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Review Article

Identification of successful factors for block chain implementation in supply chain based on business life cycle

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ABSTRACT

The implementation of blockchain technology in the supply chain has gained significant attention in recent years due to its potential to enhance transparency, security, and efficiency. However, achieving successful blockchain implementation in the supply chain requires a thorough understanding of the factors that contribute to its success. This research paper aims to identify the successful factors for blockchain implementation in the supply chain through a comprehensive analysis. The identified successful factors are categorized into technological, organizational, external dimensions. Overall, this research paper offers valuable insights into the identification of successful factors for blockchain implementation in the supply chain. It serves as a foundation for future research, providing a comprehensive understanding of the complexities and nuances involved in the successful adoption of blockchain technology in supply chain management.

1. Introduction

In any organization most of its expense is from supply chain activities as it involves many activities starting from planning to execution. From these activities execution makes supply chain very crucial part for any organization hence it is important to manage supply chain efficiently. As it consumes maximum cost for every organization, every organization is trying to make their supply chain more efficient, and it is very much possible only by digitizing the existing supply chain. The bottom line of each participant is affected by the never-ending cycle of growing supply chain expenses. If businesses work to improve supply chain efficiency, they might save a lot of money on things like transportation, inventory carrying expenses, and supply chain management. The competitiveness of today's global supply chains is largely dependent on cost reduction. Supply chain cost reduction has been highlighted by manufacturers, retailers, and distributors as a crucial problem to solve. Furthermore, strong supply chain performance has a strategic benefit that might result in quick financial payback, increases in productivity and profitability, and improvements in a crucial aspect of the global competitive edge. (Attaran, Digital technology enablers and their implications for supply chain management, 2020).[1] The manner that operations and procedures are carried out is altered by digital technology. Industries and organizations must change or risk falling behind. Digitization is changing how businesses operate and opening new potential for value generation across sectors globally. Businesses throughout the world are paying close attention to digitalization since it offers greater benefits to a variety of industries. The industrial sector has benefited much from digitization, particularly in processing and manufacturing, but there is still a tremendous amount of unrealized potential.

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Automation, intelligent machines, big data analytics, and the Internet of Things (IoT) advancements have made it possible to significantly improve performance across the whole industry value chain. Several businesses are making significant investments to digitize their supply chain management (SCM) and other business models.[2–5]

During pandemic, many organizations started digitizing their supply chain which gives tremendous boost to the use of technology in the supply chain and as per the article written by Economics times that this supply chain industry will be worth $ 1250 billion by 2028. Increased digitization brought visibility throughout the supply chain which helped business to monitor the supply chain activities and take informed decision related to the same. According to a similar report new age technologies will transform this industry and these technologies will bring improved visibility, real time decision ability and real time tracking. (Bansal, 2022). Even though new digital technologies are making supply chain more efficient but still it is facing issues such as improper supply chain infrastructure, difficulties in managing too many intermediaries, complex laws & regulations, and lack of supply chain visibility. From which traceability and transparency affects more to the supply chain performance. The absence of these factors will create blind spot in the entire supply chain and eventually will result in the failure of supply chain which will be dangerous for an organization.[6–8]

Blockchain is a decentralized, unchangeable database that makes it easier to track assets and record transactions in a corporate network. On a blockchain network, anything of value may be recorded and sold, lowering risk and increasing efficiency for all parties. Blockchain provides a decentralized and immutable ledger where all transactions and data exchanges are recorded and verified by multiple participants. This creates transparency and traceability throughout the supply chain, allowing each participant to view and track the movement of goods, verify their authenticity, and identify any bottlenecks or inefficiencies. Blockchain uses cryptographic techniques to secure data and transactions. The decentralized nature of blockchain makes it extremely difficult for malicious actors to tamper with the information stored in the system. This enhances the security of supply chain data, reducing the risk of fraud, counterfeiting, and unauthorized changes to critical information. Smart contracts are self-executing contracts with predefined rules encoded into the blockchain. They enable automation of supply chain processes, such as payments, quality control, and fulfillment conditions.

2. Literature Review

As per the research by Dylan (2018) Blockchains are distributed digital ledgers that are impenetrable and immune to tampering, implemented without a central repository and typically without a centralized authority. At their most basic level, they allow a group of users to log transactions in a shared ledger so that, if the blockchain network is functioning normally, no transaction can be modified after it has been recorded. In the research by Michael Sony & Subhash Naik, they have identified 10 critical success factors for successful Industrial 4.0 implementation in the organizations and those critical success factors that include alignment with organizational strategy, top management understanding and support, Capability of employees to adopt etc. (Naik, 2019). The research done by Mr. Mohsen Attaran in the year 2020 says, Supply Chain is an important part of any business as it involves critical activities like planning, implementation, and control of the logistics activities. Cost reduction is the main factor that every company is targeting to be in the competition which is possible only with digitization of the supply chain. So, this paper talks about the digitization of supply chain which will change the way of working and operation.[9,10]

Digitization of supply chain with the help of technologies which include successful implementation of technologies like AI, IOT, AR/VR, Blockchain, RFID, 3D Printing and 5G. According to this paper, Industries and organizations are forced to digitize or they may face risk of left behind and because of this many companies are investing heavily in these technologies but the implementation and ensuring on some critical factors is the key for the success. According to this paper, Blockchain is a technology which can help manufacturing industry or similar industries which comprise of complicated supply chain to improve on traceability and performance (Attaran,2020). Blockchain will improve speed of information sharing across the supply chain and will help in reducing vulnerabilities which lead to in accuracies. Blockchain also capable of impacting logistics by reducing paperwork, preventing from shipping frauds, and by reducing cost of logistics. According to the research paper titled as “Blockchain implementation for circular supply chain management: Evaluating critical success factors” written by Lufei Huang, Lu Zhen, Junbin Wang and Xing Zhang in the year 2022 Companies faces several challenges like financial viability, product complexity and marketing competition when redesigning the supply chain for circular economy and this challenges can be resolved by implementing new technologies which will help in providing sustainable competitive advantage to companies. But it will be only advantageous if implementation is done in a proper manner. After Analyzing the findings of this research paper technical capability, technological maturity, and feasibility plays a critical role in the implementation of the blockchain technology. (Lufei Huang, 2022)

According to the research by Kayikci et al. increase importance of circular economy has made many organizations to use their resources optimally without hampering economic development and environment. So,

technologies like Blockchain can ease the implementation of circular economy throughout the supply chain. As per this research paper, Blockchain can enhance the visibility across the supply chain, it can also help in increasing the operational efficiency while reducing overall cost associated with supply chain also it helps in improving monitoring and reporting throughout the supply chain. According to the findings of this paper, Blockchain can introduce traceability and transparency in the supply chain but to achieve it factors such as technological maturity, technical capability, feasibility and required infrastructure needs to be taken care off. Also, employee capability and readiness to adopt change matters a lot. (Kayikci, 2022)

According to the research by Alazab et al. many organizations are facing hinderance while implementing the Blockchain technology even though this technology can solve many issues like confidentiality, integrity, availability of fast and secure distribution network. In these research papers the author analyzed 3 models i.e., unified theory of acceptance and use of technology, task technology fit model and information system model. After analyzing these 3 conceptual models they found out that inter organizational trust has a direct impact on the implementation of the Blockchain technology (Alazab, 2020). According to the research paper by Elhidaoui et al. many sectors are interested in adopting Blockchain technology into their activities because of different advantages of the technology. Competitiveness is the important factor for resilience in every sector. Now a days companies are trying to understand their customers by using various technologies such as blockchain. As per the findings of the paper the most critical factors in Blockchain implementation are recording, trading and tracking after which traceability, transparency, knowledge and organization management plays important roles (Sana Elhidaoui, 2022). According to the research by Gabriella Hastig & ManMohan S. Sodhi, the corporate needs for traceability systems are to stop illegal acts, enhance supply- chain coordination, increase operational efficiency, improve sustainability performance, and detect market trends. Companies' competencies, teamwork, technological maturity, supply chain practices, leadership, and governance of the traceability activities are crucial success elements for implementation (Gabriella Hastig, 2019).

3. Research Methodology

3.1. Objectives

1. To analyze the importance of Blockchain technology in the operation industry.
2. Identifying the critical success factors for successful implementation of Blockchain technology in supply chain.

3.2. Hypothesis

1. H_1: Technology Factors have an impact over successful implementation of the Blockchain technology for supply chain of an organization in growth stage.
2. H_2: Organizational Factors have an impact over successful implementation of the Blockchain technology for supply chain of an organization growth stage.
3. H_3: External Factors have an impact over successful implementation of the Blockchain technology for supply chain of an organization growth stage.
4. H_4: Technology Factors have an impact over successful implementation of the Blockchain technology for supply chain of an organization in maturity stage.
5. H_5: Organizational Factors have an impact over successful implementation of the Blockchain technology for supply chain of an organization maturity stage.
6. H_6: External Factors have an impact over successful implementation of the Blockchain technology for supply chain of an organization maturity stage.

This research paper aims to study and understand Critical success factors for the successful implementation of Blockchain technology in supply chain and how they impact on the performance of the supply chain. This study is done based on both Primary and secondary research. The type of research is both qualitative and quantitative. The research is done for the period of 2 months. The questionnaire is developed to understand the potential for the impact of critical success factors on the successful implementation of Blockchain technology. Using this research method, this study will serve the objective of this paper. The independent variables in the study include Technology Factors, Organizational Factors, Internal Factors and External Factors. The Dependent Variable is Successful implementation of Blockchain technology. In Primary research, 60 responses have been collected to serve the purpose of primary research. In the secondary research, surveyed many research papers done by other researcher in the last one decade about the Critical success factors for the implementation of Blockchain technology, Digital supply chain management, Implementation of digital technology in supply chain. The references of used research paper are mentioned in the reference section of the paper.

4. Data analysis and Interpretation

In case of supply chain, traceability and transparency plays an important role in making the supply chain more efficient according to the primary research conducted 82% of the respondents strongly agrees that traceability and transparency plays an important role in supply chain.

Blockchain technology is highly capable of providing traceability and transparency in the supply chain and according to the primary survey conducted for this research paper around 59% of the respondents strongly agrees that Blockchain can make the supply chain more efficient whereas 37% of the respondents agrees that blockchain is capable and only 5% of the respondents disagrees of this opinion. From the advantages obtained from the secondary survey and the according to the primary research & its analysis we can clearly see that Blockchain technology is very much important and beneficial in operation industry specifically in supply chain technology.

For Identifying the critical success factors for successful implementation of Blockchain technology in supply chain., a total of 60 responses were collected, and regression was performed. Before performing the regression, it is important to check the validity and the reliability of the data collected. For checking the reliability and validity of the data, it is important to check the value for Cronbach's alpha which needs to be more than 0.7 for the excellency of the data.

Following is the output obtained after performing the reliability test:

5. Reliability Statistics

Cronbach's Alpha	N of Items
.788	8

If we check the value for Cronbach's alpha it is 0.788 which is considered excellent as per the standards. From this output we can say that data which is collected is reliable and valid.

6. Regression Analysis

The regression analysis is done to find which of the independent variables have a significant impact on the successful implementation Blockchain in companies' which are at the Growth stage of the life cycle.

The correlation coefficient or the Pearson's correlation coefficient is a measure of the linear relationship between the independent variable(s) and the dependent variable. In this case, the value of R is 0.444, indicating a moderate positive correlation. The coefficient of determination, often denoted as R square, represents the proportion of the variance in the dependent variable that can be explained by the independent variable(s). Here, the Rsquared value is 0.197, suggesting that approximately 19.7% of the variance in the dependent variable is accounted for by the independent variable(s). The unstandardized coefficient for the variable "Cost of implementation" is 0.358. This indicates that for each unit increase in the cost of implementation, the dependent variable is expected to increase by 0.358 units, holding other variables constant. In this case, the coefficient for "Cost of implementation" is statistically significant ($p < 0.05$), suggesting that it has a significant effect on the dependent variable. Organization Efforts readiness Role of traceability and transparency Maturity of technology Employee Readiness Nature of leadership Government Policies does not have a significant impact on the Blockchain successful implementation.

The regression analysis is also done to find which of the independent variables have a significant impact on the successful implementation Blockchain in companies' which are at the maturity stage of the life cycle.

The correlation coefficient or the Pearson's correlation coefficient measures the linear relationship between the independent variable(s) and the dependent variable. In this case, the value of R is 0.664, indicating a moderate positive correlation. The coefficient of determination represents the proportion of the variance in the dependent variable that can be explained by the independent variable(s). The R squared value is 0.440, which suggests that approximately 44.0% of the variance in the dependent variable is accounted for by the independent variable(s) in this model. The unstandardized coefficient for the variable Organization Efforts readiness is 0.392 and 0.365 for the variable Nature of leadership. In this case, the coefficient for Organization Efforts readiness and Nature of leadership is statistically significant ($p < 0.05$), suggesting that these two variables have a significant effect on the dependent variable. Whereas Role of traceability and transparency, Maturity of technology, Cost of implementation, Employee Readiness, Government Policies does not have a significant impact on the Blockchain successful implementation.

7. Findings and Conclusion

As discussed in the research paper, it is important to increase the efficiency of the supply chain to optimize the entire output. The efficiency of the supply chain can be increased by introducing traceability and transparency throughout the supply chain. Traceability and transparency are possible with the help of Blockchain technology. For the successful implementation of the supply chain, it is important to give attention to the critical factors such as Technology readiness, Organization readiness, Internal Readiness and External readiness. The importance of the factors changes as per the different Business stages such as Startup, Growing, Maturity and Declining. If all the business considered together then Technology readiness plays an important role in successful implementation of the Blockchain technology in the supply chain. If the Business is in Growing stage, then cost of implementation plays an important role and for the business which are in Maturity stage of its business life cycle then Organization Efforts readiness and Nature of leadership play an important role in the success of Blockchain technology implementation. With this it is also found out from the survey that while implementation of the

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.444	0.197	0.165	0.688

Predictors: (Constant), Cost of implementation

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.903	1	2.903	6.130	.020
	Residual	11.838	25	.474		
	Total	14.741	26			

Dependent Variable: Blockchain successful implementation Predictors: (Constant), Cost of implementation

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.328	.484		4.809	.000
	Cost of implementation	.358	.145	.444	2.476	.020

Dependent Variable: Blockchain successful implementation

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.664	0.440	0.262	0.432

Predictors: (Constant), Nature of leadership, Organization Efforts readiness

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.244	7	.463	2.473	.049
	Residual	4.122	22	.187		
	Total	7.367	29			

Dependent Variable: Blockchain successful implementation Predictors: (Constant), Nature of leadership, Organization Efforts readiness

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.395	1.255		-1.112	.278
	Organization Efforts readiness	.392	.168	.445	2.329	.029
	Nature of leadership	.365	.166	.396	2.194	.039

Dependent Variable: Blockchain successful implementation

Blockchain technology the priority for this critical success factors changes as per the business stages of Organizations as well as potential issues also changes as per the business stages. So, from this survey it is observed that it is important to consider the impact of all the critical success factors for the successful implementation of the Blockchain technology in the supply chain also it important to prioritize the factors according to the Business.

8. Limitations and Scope for Further Research

Availability of comprehensive and reliable data on blockchain implementations in the supply chain is a limitation. Blockchain technology is rapidly evolving, and new advancements, protocols, and standards may emerge during the research process. External factors, such as regulatory environments, legal frameworks, and industry standards, can influence the adoption and implementation of blockchain in the supply chain. These factors may vary across regions and industries and can pose challenges

in drawing universal conclusions. Assessing the long-term impacts of blockchain implementation in the supply chain may be challenging within the scope of a single research project. For the future studies the research can examine the application of blockchain in specific industries within the supply chain, such as manufacturing, retail, healthcare, or logistics. Each industry may have unique characteristics and requirements that influence the successful factors for blockchain implementation. The research can target specific supply chain processes, such as procurement, inventory management, transportation, or traceability. Investigating the impact of blockchain on different processes can help identify the factors that contribute to successful implementation in each area. The research can delve into the perspectives and experiences of different stakeholders involved in the supply chain, including manufacturers, suppliers, distributors, retailers, and customers. The research can explore the technical aspects of blockchain implementation, such as the choice of blockchain platforms, interoperability with existing systems, scalability, security, and performance.

9. Source of Funding

None.

10. Conflict of Interest

None.

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