

## RESEARCH ARTICLE

# AN IMPLEMENTATION OF BLOCKCHAIN TECHNOLOGY IN SUSTAINABLE APPAREL SUPPLY CHAIN

Kausalyah Kalithazan<sup>1\*</sup>, Fazeeda binti Mohamad<sup>1</sup> and Ahmed Zainul Abideen<sup>2</sup>

<sup>1</sup>Faculty of Industrial Management, Universiti Malaysia Pahang, 26600 Pahang, Malaysia

<sup>2</sup>Faculty of Transport Logistics, Muscat University, Muscat, Oman

**ABSTRACT** - The improper management of supply chain may lead to the occurrence of numerous complications within a company, such as financial loss in inventory and distribution. It is imperative to inform businesses, including those in the apparel industry, on how to improve their supply chain using advanced technologies like blockchain technology. Therefore, the purpose of this study was to determine the challenges of sustainable apparel in supply chain and to improve apparel supply chain by implementing the blockchain technology. Qualitative research design was employed and the data was collected via a face-to-face interview. The respondent acknowledged the company's inadequate supply chain management for sustainable apparel. Such findings add to the body of knowledge on blockchain technology and sustainable supply chains by demonstrating how blockchain technology can change and benefit the apparel industry as well as improve the interaction between suppliers and consumers.

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## 1.0 INTRODUCTION

The apparel business has a significant impact on the environment, with 75% of the materials used in the making of products are either wasted or disposed of in landfills. Aside from industrial wastage, relatively few clothes and shoes that the average customers discard per year are repurposed (Chen et al., 2021). This shows that the prevailing operating logic of fast apparel retailers, such as mass production, quick apparel consumption, and a continuous take-make-disposal model, are still in place. Consequently, the apparel industry is enormously wasteful and depleted of resources. The apparel industry is ranked fourth in terms of environmental impact, which is influenced by the extensive use of natural resources, the generation of effluents during product manufacturing, and the landfill size formed during disposal. The severity of this problem will only worsen as the world's population grows, resulting in increased demand for more product types. This is when circular apparel enters the picture. The supply chain is well known to be an integral part of most organisations and is crucial to a company's success and customers' satisfaction. Good supply chain management boosts customer satisfaction. Customers would expect the products to be available and delivered on time. Moreover, proper supply chain management increases profit leverage. The supply chain should always be monitored and take into account any room for improvement. Even though the supply chain management is good, effort should be invested to ensure it maintains efficiency and benefits the organisation. Furthermore, if fashion is returned to the supply chain in a sustainable manner, it has the ability to reduce a significant amount of potential carbon emissions. It is estimated that the fashion sector accounts for 10% of all human-caused greenhouse gas emissions.

As the need for clothing increases, the issue is getting worse, such as demand with global production exceeding 1 billion items in 2021 and consumption over 34 million tons, with consumption predicted to rise by 50% to 83 million by 2030. The designers' role is critical in resolving the complications that develop when sustainable economic thinking is combined with traditional business model principles. An effective sustainable system requires goods to be created with thought, for life, along with the next use in view. Designers must consider how to make their outfits last as long as possible from the start (Erin, 2022). In Malaysia, it is only recently that some light is shed on sustainable apparel. For instance, Fashion Revolution Malaysia held a Fashion Revolution Week. The goal is to demonstrate how wealth and influence are placed in the hands of a few, while most of the apparel business, such as the people who produce our garments, do not partake in that income and success but instead wound up being enslaved. They also seek to demonstrate the importance of transitioning from a capitalistic framework of extraction and oppression to a sustainable economy in which things would be used for as much as possible and wastage is minimised (FMT, 2022). The growing amount of bundle stores also helps Malaysia reduce apparel waste. Bundle stores sell products that are discarded by previous owners and then bought by new owners, which applies the reuse concept.

Businesses must manage their trash sustainably to meet the high expectations of the government and society. Sustainability is a strategic decision for producing long-term profit by considering how a company functions in its environmental, societal, and economic contexts. The concept behind sustainability is that establishing such measures promotes business lifespan (Raj, 2022). This necessitates paying close attention to sustainable apparel supply networks

\*CORRESPONDING AUTHOR | K. Kalithazan | ✉ [kausalyahsatiya2000@gmail.com](mailto:kausalyahsatiya2000@gmail.com)

and related business strategies. Sustainability has grown over the last decade to incorporate a comprehensive approach based on five key principles: sustainable supply, resource recovery, product life extension, collaborative economies, and product-as-a-service. The transition to a circular model necessitates the development of a new logistic system that considers the product's lifespan and its significance in society for as long as possible while making effective use of resources and producing the least amount of environmental damage. Furthermore, technological breakthroughs such as digitalization and Industry 4.0 have accelerated the rise of global supply chain management. The fourth industrial revolution arose due to developments in computers and automation, resulting in smart and self-contained modules powered by data and machine learning. Industry 4.0 encompasses artificial intelligence, robots, biometrics, the Internet of Things, augmented and virtual reality, blockchain, and other technologies. These are examples of creations that aid automation, real-time data management, intelligence systems, and information transparency, all of which are essential to the success of a supply chain system. Furthermore, technology and blockchain are fast-evolving and represent a game-changing business model for the supply chain industry. A blockchain system incorporates blockchain technologies into its design. Therefore, analysing blockchain technology systems involves understanding the system architecture as well as blockchain network structures and operations.

Blockchain technology is among today's most publicised topics and a leading topic at the turn of the century. It includes a wide range of technologies and gadgets that may be linked to practically every part of life or company, from entertainment to security. Returning to the sustainable apparel supply chain can be a tremendous disruptive force to tackle the bottom line through enhanced efficiency and traceability as well as more diversity and development. Furthermore, technology encompasses devices like sensors. External measures of behavioural or environmental factors such as motion, acceleration, temperature, moisture, lighting, and noises are taken by this instrument and can be fastened to moving or stationary objects. This helps with keeping updated about the products during delivery. Therefore, technology being integrated into blockchain is a win for the supply chain industry (Alkhateeb et al., 2022).

Every organisation has issues and Sonali Products (M) Sdn Bhd is no exception. Their primary issues are that their sustainable apparel supply chain line originates in India, which is a different country from where they are based, and that their primary method of confirming the safely transported products relies on the customers contacting them. Risks like product defects, product loss, and fraud are made possible by these issues. The company also has unworkable and unreasonable methods for controlling their supply chain. As a result, they require a proper strategy, such as the application of blockchain technology devices, to enhance their sustainable apparel supply chain.

This study highlights the significance of effective supply chain management. It was claimed that blockchain technology may help control the supply chain for environmentally friendly clothing. Future business owners can use this study as a guide to understand how blockchain technology can help with supply chain management. It will assist the company to draw in clients and compete with rival businesses. A company will stand out more if they utilise cutting-edge technology like blockchain technology. Customers and investors will view this as evidence that the business keeps up with challenges and will spend their money and loyalty on the business.

This study also illustrates how the apparel sector might change its practices to become sustainable. Apparel businesses may influence the Earth's response to climate change by investing in this sector. Companies in the sustainable apparel sector generate less waste than other businesses by adhering to the policy of reuse, reduce, and recycle. This will encourage clients to invest in them since they would rather spend their money with a company that is environmentally friendly and sustainable.

### **1.1 Research Objectives**

The objectives of this research are:

- i. To determine the challenges of sustainable apparel in supply chain.
- ii. To improve the apparel supply chain via blockchain technology.

### **1.2 Research Questions**

The questions to be answered in this research are:

- i. What are the sustainable apparel supply chain issues faced by Sonali Products (M) Sdn Bhd?
- ii. How blockchain technology contributes to improving sustainable apparel supply chain?

### **1.3 Scope of Study**

The purpose of this study is to comprehend the significance of and learn the best practices for managing supply chain. It also clarifies the most recent effective supply chain management company methods. The research was physically conducted and the target business was an online apparel retailer with distribution across Malaysia. The company lacks the tools necessary to manage its supply chain efficiently.

### **1.4 Significance of Study**

The results of this study will benefit apparel companies as it focuses on blockchain technology in the supply chain for sustainable apparel. Active companies in the apparel industry can learn and educate themselves, subsequently improving

their supply chain management. This study used advanced blockchain technology to compete in the market and outperform the business rivals. As the supply chain improves, so does the distribution of products to customers. This will improve the business operations and ensure that products are delivered safely, helping apparel businesses to win over customers.

## 2.0 LITERATURE REVIEW

### 2.1 *Blockchain*

Blockchain is the foundation technology that several cryptocurrencies, such as Bitcoin, are built on, but its distinct method of reliably collecting and transmitting data has larger implications beyond cryptocurrency. Distributed ledger technology (DLT) is a type of blockchain that enables data management throughout different computers known as “nodes”. A blockchain organises data transferred to the ledger into blocks or data groupings. Blockchain is an umbrella term for a collection of systems that share some of Bitcoin's properties. From the standpoint of software engineering, blockchain can be considered a novel software connector that enables decentralised shared storage among distrusting parties and software systems.

The days of placing an order and waiting for delivery without knowing how or where a product was are long gone. Customers today want clarity on the origins and materials of the goods they purchase. However, the worldwide and decentralised network of the apparel industry's supply chains can occasionally result in a lack of transparency. Additionally, this network is frequently linked to practices that are not sustainable in terms of both social and environmental aspects. Through its decentralised data storage solution, blockchain technology aids in assuring information accuracy while promoting transparency for its users. This study explores the importance of blockchain technology in the garment sector and its potential to move forward.

Although blockchain technology was initially used for virtual payments, new applications have emerged across various industries. A database, as opposed to a centralised authority, is approved by a larger community according to digital trends. In layman's terms, it is a decentralised system that makes data accessible to anyone while preserving security and ensuring data credibility. Think of this as a transaction involving money that needs to be made. Although every member of that particular group will be made aware of the transaction, it is safeguarded by technology to prevent manipulation. The technique is hence independent, unchangeable, and verifiable. Since everything in the network is digitally signed, it is all authenticated. In this instance, a login password serves as a digital signature. Despite the fact that it may be a new phase for the sector, many retailers are employing this technology to see every stage of manufacturing in a plant where they place orders. Given that it is safeguarded by secure, decentralised data storage methods, blockchain provides consumers with the assurance that the information they receive is accurate.

Blockchains can be public or private. Everyone may participate in a public blockchain, allowing them to access, modify, or audit the information in the database. Because no entity manages the nodes in a public blockchain, changing transactions is incredibly challenging. Alternatively, a private blockchain is managed by an organised group that has the sole ability to change the blockchain and determine who is permitted into the network. This private blockchain procedure is comparable to an internal data storage system, but it is distributed among numerous nodes to boost protection (Rodeck & Curry, 2022).

Furthermore, the transaction record for public addresses is viewable on the blockchain, which is its most defining aspect. This requires each section of the corporation to operate with dignity in the interests of the country's success, society, and customers, thus adding a new sense of accountability to financial systems and organisations. Blockchain eliminates the need for mediators in a range of transactions, including payments and real estate, due to its decentralised nature. By allowing peer-to-peer (P2P) cross-border payments using a digital currency, blockchain allows for faster transactions than traditional banking institutions. As a result, the company's operations will be more efficient. Whenever a product transaction is recorded on a blockchain, there is an official record to determine the product's origin, owing to the blockchain ledger. This will particularly benefit organisations that deal with the trade of goods and services in order to improve security and avoid corruption. It can also help with the verification of the legitimacy of assets that have been exchanged. Additionally, such technology can be used to follow the supply chain from producer to distributor in industries like pharmaceuticals while offering verifiable ownership confirmation in the arts (Koksal, 2019).

### 2.2 *Technology*

In the current digitization era, technology, often abbreviated as Tech, is used virtually in many businesses, including medical, supply chain, infrastructure, smart cities, asset management, and transportation. Technology is the ability of non-standard objects like computers and smartphones to connect to the Internet. It is now connected to heart monitors as well as to appliances and automobiles. Technological devices can exchange information with one another via the Internet. Technology platforms serve as a conduit between the data system and the sensors on the devices. Technological solutions have been used as a foundation for cost reduction, more transparency, accurate information, and data collecting via sensors throughout the supply chain industry.

High-tech businesses throughout the world are constantly creating amazing new technology. Several large firms have produced a number of successful technology-based devices, including Amazon Echo, Ecobee, and Google Home. These

amazing technological advancements show how technology is swiftly developing and fostering a smart environment for a higher quality of life for people.

Technology devices are used to build a smart environment that decreases waste, automates processes, saves labour costs, enhances service delivery, and boosts customer transaction transparency. Since they affect almost every element of human existence, both personally and professionally, technological devices emerged as one of the most influential technological developments (Gupta et al., 2020).

Another sector that has been affected by technology devices is the supply chain. Dealing with the lack of clarity regarding trust, terms and conditions for the goods and materials, procedures, data management issues, and demand security uncertainty is the fundamental problem with the supply chain process. Many risks frequently arise during the supply process, which can be reduced by integrating technological devices into the supply chain process. The practical solutions made feasible by technical advancements have improved the supply system.

### 2.3 *Blockchain Technology*

Technology sensors produce numerous personally identifiable information that must be maintained. Two important factors for technology systems that continue to provide substantial obstacles are confidentiality. Conversely, the Bitcoin cryptocurrency ecosystem is growing to depend on blockchain as a critical safety net. Blockchain enables safe and irreversible transactions without the need for a centralised authority. Blockchain can only be changed with the agreement of all users. This technological advancement can have an impact on various industries, including technology. This is because decentralising data reduces the likelihood of data manipulation and establishes a trust-free environment where technology can flourish (Omar & Goyal, 2022).

There are two approaches for integrating blockchain technology into technological systems. The first one concerns a technology system's use of blockchain. This viewpoint takes into account the logical and actual placement of blockchain within a technological system. The logical location of an integrated blockchain is the location of the functional elements of a technology system that it replaces or enhances. The fact that blockchain nodes are physically located suggests that they are a part of the infrastructure supporting technology systems. Meanwhile, the second viewpoint focuses on what a technology system accomplishes for blockchain. This viewpoint encapsulates the kind of information and reasoning that a technological system uses with an integrated blockchain.

There are two aspects for integrating blockchain technology. The first relates to how integrated blockchain networks are set up. The number of networks to be used, the protocol to be employed, and the technology to be used to build the integrated blockchain networks are important architectural design considerations in this viewpoint for an integrated blockchain. The second viewpoint focuses on how blockchain is designed to function with existing technological systems.

Interest in researching the blockchain technology system has increased along with its popularity. A main emphasis is placed on the involvement of third parties that significantly affects the transaction's effectiveness and cost-efficiency. To handle these business activities, they promote the creation of distributed autonomous enterprises (DACs) using blockchain technology. Transactions involving resources are tracked by blockchain technology and the logic of the exchange business procedures is outsourced.

Utilising eco-friendly materials is a common business practice in the apparel industry today, which can have an impact on a fashion product's price and environmental impact. The incorporation of ecologically friendly materials can potentially affect the market demand for fashion products given the public's growing social conscience. A particular focus is placed on the information games around environmental efforts in the supply chains for apparel by taking into account apparel retailers that purchase from a producer of sustainable apparel items made of green materials. The apparel store has the option of using either an eco-label or blockchain technology to inform customers about the environmental quality of the fashion goods. Manufacturers with credibility issues can have true environmental quality of the apparel product devalued because the environmental quality is not visible to the apparel retailer and the consumers. This contributes to the current understanding of how blockchain technology can be used to promote sustainable supply chains in the apparel industry.

### 2.4 *Supply Chain*

A supply chain is a network that links a company to its suppliers in order to develop and distribute a product to a customer. It refers to the process of transporting a product or service from its origin to its final destination and the network includes a diverse set of activities, people, organisations, data, and resources.

The late 20th century has experienced a substantial growth of supply chain networks across multiple sectors such as automobiles, food, pharmaceutical, warehousing, and fashion industry. Global supply chains have become increasingly complicated as a result of globalisation and technological innovation, prompting supply chain managers to implement Industry 4.0 technologies in the supply chain to address traditional supply chain concerns. These Industry 4.0 applications, such as technology and blockchain, offer transparency and security that will help to boost the digital supply chain.

Under the umbrella of Industry 4.0, real-time networking, monitoring via sensor technologies, upgraded and more transparent predictive analysis, and other breakthrough technologies are solving the primary traditional issues for better decision-making. All of this contributes to the digitalisation of supply chain networking and the facilitation of product and service transfers across national borders.

A good supply chain uses its resources at maximum capacity, whether financial, human, technological, or physical. As a result, resource and manufacturing operational costs will decrease alongside time wastage. Customers, partners, suppliers, and vendors are several instances of important stakeholders whose genuine demands are met or exceeded by an efficient supply chain (Jacobs, 2019).

### 2.5 Sustainable Apparel

Sustainable apparel is made of fabrics that are derived from environmentally friendly resources, such as sustainably farmed fibre crops or recycled materials, and is used and sustained in society for as long as necessary in its most valuable form before being safely returned to the biosphere when it is no longer required for human use (Patti et al., 2020). The usage of second-hand retail repairs as well as frequently used upcycling and recycling of clothing are all aspects of sustainable apparel. It also describes the method used to create these fabrics whereby using materials already available to the apparel industry constitutes sustainable clothing. Sustainable apparel begins from the design phase of an apparel's lifecycle.

Sustainable apparel designers must consider the durability and longevity of the product, how long it will be relevant, the sustainability of the materials used, the proper treatment of workers in the factory, the amount of pollution caused by the factory, and whether the product can be reused and transformed into other product once its lifespan is reached. The concept of sustainable apparel revolves on making a circle with purchases and reducing the need to generate new materials or clothes by repurposing what is currently on the market. Since 2019, the Ministry of Supply has been creating its Aero Zero° dress shirts from repurposed PET water bottles and milling the fabric with sustainable solar power, decreasing carbon emissions by over 50%. The emissions that this brand is unable to remove are offset, resulting in a carbon-neutral dress shirt made entirely of recycled materials.

A prominent environmental benefit from sustainable apparel is the disposal of less waste into landfills. Waste reduction is a main priority when designing sustainable apparel goods so that the resources can be reused. Similarly, natural materials are being generated in smaller quantities. Sustainable apparel promotes the reuse of existing materials, reducing the need to generate new raw material resources. This in turn will promote green energy and reduce pollution.

Furthermore, sustainable apparel helps the environment since less trash ends up in landfills. When creating sustainable apparel products, reducing waste is important to allow for resource reuse. Natural resources are produced in lesser amounts as well. Reusing current materials is encouraged by sustainable clothing, which lessens the demand for new sources of raw materials. Many environmentally friendly clothing companies work with outside production and transportation partners who rely on renewable energy sources like wind and solar.

### 3.0 CASE COMPANY

The company being researched in this study is Sonali Products (M) Sdn Bhd. Founded by Susma Suresh in 1994, Sonali Products (M) Sdn Bhd sells various types of traditional Indian products. Their mission is to provide traditional Indian products of good quality to everyone at an affordable price. This is an online business that uses the platforms of Instagram and Facebook, and the company currently has 3,034 followers on Instagram and 70,543 likes on their Facebook page.

Sonali Products (M) Sdn Bhd ships throughout Malaysia and has established a good reputation with many loyal customers. The company sells traditional Indian clothes, skirts, and blouses made from rejected products. This demonstrates that they are a sustainable business with environmental concerns. The company often offers discounts to promote their products. This kind of supply chain management is ineffective and inefficient. Therefore, Sonali Products (M) Sdn Bhd must invest in cutting-edge technologies that can both speed up and smoothen their corporate processes.

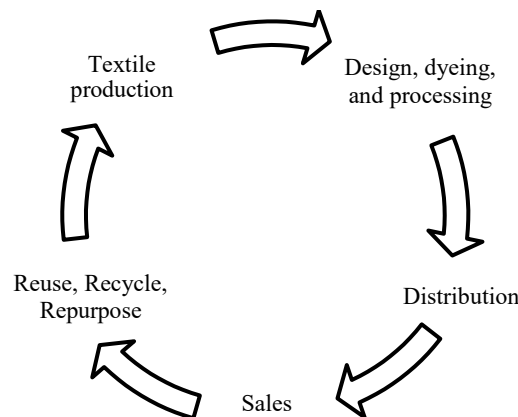


Figure 1. Sustainable apparel cycle

Nevertheless, Sonali Products (M) Sdn Bhd has several market rivals, such as Rao Saree Centre Sdn Bhd and Devan Jewelry that are both on Instagram. Rao Saree Centre Sdn Bhd strives to use less plastic in packaging their products, making it a sustainable business. The company has made significant progress with the development of eco-friendly cotton saree bags. Meanwhile, Devan Jewelry is also making efforts to use less plastic by packaging their goods in cardboard boxes. Hence, Sonali Products (M) Sdn Bhd requires a strong supply chain management system to compete with other respectable companies in the market.

## 4.0 RESEARCH METHODOLOGY

### 4.1 Flow of Research

Past literature denotes that the two most critical variables for customers' loyalty are partnership and commitment. Businesses today require fresh information that will help them to advance these two critical issues, hence ensuring that communication with their key demographics is as precise and real as possible. The insights gained by companies may drive them to adjust their lingo, add value to their goods, and seek for methods to repair a deteriorating status.

This study employed the qualitative research design to fulfil the intended objectives. Many researchers use qualitative research methods to obtain in-depth information about the respondents' experience, meaning, and perspective (Hammarberg et al., 2016). Furthermore, the odds of encountering negative responses as a result of misunderstanding are considerably minimised with qualitative research (Gaille, 2018). The data was obtained through face-to-face interview with the proprietor of Sonali Products (M) Sdn Bhd. Open-ended questions were used during the interview to elicit the respondent's opinions and points of view about the topic under investigation. Any confusion regarding the questions was addressed and the respondent had no trouble answering the questions in a straightforward manner. Figure 2 illustrates the flow of this research.

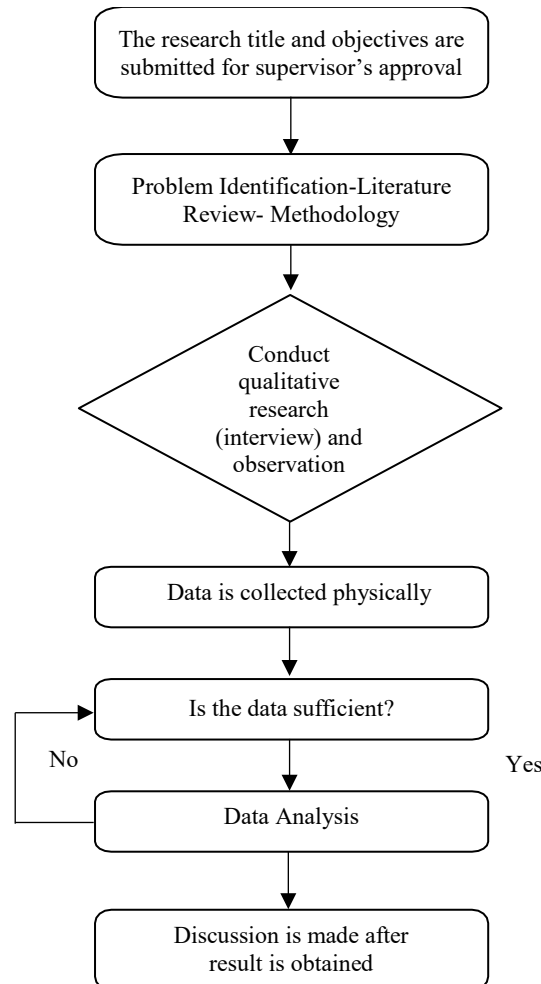


Figure 2. Research flow chart

## 5.0 RESULTS AND DISCUSSION

Sonali Products (M) Sdn Bhd was established in 1994 and has been operating for 29 years to date. The company has been in the sustainable apparel industry for quite some time and contributes to the sustainability cause. For instance, they have been using rejected materials and defective products to produce skirts and blouses. This reduces wastage in landfills

and gives good exposure to the business as it benefits the environment. A great amount of waste in landfills will lead to the release of greenhouse gases that are harmful to the Earth.

Being sustainable helps a company to succeed in their respective markets. Customers would want to invest their money in a company that helps the environment to become better, especially in the current generation where climate change is becoming worse. Companies should play a role in fighting climate change, particularly during the production phase. Being a sustainable company helps to improve brand image and serves as an advantage to compete in the market. Moreover, investors tend to invest in sustainable businesses as they possess high likeliness to make money, ultimately benefiting both parties.

Moreover, the suppliers of Sonali Products (M) Sdn Bhd are located in India. Upon payment, customers' orders are relayed to the suppliers and once the stocks arrive, they will be delivered to customers through local couriers. This process takes approximately 2 weeks. Finally, the company will wait for the customers' feedback to ensure that the products have reached safely. In this regard, several risks exist in their supply chain that mainly begin in another country, such as the shipment of defective products. The inter-nations shipment is also time-consuming and inflicts significant difficulty on the company's time management.

A supply chain involving another country requires careful and proper management. While this is a risky path, proper supply chain management can lessen certain risks, including extreme weather climate as well as data integrity and quality (Jacobs, 2019). There is also a possibility for products to become lost during delivery, which will upset the customers and ruin the company's image. It also may lead to financial loss as the company will have to take responsibility and reimburse the losses using their own capital. There is also the risk of losing trust from loyal customers and pushing away potential customers.

Therefore, blockchain technology can assist in lessening the loads borne by Sonali Products (M) Sdn Bhd. The business is open to experimenting with fresh approaches to enhance their sustainable supply chain management. Blockchain technology eases the control of supply chain and eliminates manual labour. The company will be able to track and guarantee the safe delivery of goods without having to wait for customers' feedback. Both the company and clients will also gain faith in the security and dependability of blockchain technology as this cutting-edge, fashionable technology uses encryption. Many investors also encourage businesses to employ this technology due to the transparency of the transactions.

Transparency in the supply chain is an advantage of blockchain technology, particularly for Sonali Products (M) Sdn Bhd. Transparent and unchangeable transactions and data recording are made possible by blockchain. This implies that the whole supply chain for the apparel sector, from the sourcing of raw materials to manufacture, distribution, and sale, may be tracked on the blockchain. This openness promotes ethical sourcing, prevents the sale of counterfeit goods, and gives customers thorough information about the provenance and authenticity of the goods they buy. Another benefit of blockchain technology for Sonali Products (M) Sdn Bhd is supply chain efficiency. There are many parties involved in the apparel supply chain, including producers, suppliers, distributors, and retailers. Blockchain technology simplifies this convoluted network by giving everyone access to a common platform for tracking and verifying transactions in real time. It helps to reduce paperwork, do away with middlemen, minimise errors, and improve overall supply chain effectiveness. On the blockchain, smart contracts may automate and enforce contracts, ensuring prompt payments and effective inventory management.

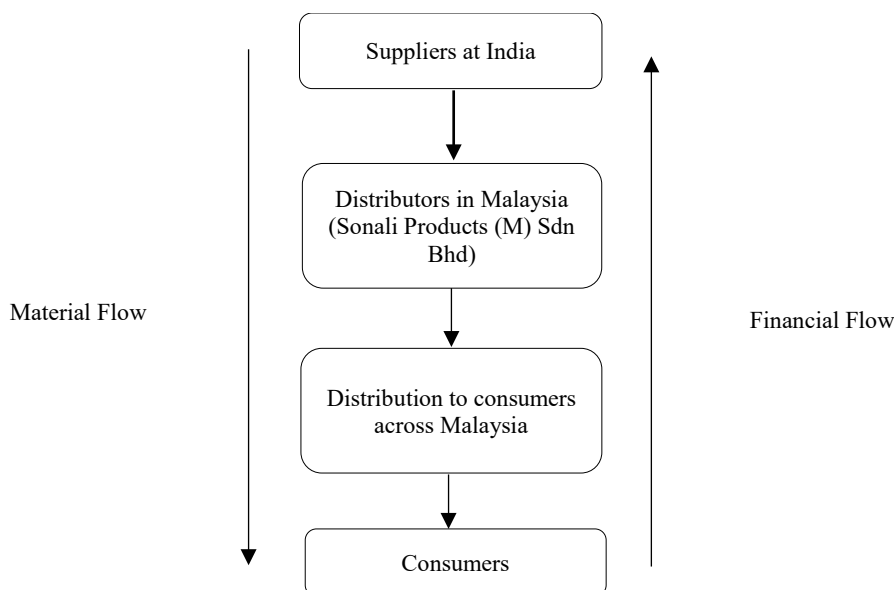


Figure 3. Supply chain management of Sonali Products (M) Sdn Bhd

## 6.0 CONCLUSIONS

Numerous enterprises emerge as time passes and many of them will compete in the same market. Therefore, businesses should be innovative and stand out from other competitors, especially in important areas like supply chain management. As the Earth is currently witnessing a hike in the amount of waste, sustainable apparel supply chains are essential. Therefore, businesses must assume the responsibility of improving the world. Sonali Products (M) Sdn Bhd is contributing to the cause by turning defective goods into fresh goods. This helps both the environment and their business because it expands the range of demographics that the company can serve. It is also advantageous for the business to investigate new markets.

The present is the future of blockchain technology. Hence, businesses need to change and keep up with the recent technological advancements in order to operate more effectively (Levis et al., 2021). More products will be produced with less expense and waste as companies become more efficient. Furthermore, the rapid development of blockchain technology is impacting our daily lives. Security remains a top concern for the technology ecosystem despite advancements since it leaves various devices, enormous amounts of data, supply chain partners, and the entire community vulnerable to security breaches (Townsend, 2023).

Moreover, many of these security and trust concerns can be resolved by the distributed architecture of blockchain, which can be used to keep track of sensor data readings and stop them from being mixed up with damaging information. Technology sensors can communicate data via blockchain without having to establish trust with a third party. Blockchain enables device autonomy (smart contracts), personal identity, information integrity, and peer-to-peer networking by lowering technological hurdles and inefficiencies (Hayes, 2023). It can also reduce the costs associated with setting up and running the Internet of Things due to the absence of a middleman. Technology devices are publicly addressed by blockchain, which provides a history of connected devices for debugging purposes.

## 7.0 LIMITATION OF THE STUDY

It was challenging to arrange the in-person, face-to-face interview because the research was conducted amidst academic weeks with many classes. The respondent was also constantly busy with the task of sorting and sending out parcels. This caused the interview to be delayed for a week as both parties had to mutually agree on a day and time when they were available. However, the questions were answered promptly with no difficulties and the responses provided information that was useful for this research.

## 8.0 RECOMMENDATIONS

The blockchain technology can create a network that connects all devices through the cloud. It has the capability to underpin the structure of smart cities in the future, making connections significantly more optimised and efficient than the present. However, a key impediment to technology is its heavy reliance on centralised infrastructure, which can expose personal information to hackers. Blockchain technology can address such issues. This is because blockchain is a digital ledger of transactions that stores data in a form that avoids hacking and manipulation of data. It is accomplished by replicating transactions and distributing them to "nodes" around the network.

Unfortunately, there remain barriers to a complete integration of blockchain with technology. At the moment, all technology devices that "speak" to one another should be on the same blockchain. Future blockchain technology will need to depend on a web of blockchains, similar to how the internet functions on a wide web of servers. As a result, adaptability is a significant barrier in combining technology with blockchain as current blockchains are yet to reach this level of competence.

Despite these challenges, combining blockchain with technology can be transformative and may produce a log of each technology transaction that can never be changed, making data significantly more protected. It will also simplify the whole supply chain, from production lines to consumers, by providing documentation to all stakeholders as needed. Additionally, a completely implemented blockchain technology will link and smoothen the transactions between companies that depend on one another, such as the apparel industry and supply chain management.

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## 10.0 CONFLICT OF INTEREST

The authors declare no conflicts of interest.

## 11.0 AUTHORS CONTRIBUTION

Each author involved and contributed evenly to this manuscript. All authors read and approved the final manuscript.



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