AN EVALUATION FRAMEWORK FOR BLOCKCHAIN ADOPTION IN SUPPLY CHAIN

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ABSTRACT

Blockchain technology has been growing in importance and acceptability over the past several years. Yet, there is limited research on the organizational and technology specific factors that play a critical role in driving its adoption. The purpose of this paper is to develop a comprehensive framework for blockchain adoption in the supply chain by identifying the enablers and evaluating their interdependencies and impact on adoption. Enablers of blockchain adoption in the supply chain are identified using an extensive literature review and theoretical lenses from the Diffusion of Innovation (DOI) theory and Technological, Organizational and environmental (TOE) model. To our knowledge, there is only one framework in literature somewhat similar to ours, yet only uses TOE and doesn't consider any alternative blockchain platforms. We know from our earlier research that importance of factors influencing the decisions are impacted by the alternatives. Our research fulfills this research gap in the literature. We, therefore, assert that frameworks not incorporating alternatives have limited applicability.

Keywords: Blockchain Adoption in Supply Chain, Enterprise Blockchains Adoption, Analytic Network Process, Blockchain Evaluation Frameworks.

1. Introduction

It is a great challenge for supply chains to adopt the blockchain platform of the right fit. Part of the reason for this challenge is the limited availability of reliable evaluation frameworks. One needs technical knowledge to select a suitable platform for each application.

Organizations adopt and integrate innovatively new technologies, practices and processes with the objective of diffusing them throughout the organization and exploiting its capabilities. Thus, technology adoption models should consider factors influencing the diffusion of innovations in addition to the drivers of the technology adoption in itself. In explaining blockchain adoption, extant literature lacks such a comprehensive framework. In an effort to bridge this gap, we offer a theoretical framework of blockchain adoption combining the TOE and DOI models that will help managers choose a blockchain platform from a list of alternative choices.

2. Literature Review

Blockchain is a transactional database technology providing a decentralized way to manage validation and tamper-resistant transactions with consistency across a significant number of participants called 'nodes' (Glaser, 2017). All participating members in a blockchain network have complete authority to monitor all transactions in the network. It is thus

cryptographically armored against retrospective manipulations and uses a consensus mechanism to ensure database consistency whenever new transactions are validated (Beck et al., 2018). The operation of the blockchain frameworks relies on associated consensus algorithms, which are responsible for deciding the group of active nodes on the network (Deepa et al., 2022).

Woodside et al. (2017) explore precedents of blockchain diffusion within an organization using the DOI theory and find that transparency, cost, user control, and quality are important in this respect. Agia and Jha (2021) combine the business Technology Adoption model with TOE to find that external pressure and relative advantage are the two most prominent categories of blockchain adoption enablers in the supply chain, along with raising awareness among stakeholders about the advantages of blockchain over existing technologies. Blockchain adoption has also been explained using a new Integrated Process, Institutional, Market, Technology (PIMT) Framework (Hughes et al., 2019) which offers various institutional (norms and culture, regulations and legislations, governance), market (market structure, contracts and agreements, business process) and technical (information exchange and transactions, distributed ledges, shared infrastructure) factors that contribute to blockchain adoption decisions.

None of these Blockchain adoption frameworks considered the influence of alternative Blockchain Platforms on blockchain enablers' whereas each platform's strengths are different, and they affect the "Best" platform for a supply chain. Our research fulfills this research gap in the literature.

3. Hypotheses/Objectives

The research questions of our study are:

RQ 1. What are the factors that influences the "best" Blockchain adoptions for a particular Supply Chain?

RQ 2. What are the prominences of different factors affecting the "best" Blockchain adoptions?

RQ 3. What are the priorities of different alternative blockchain systems?

RQ 4. How sensitive are the results to the change in criteria prominence?

RQ 6. How can we do raw sensitivity in Analytic Network Process

4. Research Design/Methodology

Analytic Network Process (ANP) is used as a methodology. Blockchain platform adoption factors (BCPAF) as well as the alternative blockchain platforms (PCP) will be provided during the presentation because of the page limit given for the extended abstract. Factors are clustered into components. The influence matrix of m+n by m+n is developed via co-operating with decision makers considering the developed adoption factors and alternative blockchain platforms (Figure 1). The rest is, as we all know, developing an unweighted super matrix, pairwise comparisons of the clusters and generating weighted super matrix. Limit Matrix is derived via taking powers of the weighted matrix. We didn't take the power, and we used SuperDecision software to derive the limit matrix (www.superdecisions.com).

		Technology Factors		External Task Environment			Organizational context				Innovation factors						Alternative Blockchain Platforms	
		A1	A2	B1	B2	B3	C1	C2	C3	C4	D1	D2	D3	D4	D5	D6	P1	P2
Tech. Factors	A1						X		X	X		X	X	X		X	X	X
	A2	X							X	X	X	X	X		X	X	X	X
External task envirn	B1					X	X	X		X	X	X	X		X		X	X
	B2			X			X			X	X		X		X		X	X
	B3			X			X			X	X		X	X	X	X	X	X
Organizational context	C1				X	X								X	X			
	C2	X					X		X	X	X		X				X	X
	C3		X					X		X	X				X			
	C4	X		X	X	X	X	X					X		X		X	X
Innovation factors	D1				X				X	X			X		X		X	X
	D2							X	X	X			X	X	X	X	X	X
	D3									X	X				X		X	X
	D4					X	X			X	X		X				X	X
	D5			X		X	X	X	X	X	X	X	X	X		X	X	X
	D6	X	X								X		X				X	X
Alternative Blockchain Platforms	P1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
	P2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		

Figure 1. Influence Matrix

5. Data/Model Analysis

ANP network model will be provided during the presentation because of the page limit given for the extended abstract. Consistency indices were within limits. During model building, very rarely indices were beyond limits. It was dealt with via soliciting new judgments. Our approach was to elicit judgements to identify the priority of the alternatives, and the importance of criteria in the mind of decision makers; consistency index was just instrumental to achieve the prominences of different factors affecting the "best" Blockchain adoption for supply chain.

6. Limitations

The four biggest Blockchain Trends In 2022 are Green blockchain initiatives, Blockchain and The Internet of things (IoT) integration, Blockchain in vaccine manufacture and tracking, and non-fungible tokens (NFTs) beyond online art. We have not yet, studied any of these new trends. We are likely to see a great deal of emphasis on attempts to "greenify" blockchain by moving to less energy-intensive models of blockchain technology – typically those that rely on "proof-of-stake (POS)" algorithms rather than "proof-of-work" to generate consensus.

7. Conclusions

We contend that decision making is a learning process. The methodology and its decision support systems, we suggest, help the decision makers in this process. We assert that

frameworks not incorporating alternatives have limited applicability. Another weakness of the current research in Blockchain adoption is just to propose a "best" blockchain platform for supply chain. However, this best blockchain might change when the influence of factors changes. Therefore, these models need sensitivity, and robustness analysis. To the best knowledge of the authors, it does not exist in the literature yet since sensitivity on ANP is far more challenging than the robustness analysis of AHP applications/implementations.

8. Key References

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