data. In this study, the cause-and-effect relationship among the critical success factors is determined by the DEMATEL technique. The top five most influential factors are transparency of data, track and traceability, government support, immutable

and top management support. On the other hand, implementation cost is determined as the least influencing factor.

Zhou, et al. completed a research study in determining the critical success factors and key challenges of blockchain implementation in the maritime industry. AHP, a fishbone diagram, and PESTEL analysis are used to obtain the results [10]. The critical success factors that are identified in this study are professional consultation and assistance, support from senior management, support from the shipping community, ease of local legislation, staff training, and sufficient capital. According to the results, sufficient capital achieves the first ranking with a weight of 0.27, followed by staff training (0.24), ease of local legislation (0.16), support from the shipping community (0.15), professional consultation and assistance (0.12), and lastly, support from senior management (0.06). In this study, the lowest place is occupied by support from senior management since it has the lowest weight. This study is significant as it implicates blockchain talent and knowledge acquisition to accelerate the implementation of blockchain.

Mishra, et al. identified and modeled the critical success factors of blockchain technology adoption for sustainable and resilient operations in the banking industry [11]. The critical success factors are evaluated by using the DEMATEL technique and the fuzzy Delphi method. The cause-effect relationships of the critical success factors are determined by the DEMATEL method. There is a sum of 17 critical success factors is included in this research. The critical success factors are technological maturity and standardization, full ecosystem interoperability, smart contract robustness and business case deployment, incentives for miners, integration with other cloud services/e-commerce platforms, blockchain talent availability, professional consultation & advisory capability, availability of funds for implementation, personnel training, ease of local & international legislation and regulation, user engagement & desirability, user data privacy, security and integrity, scalability, transaction storage/energy efficiency, transaction cost efficiency, and management leadership buy-in. The following critical success factors are ranked in the top five: ease of local & international legislation and regulation, user data privacy, security and integrity, availability of funds for implementation, and transaction cost efficiency. The finding of this study is good to guide policymakers and practitioners in knowing the importance of critical success factors and thereby assist devise a strategy for the successful adoption of blockchain technology in the banking industry.

Elhidaoui, et al. studied the critical success factors of blockchain adoption in green supply chain management with the aid of interpretive structural modelling [12]. The critical success factors that are taken into consideration in this study comprise collaborative logistics, green practices, organizational management, knowledge, tokenization, trust and reliability, smart contracts, transparency, traceability, and recording, tracking and trading. The major findings of this study highlight that smart contracts and tokenization are the two key concepts of blockchain technology that require more support to facilitate their adoption in green supply chain management. On the one hand, collaborative logistics and green practices require more preparedness to be adapted to blockchain technology. Trust and reliability ought to be enhanced toward its adoption in green supply chain management.

3 Methodology

3.1 Analytic Hierarchy Process (AHP) Model

AHP model is used to tackle complex decision-making problems [13]. AHP model can be utilized to identify the weightage of the decision criteria [14,15]. The following steps are used to execute the AHP analysis [16-20].

Step 1: Establish an $n \times n$ pairwise comparison matrix P for the decision criteria by identifying the relative importance of the decision criteria. Nine-point scale is used to determine the relative importance among the decision criteria.

Table 1. Nine-point scale.

Relative importance	Numerical index
Similarly importance	1

Weak importance	3
Essential importance	5
Demonstrated importance	7
Extremely importance	9
Intermediate values	2, 4, 6, 8

$$P = \begin{bmatrix} p_{11} & \cdots & p_{1j} & \cdots & p_{1n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ p_{i1} & \cdots & p_{ij} & \cdots & p_{in} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ p_{n1} & \cdots & p_{nj} & \cdots & p_{nn} \end{bmatrix} \quad (1)$$

where $p_{ji} = \frac{1}{p_{ij}}$, $i = 1, 2, 3, 4, 5, ..., n$ and $j = 1, 2, 3, 4, 5, ..., n$. p_{ij} is the relative importance of decision criterion *i* over decision criterion *j*.

Step 2: Normalize the PCM by utilizing all the elements in the PCM divided by the summation of each column. The normalized matrix is displayed as follows:

$$N = \begin{bmatrix} N_{11} & \cdots & N_{1j} & \cdots & N_{1n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ N_{i1} & \cdots & N_{ij} & \cdots & N_{in} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ N_{n1} & \cdots & N_{nj} & \cdots & N_{nn} \end{bmatrix} \quad (2)$$

Step 3: Identify the relative weight of each decision criterion by taking the average values in the normalized matrix. The decision criterion with the largest weight will be classified as the most important criterion.

Step 4: Check the consistency of the PCM. The consistency ratio (*CR*) is determined by using the consistency index (*CI*) divided by the random index (*RI*).

$$CR = \frac{CI}{RI} \quad (3)$$

The results of the study is acceptable and reliable if the *CR* value is not more than 0.10. This implies that the results do not exhibit any serious inconsistencies.

Fuzzy AHP model is used as it can handle uncertainty and ambiguity effectively [21]. Fuzzy AHP model is essential to deal with the decision making problems in an uncertain and multiple criteria environment choice [22]. According to Wu et al., fuzzy AHP model is capable to capture the thinking logic of human beings, as well as identifying the relative importance of the evaluation criteria [23]. Fuzzy AHP model is able to deal with ambiguous, uncertain and imprecise data effectively [24].

4 Proposed Conceptual Framework

A conceptual framework to identify the business success factors by using the Fuzzy Analytic Hierarchy Process model is proposed in this study as shown as follows.

Table 2. Fuzzy Analytic Hierarchy Process model.

Steps	Expected Results
Step 1: Identification	Identify the business success factors for implementing blockchain in various fields.
Step 2: Concepts Selection	Perform the pairwise comparison between the business success factors by using the Fuzzy Analytic Hierarchy Process model.
Step 3: Evaluation	Rank the business success factors based on their relative weights. The factor with the highest weight is identified as the most significant criterion.
Step 4: Result Validation	Use the consistency ratio to check the consistency of the PCM.
Step 5: Result Discussion	Interpret the result and make final conclusion.

5 Conclusion

Assessing blockchain business success factors through the Fuzzy Analytic Hierarchy Process model provides valuable guidance for stakeholders in the blockchain industry in Malaysia. The identified factors help businesses develop effective strategies, allocate resources, and foster collaboration to foster innovation and growth. Understanding these success factors is crucial for the sustainable development of blockchain enterprises and for promoting the widespread adoption and integration of blockchain technology in Malaysia's economy. By acknowledging the factors that drive success, stakeholders can make informed decisions that contribute to the industry's long-term prosperity and impact the nation's technological landscape positively.

By utilizing these factors, businesses can develop effective strategies and enhance their competitive advantage in the market. Policymakers can create an enabling environment that supports blockchain innovation and growth. Additionally, other stakeholders can collaborate to foster a thriving blockchain ecosystem. Embracing flexibility and staying updated with emerging trends and technologies will contribute to the sustained success and advancement of blockchain businesses in Malaysia.

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