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A Systematic Literature Review of Sustainable Supply Chain Management using Block Chain Technology in Fashion Industries and Proposing ABC Framework

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Abstract: ***Indian Fashion industries using Blockchain in sustainable supply chain practices are still developing. The literature base is also significantly less in BT(Blockchain) using SSCM (Sustainable supply chain Management) fashion industries. To understand the literature clearly, the PRISMA technique is used to identify, screen, and include the related research concepts in the area of BT using SSCM fashion industries. The analysis of PRISMA gives the result of proposing the ABC framework shows significant factors involved in the A (adoption of Blockchain), B (the barriers during the implementation), and C (critical success factors) to be maintained to create a competitive advantage. The adoption of blockchain in SSCM has to be studied and involved through 1. Force Field Theory, and 2. When implementing the SSCM using BT, specific barriers have a concept of TOE framework, which includes (Technology, Organisation, and Environment) related to organizational performance. The performance factors should be identified to implement the factors in such a way as to get the maximum benefits out of it. The performance indicator factors are organizational, environmental, economic, information, and customer performance. After the implementation, the organization should maintain the factors effectively with the help of critical success factors such as top management support, financial constraints, supplier performance, customer acceptance, and Government regulations. This is the first paper that discusses the adoption, barriers, and challenges in implementing SSCM using BT in the fashion industries. Industry practitioners, academicians, and research scholars can use this paper as a guide to know the essential factors suggested by various eminent authors in BT and SSCM.***

Keywords: Blockchain, Sustainability, Supply chain, Fashion Industry, India

I. INTRODUCTION

Indian Fashion Industry is one of the top ten all over the world and is seeing rapid growth in its manufacturing sector for various reasons such as a growing middle-class economy and growing tech savvy, as the report given by McKinsey on the state of Fashion report in partnership with Business of Fashion. At the same time, India's GDP is growing more robust, reaching 8 percent in the upcoming years.

India's Apparel Industry will be worth $59.3 billion at the end of 2022 and will be the world's sixth largest. Indian industries are more focused on leveraging technology in their workflows, such as augmented reality and artificial intelligence in their stores. Besides retail, the Indian Apparel Industry is increasing its technological improvement in the supply chain with technical aspects such as Blockchain, Sustainability in production, and IOT [16].

Brands are increasing their technological aspects to improve their business, reach customers, and connect with them digitally. Industries are adapting new technologies for better security and efficiency. One of the recently trending technologies is Blockchain in the supply chain. This technology is already revolutionizing its benefits, predominantly in the automobile business. The adoption of Blockchain technology in the fashion industry technology is still in a nascent stage. Still, fashion Industries are now more focused on sustainability factors; Blockchain is one of the technologies to combine the sustainability factors in the supply chain to improve transparency between the process flow and reach the final product efficiently. Due to the pandemic, many industries focus on digital technologies to increase productivity with fewer hindrances.

Blockchain technology is in a nascent stage in fashion industries in India, and these industries need a better understanding of the factors involved to improve their growth. So, this paper has come up with the compilation of the adoption, the critical factors, the barriers involved in the sustainable supply chain, and the blockchain technology.

The paper utilizes the systematic literature review concept to study the previous research papers focusing on the Blockchain and sustainable supply chain in Fashion Industries. In this way, this paper will benefit academicians and research scholars. Of course, industry people to know about the various factors involved in the sustainable supply chain in a digital platform that is blockchain technology. This paper also contributes to theoretical and managerial implications in Blockchain and sustainable supply chain.

II. RESEARCH QUESTIONS

1) What are the techniques involved in adopting Blockchain for a sustainable supply chain in fashion Industries?
2) What are the barriers to implementing Blockchain for a sustainable supply chain in fashion Industries?
3) What are the critical success factors in implementing Blockchain for a sustainable supply chain in fashion Industries?

Before addressing the research questions, the literature review section discusses Blockchain and sustainable supply chains.

III. METHODOLOGY

Systematic literature review works on the concept of identification, screening, and eligibility and included papers based on the PRISMA (Preferred reporting items for systematic reviews and meta-analyses) methodology. Using the search words "Blockchain," "SSCM," "Sustainability," and "Fashion Industry" in the web of science and Scopus listed journals. Based on the search, I identified the papers, screening, and finally recorded the literature.

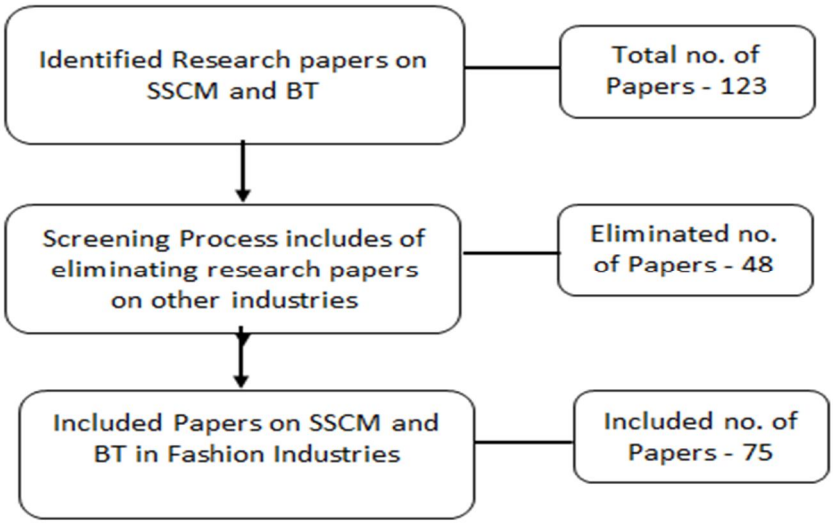

Fig. 1 Systematic Literature Review using PRISMA technique

Table I - ARTICLES PRESENTED SSCM USING BLOCKCHAIN IN FASHION INDUSTRIES

Year	Authors	Journal	Title
2018	Hasan and Sharif	Journal of Business Management and Economic Research	Supply Chain Management for Garments Industries Using Blockchain in Bangladesh
2020	Kamlendu Pal and Yasar	Procedia Computer Science	Internet of Things and Blockchain Technology in Apparel Manufacturing Supply Chain Data Management
2021	Neha and Somrabh	South Asian journal of Marketing and Management Research	Apparel or Textile supply chains using blockchain
2018	Tarun, Ajay and Vijay	Springer Series in Fashion Business	Blockchain-Based Secured Traceability

			System for Textile and Clothing Supply Chain
2018	Magdi and Adel	International Journal of Materials and Textile Engineering	CRYPTO COPYCAT: A Fashion Centric Blockchain Framework for Eliminating Fashion Infringement
2020	Tsan Ming and Hing Kai	Transactions on Engineering Management	Applications of Blockchain Technology in Sustainable Fashion Supply Chains: Operational Transparency and Environmental Efforts
2021	Gautami, Vandana, Abdul Ahad and Nousahaba	Intelligent Systems Reference Library - Springer	Blockchain Technology and Fashion Industry-Opportunities and Challenges
2022	Shlomit Yanisky-Ravid and Grace	Brooklyn Law Review	The Promised Land: Blockchain and the Fashion Industry
2018	Tsan-Ming, Ya-Jun and Bin	IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT	Sustainable Fashion Supply Chain Management: A System of Systems Analysis
2018	Bailu Fu , Zhan Shu and Xiaogang	MDPI Sustainability	Blockchain Enhanced Emission Trading Framework in Fashion Apparel Manufacturing Industry
2018	Mahtab Kouhizadeh and Joseph Sarkis	MDPI Sustainability	Blockchain Practices, Potentials, and Perspectives in Greening Supply Chains
2021	Tarun Kumar, Vijay Kumar, Rudrajeet, Lichuan and Yan	Computers & Industrial Engineering	Blockchain-based framework for supply chain traceability: A case example of textile and clothing industry
2020	Xinlai, Brave, Yelin and George	Sustainable Design and Manufacturing	Blockchain-Enabled ESG Reporting Framework for Sustainable Supply Chain
2018	Baozhuang, Yaoqi, Lei and Ping	Journal of systems science and system Engineering	Outsource to an OEM or an ODM? Profitability and Sustainability Analysis of a Fashion Supply Chain
2019	Tsan-Ming Choia and Suyuan Luo	Transportation Research	Data quality challenges for sustainable fashion supply chain operations in emerging markets: Roles of blockchain, government

			sponsors and environment taxes
2020	Kamlendu Pal and Yasar	Procedia Computer Science	Semantic Approach to Data Integration for an Internet of Things Supporting Apparel Supply Chain Management
2021	Nir Kshetri	International Journal of Information Management	Blockchain and sustainable supply chain management in developing countries
2021	Shobod Deba Nath and Abul Khayer, Jeta Majumder and Suborna Barua	Industrial Management & Data Systems	Factors affecting blockchain adoption in apparel supply chains: does sustainability-oriented supplier development play a moderating role?
2021	Journal of Organizational Change Management	Giulio Caldarelli, Alessandro Zardini and Cecilia Rossignoli	Blockchain adoption in the fashion sustainable supply chain: Pragmatically addressing barriers
2022	The TQM Journal	Kunle Francis Oguntegbe, Nadia Di Paola and Roberto Vona	Communicating responsible management and the role of blockchain technology: social media analytics for the luxury fashion supply chain
2021	Wafaa A. H. Ahmed and Bart L. MacCarthy	MDPI Sustainability	Blockchain-Enabled Supply Chain Traceability in the Textile and Apparel Supply Chain: A Case Study of the Fiber Producer, Lenzing
2020	Bill Wanga, Wen Luob, Abraham Zhanga,c, Zonggui Tiand, Z. Lid	Computers in Industry	Blockchain-enabled circular supply chain management: A system architecture for fast fashion

IV. LITERATURE REVIEW

A. Blockchain

A Blockchain is a system recording information that makes it impossible to hack or change the system, and it is a digital ledger that stores information. It is a shared, immutable ledger that facilitates the process of recording transactions in a business network. Each piece of information in a block with a network of computers. The members can eventually check the transactions where the information gets recorded in every member's ledger.

The decentralized database is also called Distributed Ledger Technology [26].

Blockchain technology has become predominantly gained success because of its usage in Bitcoin and cryptocurrency exchanges. In cryptocurrency, the information is stored efficiently and effectively for better transparency and traceability. So, many manufacturing industries such as automobiles, food, pharmaceutical, airlines, hotels, and retail have started to utilize the technology for better traceability of their transactions and data storage [46].

Blockchain technology is considered one of the efficient technologies in the industry revolution 4.0. This technology uses a decentralized database for high-volume transactions and the process involved between the contracting members in the supply chain. For a better assessment of the product life cycle, using Blockchain will have better environmental performance [11].

B. How Blockchain Works

Whenever a transaction happens, it records as a data block. The league is connected to the ones before and after. The information specified is based on 5W and 1 H, which are what, where, when, which, why, and how. Once the data is recorded, the time and sequence of the blocks are maintained. The number of transactions is in an irreversible chain and blocked together. That is why it is called Blockchain. There are two types of networks public and private. In a public network, anyone can join the web, and very little and sometimes no privacy in the transactions. But a private network is well secured, and one organization will handle all the trades and secure and personal network [26].

C. Characteristics of Blockchain

1) Decentralization

The concept of decentralization models in the Blockchain will make the activities more transparent and more trusting towards the supply chain practices. Blockchain eliminates the need for a third party and enables faster and less expensive transactions. and it has high capabilities [23].

2) Immutability

The term immutability is used in object-oriented programming; the data structure and the operations or functions are fully controlled by the programmers. Once it is created, it cannot be modified [45]. Because of these characteristics, blockchain transactions are memorable and not forged. This increases transparency in the supply chain practices. Immutability allows authorities and regulators to access key data and information regarding sustainability [52].

3) Cryptography-Based Authentication

Blockchain uses cryptography-based authentic signatures to verify the authenticity of the signatures. A private key is generated for the transactions when the account is created. The key is a long alphanumeric code. Using arithmetic algorithms, blockchain can create private keys from public keys. The information is shared with the help of a public key. This facility is used to measure and track sustainability-related transactions.

4) Traceability, Transparency, and Trust

The blockchain is used to assess the trustworthiness of the intermediary participant, and it is the best consequence of decentralization. The technology guarantees the system's integrity when there is dishonesty and idleness in the supply chain practices. This describes the traceability of the blockchain. Participants in blockchain technology can view the transactions at any level and at any time [52].

This improves the system's transparency and the transactions happening during the supply chain practices. A blockchain system can be generalized and used to implement based on certain rules. The blockchain system architecture is unique and ensures that the multiple parties involved in the transactions are trustworthy [43].

V. SUSTAINABLE SUPPLY CHAIN MANAGEMENT (SSCM)

The supply chain is "a set of three or more entities directly involved in the upstream and downstream flow of products, services, finances, and information from a source to the customer" [19]. Sustainability in the scenario now, the supply chain is combined and termed a sustainable supply chain. It is defined as "the management of material, information along with three sustainable goals such as economic, environmental and social those are derived from customer and stakeholder requirements" [17]. A sustainable supply chain also merges with other terms like environmental, social, and economic performance [48]. The area of SSCM shows benefits such as an increase in energy efficiency, cost-cutting services, and improved goodwill and brand value. At the same time, this aspect is difficult to implement in all manufacturing industries as it has many complexities, such as cyber-attacks, globalization, and the behavior of partners involved in the supply chain [14]. The transformation of supply chain activities into sustainable supply chain practices creates significant pressure on the organization. They should focus on three critical aspects, i.e., how the organization will perform the sustainability practices in terms of environmental, economic, and social performances.

These three are the pillars of sustainability. The social version works on the democratic design, and the rights of the stakeholders are protected. The organization must protect and perform its sustainability practices to improve its competitive advantage, which has been a major driving force for demand and improved customer loyalty [48].

VI. SUSTAINABLE FASHION SUPPLY CHAIN

Sustainability is a crucial issue in the fashion industry. Fashion is relevant to apparel, textiles, fashion accessories, etc. Fashion supply chains are capital intensive (e.g., raw materials purchasing, plants and facilities investment), labor-intensive (e.g., hiring workers under ethical working conditions, age, or payment), and environmentally influential (e.g., carbon emission, polluted water management). for the retail side of a fashion supply chain, the fast fashion business model, which encourages consumers to "wear new fashion and throw away old fashion," is environmentally unfriendly and creates ethical and social problems.

In terms of technologies, advances in information technology such as radio frequency identification (RFID) devices, enterprise resources planning (ERP) systems, cloud computing mobile applications, the Internet of Things, business intelligence and analytics systems, etc., are all pushing the industry to a new data-driven era. Nowadays, we know that data analytics are closely related to many traditional topics in sustainability. Examples are end-of-life product (EOLP) management, ecological footprint, risk analysis, and assessment, reliability and failure control, reverse logistics and product returns, crowdsourcing, sustainability indexing, early warning systems, corporate social responsibility programs, etc.

As the fifth industrial revolution begins, technology, automation, and artificial intelligence usage tremendously increased in almost all industries. In this way, the fashion industry has already started its technology journey to protect and track data using blockchain. The fashion supply chain is considered one of the well-qualified systems, with the help of Blockchain, to share more energy sustainably. It helps reduce wastage and sustainably manage wastage [44]. As mentioned by Choi et al., the principles for building a sustainable supply chain are sustainability coordination and technology. The cooperation between the supplier and the manufacturer will lead to economic and environmental sustainability [45]. Profit-oriented retailers and manufacturers are a way to use green products for a sustainable supply chain. So manufacturers and retailers have started implementing technology in the supply chain [57]. One of the technology is Blockchain technology which will help them in cleaner technology investment. At the same time, they are becoming more environmentally conscious. A coordination mechanism is implemented to reduce vendor maintenance [32]. Supply chain members are of great importance in sustainability practices.

The different coordination mechanisms, such as cost sharing and two-part tariff, improve the carbon cap and trade regulation. the cooperation between the retailer and the manufacturer improves economic and environmental sustainability. The effects of the retail competition and consumer expectations on the green development of fashion products using blockchain. The manufacturer and the retailer are in competition to maintain their legacy, and they are promoting through green marketing and sustainability.

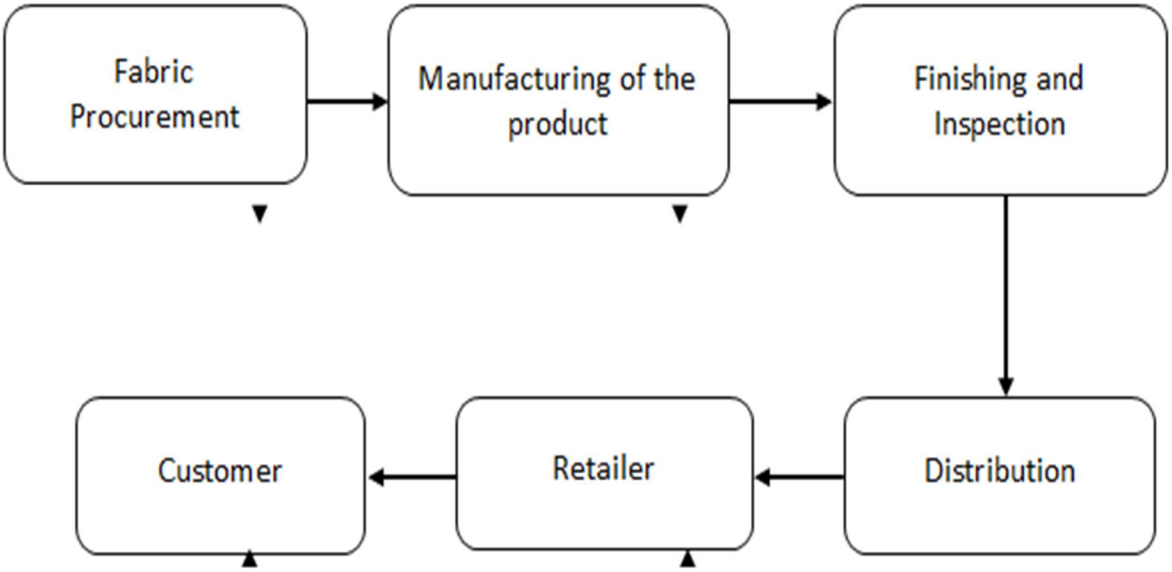

Fig. 1. Work Flow in the Fashion Industry - Traditional Supply Chain

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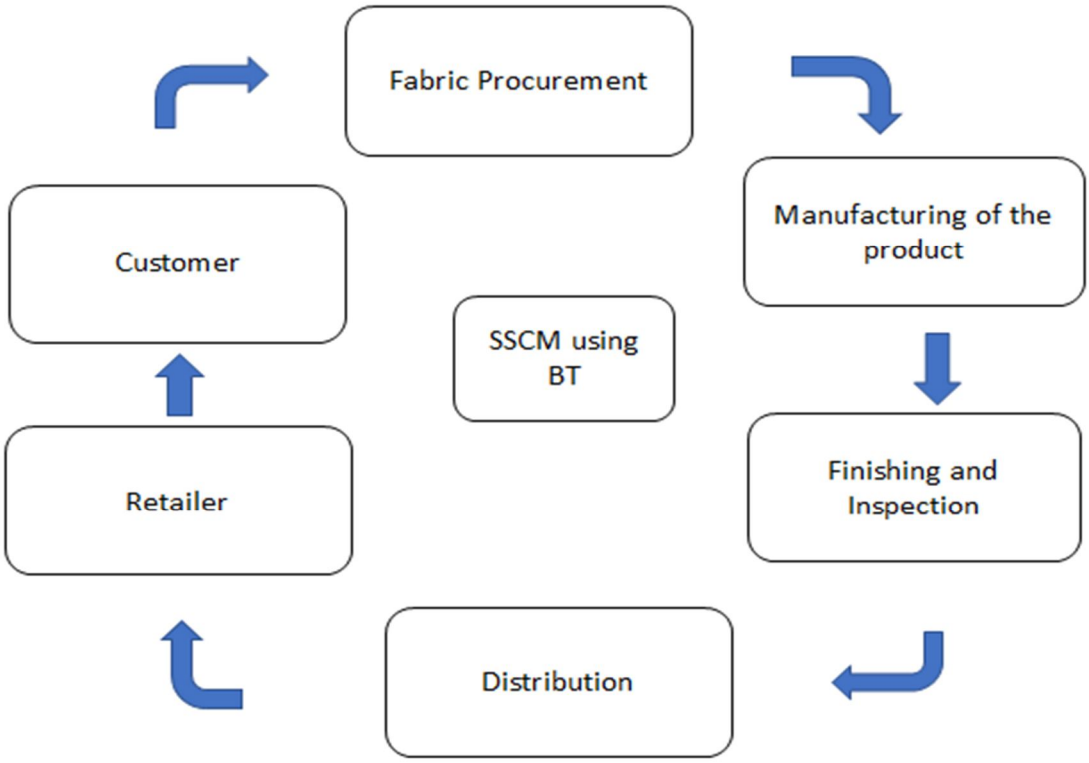

Fig. 2. Work Flow in the Fashion Industry - Blockchain-based Sustainable Supply Chain

VII. AREAS OF BLOCKCHAIN APPLICATION IN THE FASHION INDUSTRY

A. Supplier Selection and Development

The supplier's in-depth details and historical performance data is recorded. Supplier selection will result in easy identification and helps customers to trace and benchmark performance. At the same time, the most suitable suppliers can also be identified [55].

B. Procurement

The lifecycle of products as well as the material efficiency can be identified and analyzed using blockchain technology. They can maintain a record of well-established suppliers and procure raw materials [60].

C. Production

Blockchain technology can locate, view, and track internal and external production operations records. Alignment of the production operations and auditing can be recorded as per supply chain requirements [37].

D. Logistics and the Material Management Process

Blockchain technology is used to track and identify the failed products to minimize the number of products lost during the transit process. The material management lead time and the efficiency of the resources can also be improved using blockchain technology [45].

E. Overall supply chain control and sustainable fashion management

Blockchain technology in supply chain control ensures better traceability, transparency, and better data sharing among the stakeholders involved in the supply chain process. At the same time, blockchain technology ensures fewer carbon emissions during the transit of the material from the initial stage to distribution. This technology also encourages and facilitates better supply chain collaboration among the stakeholders [50].

To avoid purchasing fake products from the supplier during procurement, the unnecessary spending in duplicate is like paying in a double transaction while tracing the supply chain records in various transactions through the data stored. In the below ABC framework, which allows the industries to adopt the BT in SSCM using Forcefield and TOE theory when the Implementation of the BT is done, the industry can regulate the barriers and the challenges involved in the regulation of the technology. Finally, the industry can achieve the critical success factors mentioned.

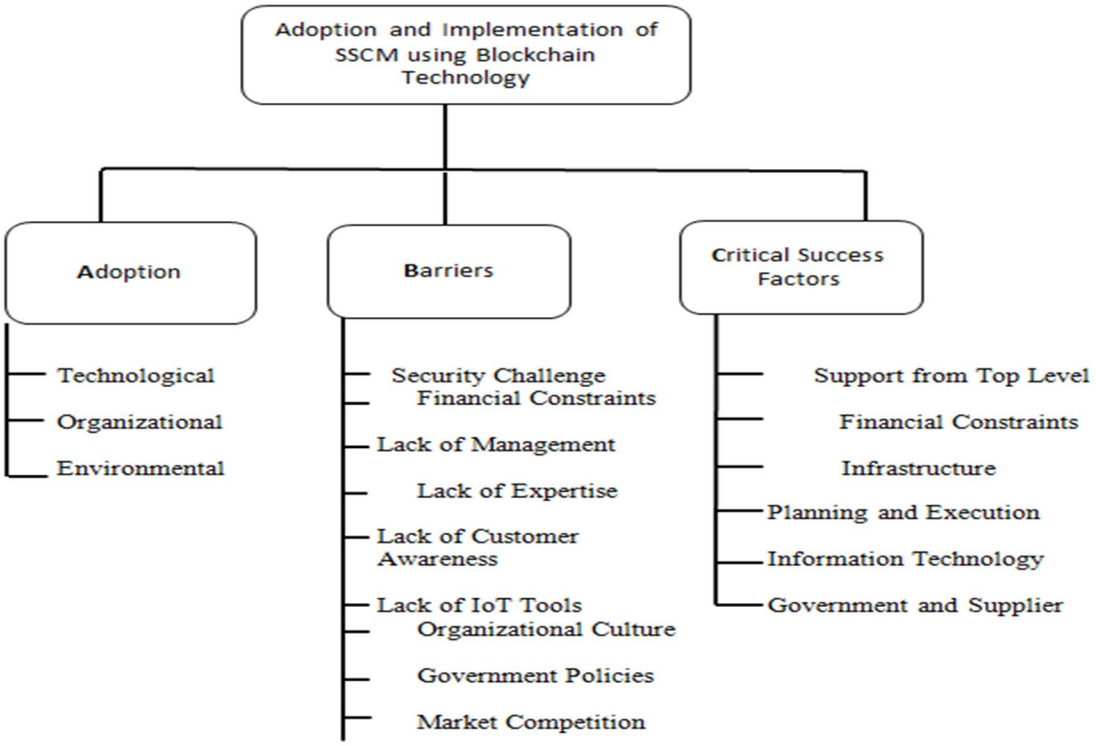

Fig. 3 Proposed ABC Framework in Fashion Industry using Blockchain Technology in SSCM

VIII. A - ADOPTION AND B - BARRIERS IN THE IMPLEMENTATION OF SSCM USING BLOCKCHAIN TECHNOLOGY IN THE FASHION SECTOR – TOE THEORY AND FORCE FIELD THEORY

A. Force Field Theory

It incorporates forcefield results in overcoming the challenges and barriers to effective supply chain practices and implementing blockchain technology. This theory is also considered a significant one in addressing the barriers. This theory also explains the nature and behavior of an organization's challenges in adopting innovation, i.e., blockchain technology. It is a theoretical backbone for barrier analysis while embracing the new technology in supply chain practices [42].

Force Field Theory summarizes the essence of organizational transformation and the changes in the new adoption of blockchain technology. This theory follows three steps those are unfreezing, change, and refreezing. When adopting new technology, the old one is unfreezing. With new techniques, the adoption of new technology is refreezing. Most of the time, this theory is widely used in change management practices. This theory is also considered a robust tool for change management in academics [13].

B. The Theory of TOE

TOE is a framework that defines the challenges and the barriers involved in the new technological innovation. Technology adoption is influenced by three factors, i.e., technology, organization, and environment. The organization requires structure, within-firm communication, and resources in an organization. The technological element has the accessibility of technological innovation. The environmental aspect combines industries, markets, and the regulatory environment [10].

Blockchain has the potential to improve supply chain sustainability with its decentralized digital ledger techniques. More energy consumption and high carbon emissions lead to the adoption of blockchain technology. The factors for adoption, such as technology, organization, and environment (TOE), are sometimes a barrier to implementing the technology. The introduction of the new technology of Blockchain has some challenges in the implementation phase [33].

The below table indicates about the factors involved in the TOE theory. The factors are Technological context describes about IT infrastructure to utilize BT in SSCM, Organizational context describes about the policies, goal and commitment of the organization with the environment in collaboration with the supply chain practices and the Environmental Context explains about the integration of the organization's supply chain practices with the Government policies to safeguard the environment and it also discusses that competitiveness from fellow industries to

Table 2. TOE FACTORS FOR ADOPTION AND BARRIERS OF BT IN SSCVM

TOE Factors	Barriers	Description
Technological Context	Security challenge	Concerns regarding hacking, inaccurate information
	Access to technology	IT infrastructure
	The negative perception toward technology	Associating cryptocurrencies as Bitcoin
	Immutability challenge of Blockchain technology	Incorrected recorded can be deleted and updated. But the info still remains in the block
Organizational Context	Financial constraints	Adopting sustainable practices is costly
	Lack of management commitment and support	Fail to have long term commitment
	Lack of new organizational policies for using blockchain technology	Defining the new policies in the organization
	Difficulty in changing organizational culture	Technological expertise is not present in the organization
	Hesitation to convert to new systems	Transformation of organization into new culture
	Lack of tools for blockchain Technology implementation in sustainable supply chains	Resistance and Hesitance to replace new technology
Environmental Context	Lack of customers' awareness and tendency about sustainability and blockchain technology	Understanding of the technology by the stakeholders is low
	Problems in collaboration, communication and coordination in the supply chain	Integrating supply chain practices with blockchain technology
	Challenges in integrating sustainable practices and blockchain technology through SCM	Government policies not supporting to implement

IX. C - CRITICAL SUCCESS FACTORS IN SSCM IMPLEMENTATION

In the ABC framework, the final factor explains about the critical success factors in implementing the Blockchain in the Sustainable Supply chain practices, It requires top management support to implement the strategies, coordination of the activities in the infrastructure in the planning and execution part where all the stakeholders are involved. When the blockchain is about to get implemented, the financial constraints also become tedious to meet the new changes in the organization. The following critical success factors will give insights to the organization to plan and implement the blockchain in sustainable supply chain practices.

Table 4. CRITICAL SUCCESS FACTORS OF SSCM

Critical Success Factors	Conceptualization
Top Management Support	Board of Directors and their strategies in implementation
Infrastructure	Smooth coordination of storage facilities access to green products
Planning & Execution	Planning and executing the SSCM processes with the stakeholders
Financial Constraints	To carry out the financial activities to implement the SSCM process and to calculate the performance in financial terms
Information communication and Technology	To ensure data security and necessary support in technology adoption
Supplier Acceptance	To enable the support from the upstream suplliers in terms of raw material producer. To create awareness to encourage their involvement in the SSCM process
Government Support	Policies and regulations from the Governement for SSCM initiatives
Competition	To cater to the needs of customers and to produce similar products

X. PERFORMANCE OF BLOCKCHAIN TECHNOLOGY IN SSCM

Blockchain performance can analyze through the implementation. The stakeholders should identify and understand the version of Blockchain before the implementation process. The commission will result in the elimination of the challenges and barriers during the adoption. Four dimensions of performance have been given in the literature; they are listed as follows:

To ensure the Implementation of SSCM processes in the fashion study, these are the critical factors to be addressed. To gain maximum benefit from the SSCM process, the stakeholders, top management, supplier, and the government should understand their responsibilities and develop the factors according to them. So overall performance of the SSCM processes controls with the help of these critical success factors.

Table 3. PERFORMANCE CRITERIA

Main Criteria	Sub Criteria	Definitions
Environmental Performance	Green Image, Green Marketing	Lifecycle assessment results in more greener products
	Corporate Environmental responsibility	Blockchain offers sustainability tools such as renewable energy grids and ewaste monitoring
	Waste, emission reduction	By applying low carbon design and production
	Product life cycle impact on environment	Movements of the products can be identified using the records of Blockchain
	Green Packaging	Blockchain enables the traceability involves in the green packaging
	Green supply chain	With the environment in concern, the organization can be able to provide socially, economically and environmentally solutions
Economic Performance	Reduce operational costs	Blockchain links the activities such as product flows, distribution and information flow which reduce operational costs
	Reduced Supply chain costs	Because of disintermediation, results in wastage reduction
	Increased Supply chain resilience	By improving visibility results in adaptation and anticipation capabilities, reduces lead time and logistics costs
Customer Performance	Customer Attitude and Satisfaction	With the energy consumption, there is a improvement in the decision making and energy consumption

	Customer confidence and customer relationship	Tracking process improves the customer confidence and it improves the relationship between the members.
Information Performance	Forward supply chain processes	The stakeholders can be updated with the products upstream and downstream processes
	Reverse Supply chain processes	In blockchain technology, the information is recorded in the ledger which is traceable and immutable
	Organizational internal/external/ knowledge/expertise	Organizational strategies, values and cultures results in value gaining with shared knowledge
	Product lifecycle Information	Blockchain based lifecycle develops and improves the understanding of the product

XI. CONCLUSION

This is the first paper discusses the overall requirements for adoption and implementation of blockchain technology in the sustainable supply chain management practices in the fashion industries. In a systematic literature review using PRISMA technique, the research papers have been identified that mainly cover adoption, barriers, and critical success factors in implementing blockchain technology in the fashion sector. With the help of a systematic literature review, the proposed ABC framework is identified, where A indicates the Adoption of BT and SSCM in the fashion industry, and B shows the barriers to overcome the difficulties and challenges during the implementation process. Finally, C indicates the Critical success factors to be addressed after the implementation process. Using this concept as the ABC framework of Blockchain technology in the sustainable supply chain management in the Fashion Industry leads to enormous benefits. The benefits of using Blockchain in sustainable supply chain management are trust, technology, traceability, transparency, immutability, and disintermediation of stakeholders during supply chain practices. Along with the other benefits, the application of blockchain technology in sustainable supply chain management results in the reduction of wastage in every supply chain process. The geo-tracking and internet of things will also benefit the management in supply chain collaboration. There will be a reduction in counterfeit products and unethical practices.

XII. IMPLICATIONS AND FUTURE RESEARCH

Theoretically, the paper contributes to the literature that the compilation of the significant factors involved in adopting and implementing Blockchain in the sustainable supply chain in the fashion industry. Managerial implication states that the practitioners can understand the adoption techniques and factors involved in the barriers of BT and to make a unique strategy in their business, they can understand the critical success factors, and they can overcome the obstacles and the challenges involved.

The proposed ABC framework can be used by academicians and research scholars in their research work based on BT and SSCM in the Indian Fashion Industries. Quantitative studies can also address the ABC framework's real-time scenario in other industries.

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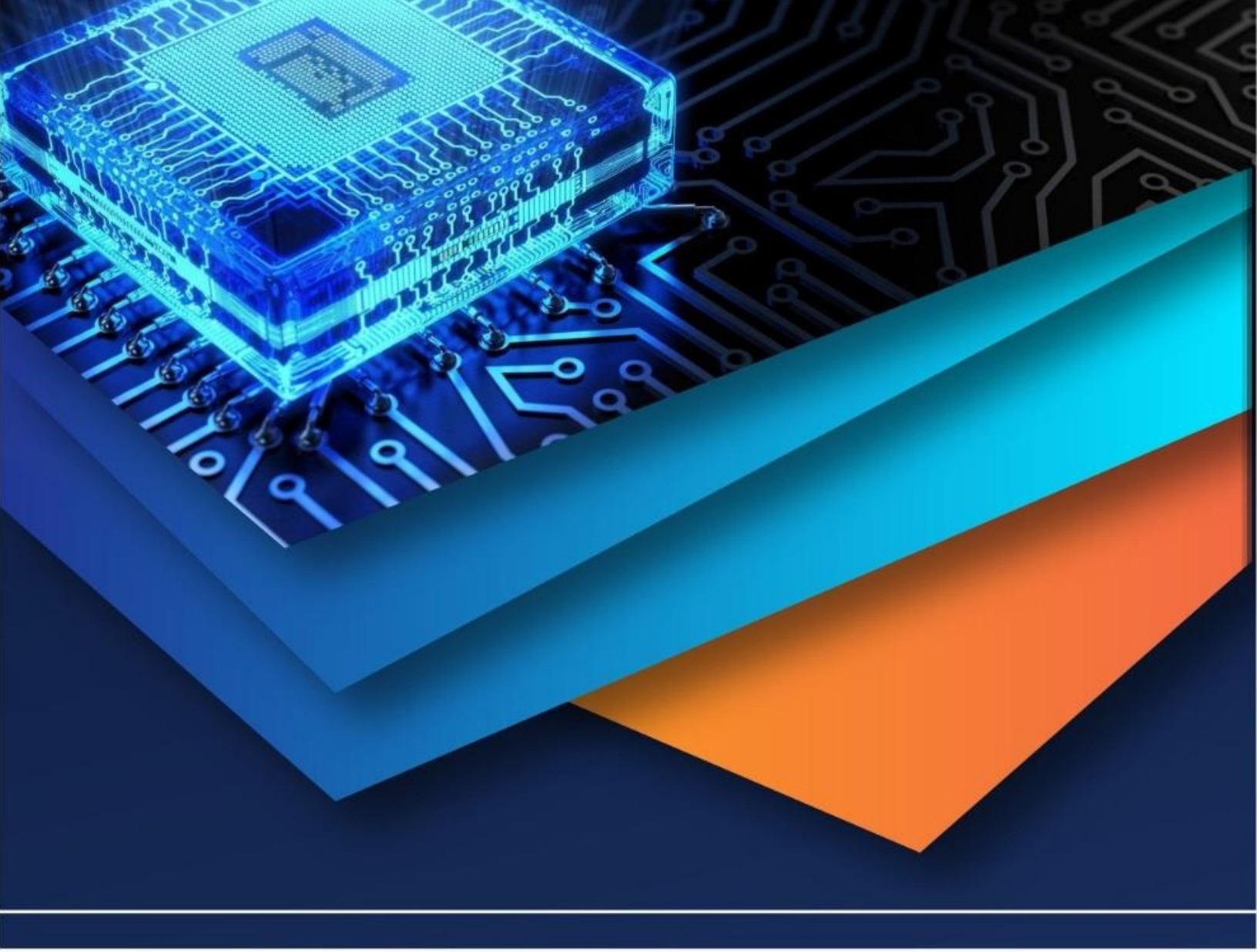

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