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RESEARCH ARTICLE

IMPROVING A CIRCULAR REVERSE LOGISTICS TO HANDLE PRODUCT RETURN: INSIGHTS FROM A GLOBAL ELECTRONICS SERVICES PROVIDER

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ABSTRACT - In the retail industry, consumers often return goods for various reasons, including damage, flaws, or plain dissatisfaction. The storing of returned goods can result in insufficient arrangement of the existing storage space and capacity. Such issue can cause problems like longer processing times, higher operating costs, and reduced customer satisfaction, hence necessitating prompt response. Therefore, this case study was conducted in a global electronics services provider to examine how circular reverse logistics can enhance the handling of product returns as well as developing a smart product return strategy. It is believed that creating a plan for product returns and integrating internal process improvements with external collaboration are highly important. The results showed that the organisation can establish a circular reverse logistic process to lower the cost and amount of product returns, enhance consumer service, and boost profitability. Such findings can benefit organisations wishing to establish circular reverse logistics procedures to handle product returns.

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1.0 INTRODUCTION

This should provide an adequate background and general context for the work, explaining its significance, and indicating why it should be of interest to researchers. Avoiding a detailed literature survey or a summary of the results. State the objectives of the study at the end of this section.

According to Shaharudin et al. (2023), Malaysia is one of the most diversified developing countries and the fastest emerging economy in Southeast Asia. Such circumstances have seized the country into the challenge of managing its waste in a sustainable manner. Malaysia succumbed to a higher rate of waste with only 19,000 tons per day in 2005 to 38,000 tons per day in 2018, constituting to 100% increase over a period of thirteen years. Its diverse electrical and electronic (E&E) industry is in its fifth decade of operation, having begun in the 1970s with only eight component manufacturing companies. Malaysia's E&E industry is a significant economic contributor and comprised of numerous sectors, such as electronic components, electronic goods for consumers, and communications equipment. The country has been home to a number of large multinational companies with manufacturing facilities, including Intel and Samsung. Conversely, a highly trained workforce and favourable government policies support the industry.

Improving circular reverse logistics to manage product returns is unquestionably crucial. Product returns should be managed via circular reverse logistics to reduce pollution and environmental impact. Reverse logistics is crucial because it contributes to the improvement of organisational objectives, such as increasing customer satisfaction and decreasing resource investment levels (Lisec et al., 2023). Producing new products with less energy consumption will save resources and reduce pollution. Many jurisdictions have implemented numerous regulations and standards concerning waste management, recycling, and environmental sustainability. Circular reverse logistics can facilitate following these regulations, thereby avoiding fines and legal consequences. For example, India is not devoting enough attention to e-waste management and the procedure still has many loopholes due to a lack of infrastructure, strict legislation, public commitment, and socioeconomic conditions (Gupta, 2023). A company can improve its reputation and brand image by demonstrating a commitment to responsible product disposal. As consumers' demand for convenience and sustainability increases, businesses must optimise their supply chains to meet these demands. Customer satisfaction is highly dependent on reverse logistics. Therefore, companies are implementing return policies that encourage simple returns, faster refunds, and easier replacements to improve the overall customer experience. Technological developments, such as automation, artificial intelligence (AI), and the Internet of Things (IoT), may have an impact on the reverse logistics industry. Aside from maximising efficiency, these advancements can improve decision-making, streamline routing, and improve monitoring.

Reverse logistics (RLs) activities have become increasingly crucial for companies looking for improved customer service, cost reduction, and sustainability perspectives. Limited resources and insufficient technology and knowledge have led manufacturing firms to cooperate with professional RL providers (Mohammadkhani & Mousavi, 2023). The objective of reverse logistics is to ensure that products and materials are efficiently transported from the site of consumption back to their point of origin. Reverse logistics can play a crucial role in handling returned products, recycling

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or disposing of materials, and planning replacements and repairs (Sarkar et al., 2023). Through circular reverse logistics, returned materials or products can be repurposed, restored, or reused. Such a procedure is essential for reducing waste, increasing product longevity, and decreasing transportation expenses by reducing waste, increasing products' lifespan, and decreasing transport costs. When a product is returned efficiently as a result of circular reverse logistics, consumers can feel more confident in their purchase decisions. Increasing business profits is also possible by enhancing circular reverse logistics. If businesses repurpose, repair, and utilise returned products, the cost of manufacturing new products can be reduced. Companies can also save money on packaging by returning and reusing their products without repackaging them using circular reverse logistics.

Due to the fact that reverse logistics process involves managing the returns of products (Naseem et al., 2023), it involves several processes that are profoundly integrated and require coordination between multiple enterprises, such as planning, scheduling, dispatching, inspecting, and refurbishing. In the manufacturing industry, a large number of logistics requirements can be met by ensuring that products meet the size, value, and mobility requirements in addition to other quality characteristics. After years of experience, business executives may have grown accustomed to considering returns management as an operational expense. The danger, however, lies in ignoring the return on investment for strategic marketing, such as increasing consumer loyalty and decreasing wasteful spending. Handling the reverse flow of products is becoming increasingly necessary to sustain business economic development in light of the rising volume of returned goods. Any product may be returned by consumers for any reason, including defects, damage, dissatisfaction, or other unknown reasons.

When dealing with product returns, it is difficult for businesses to forecast return volumes, timings, and qualities. Having only recently been introduced to circular reverse logistics, many businesses are still in the process of understanding the significance of this form of reverse logistics and the optimal way to conduct reverse logistics operations. Implementing circular reverse logistics involves modifying internal processes and considering the environmental impact of their activities; however, there is still a learning curve for many businesses. It also necessitates a reconsideration of supply chain management and resource consumption management. This paper examines reverse logistics in circular systems in relation to how companies manage product returns in circular systems. Returned products have more than a monetary impact; they may inflict negative impacts on consumer satisfaction as well as brand and product perception. Therefore, it is imperative for customers' expectations of product quality, specifications, and customer service to be met. Consideration of circular reverse logistics from the standpoint of product returns may prompt practitioners to reconsider some of their current procedures. Academics may conduct research on circular reverse logistics by examining how extensively studied product returns impact circular reverse logistics as well as developing research areas.

Stakeholders in the supply chain, such as retailers, logistics services providers, customers, and manufacturers, can contribute to the improvement of circular reverse logistics (Butt et al., 2023). By implementing both upstream and downstream activities, businesses can construct a successful and efficient supply chain. Keeping track of these practices can be challenging, resulting in inconsistent outcomes that affect product delivery and quality. There are contradictory findings regarding consumer behaviour. Primarily, customer behaviour is a major factor in product returns. Others may not be motivated to return products or may value convenience over sustainability, despite the fact that some consumers participate in return programmes and favour eco-friendly alternatives. Despite significant progress, circular reverse logistics for product returns continues to highlight a number of research gaps. Insufficient research has been conducted on strategy and regulatory frameworks. To ensure that circular reverse logistics initiatives can be implemented and supported effectively, it is necessary to identify voids and roadblocks and to propose policy recommendations. Based on this case study, it is difficult for a business to collect and store large quantities of product returns, resulting in limited storage space, inefficient inventory management, deterioration, processing delays, increased logistical depth, and a lack of overview into customer preferences and return reasons. Companies can also implement environmentally responsible disposal methods to resolve product return issues, whereby products that cannot be repaired or refurbished must have their recyclable materials and hazardous waste disposed of appropriately.

This case study investigates how circular reverse logistics are incorporated into product return activities. Such a topic stands as a major problem for global service providers in dealing with product returns, which can have an adverse impact on the environment since they increase trash and transportation. Apart from innovating to decrease product returns, companies can also use innovative ways to influence customer behaviour, enhance return systems, and promote an improved circular reverse logistics process. It is also suggested for electronic device service providers worldwide to do a periodic evaluation of reverse logistics practices. Finally, reverse logistics must be improved to manage returned goods more effectively. This study utilised the circular reverse logistics concepts in providing alternate strategies to product return circumstances in the electrical manufacturing sector. An important conclusion from this study is how electrical manufacturing businesses manage product returns.

This paper is divided into several sections. It began with a thorough review of past literature concerning the topic, followed by a discussion of the research methodology. The results are then presented in the subsequent section along with the implications and recommendations on how the firm can accommodate the ideal scenario for its supply chain. The paper ends with a conclusion of whether the objectives have been met.

2.0 LITERATURE REVIEW

2.1 Circular Reverse Logistics

As the term indicates, circular reverse logistics seeks to mitigate the negative environmental impacts of the traditional linear paradigm of production and consumption. A company's financial profits may be negatively impacted if it fails to set aside enough money for recovery operations such as the reuse and remanufacturing of returned items. Furthermore, a company's drive to improve financial performance may be strengthened by the success of product returns (Fernando et al., 2022). The life cycle of an object is closed when it is recycled, restored, or utilised once it has served its purpose rather than being discarded. Waste is reduced and resources are conserved as a consequence of this process since components, materials, and products may be reused rather than thrown away.

Recycling as many products and resources as possible is a key component of the periodic reverse logistics concept. Various strategies can be employed to achieve this, including product repair and remanufacturing, product lifespan extension, and discovering new uses for outmoded products. Recycling the components and materials from returned items is also an element of circular reverse logistics. Aside from improving resource efficiency, reducing waste, and reducing the usage of raw materials, circular reverse logistics offer other benefits. Used and recycled products utilise less energy during production and delivery, which lowers their carbon footprint. Since circular reverse logistics calls for new businesses, jobs, and skills, it may contribute to the economy's growth. This may also result in improvements in product quality through the remanufacturing of things to meet the specifications of freshly created products.

2.2 Product Return Management

A product return management process allows companies to manage and handle customer returns. A business's returns department is important because improper implementation can be expensive and time-consuming. Getting customers to return products more conveniently and efficiently is the primary goal of return management. Product return management involves various procedures, from creating a return policy to devising a return process. A company's competitiveness is directly affected by how it handles product returns (Fernando et al., 2022). It is possible to have a product returned due to defects, recall, or even for maintenance, repair, or overhaul purposes (Bernon et al., 2018). Returns may have quality issues, so they need to be repaired by the seller.

Customer returns policies should inform them how to return products and the conditions. It should be easy to understand the steps to make a return. Nevertheless, preventing returns is the best way to reduce returns, which can be achieved by implementing a quality assurance process, providing clear product descriptions and images, and offering customer support. The cost of return processing should also be reduced by businesses. Providing customer support to ensure the correct handling of returns can be accomplished by introducing a streamlined returns process. When it comes to returning products, businesses must ensure that customers have a positive experience. Companies can achieve this by offering clear returns instructions, free return shipping, and refunds within a reasonable period. To provide customers with a positive experience, product return management is an essential part of any business. Returns are unintended consequences and have become a more pressing issue, moving from the cost of doing business to a more serious erosion of net profit margins (Frei et al., 2020). Customers can have a positive experience when businesses establish a quality assurance process, provide clear product descriptions and images, and offer customer support. This can reduce the costs of returns and ensure customer satisfaction. Treatable or recoverable waste is referred to as a return, while non-treatable or non-recoverable waste is referred to as disposal. Figure 1 illustrates the flow of product returns following the submission of a request for product return.

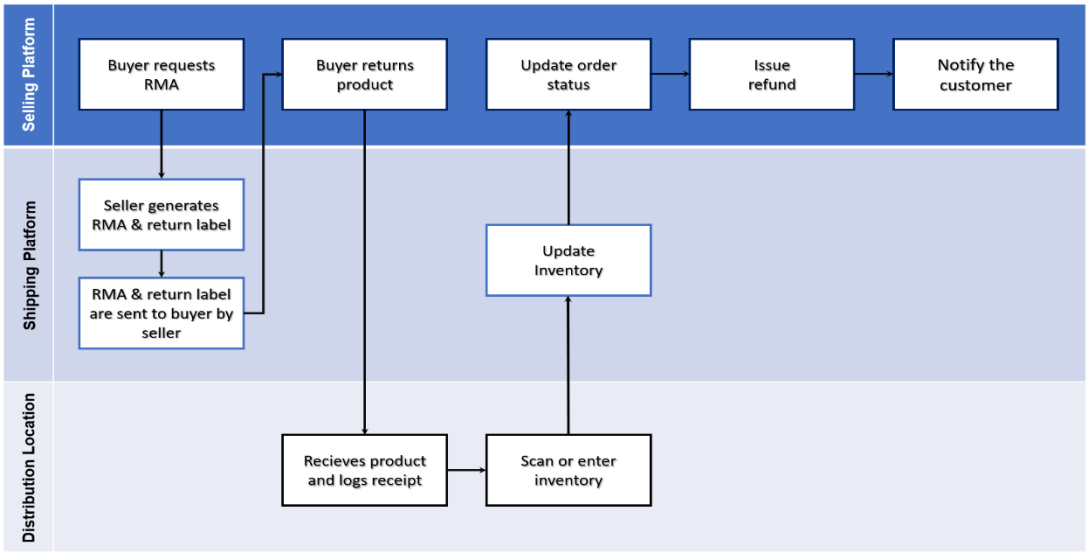

Figure 1. Overview of product return flow in the manufacturing industry

2.3 Circular Economy

Circular economy (CE) refers to a model of production and consumption in which materials and products are shared, leased, re-used, repaired, and refurbished where reuse is made possible through sharing, leasing, re-using, and recycling as much as possible. This will result in products with a longer life cycle. Zero waste refers to the concept of generating as little waste as possible in practice. As soon as a product reaches the end of its useful life cycle, recycling ensures that the materials within the product remain in the economy as much as possible. There are several ways to reuse these products and services in a productive manner over and over again, which contributes to their overall value. Taking the traditional take-make-consume-throw away paradigm and transforming it into a paradigm travesty represents a paradigm shift. Many scholars have repeatedly referred to the natural ecosystem model of matter and energy flow as a model of economic sustainability for humans, and the circular economy is a model for this approach that reflects the natural laws of nature (Yang et al., 2023).

A common solution proposed for averting the catastrophic consequences of linear production and consumption is to transition to a circular economy, which is an economic system that is based on business models that replace the "end-of-life" concept with reducing, alternately reusing, recycling, and recovering materials in production/distribution and consumption processes (Miller et al., 2023). The model relies on the availability and affordability of cheap materials and energy. Moreover, companies use planned obsolescence in this model when they design products to not last as long as possible so they can encourage consumers to buy them again. It has the added benefit of protecting the environment and reducing waste when circular economies are implemented. In addition to providing environmental benefits, circular economies reduce waste in landscapes and habitats as well as improve biodiversity conservation measures by slowing down resource use. Generally, the air quality would improve as a result of reducing waste production, decreasing landfill waste, and reducing landfill waste. Apart from creating jobs and stimulating investment, a circular economy can stimulate the economy. Figure 2 shows how a circular economy is implemented in the logistics process of a manufacturing company.

Figure 2. Overview of circular economy in the manufacturing industry

2.4 Reverse Logistics

Reverse logistics is a key component of the supply chain that most businesses pay high attention to nowadays (Nanayakkara et al., 2022). Following their arrival at the respective destination, goods are returned to their points of origin or other designated areas. In reverse logistics, items are repaired and/or refurbished and materials are disposed of or recycled. Among the reasons for returning products in reverse logistics are dissatisfaction with the product, recalls, warranty claims, and end-of-life disposal. Collection, sorting, transportation, inspection, testing, refurbishment, repackaging, redistribution, or responsible disposal are all part of this process. Customer satisfaction and environmental impact can also be improved through reverse logistics in addition to cost savings. By improving efficiency, benefits such as reduced labour costs, reduced inventory, improved customer service, and cost savings can be achieved. Products that can be recycled or reused can also reduce waste and costs.

Apart from reducing transportation costs and restocking fees, reverse logistics can also help reduce customer service costs. Customer satisfaction can be improved through reverse logistics by offering customers convenient means of

returning products for refunds or replacements. In addition to providing customers with timely updates about the return process, reverse logistics enables companies to quickly respond to product defects and recalls. Customer satisfaction is increased as a result of receiving quality products. In reverse logistics, product waste and costs can be reduced by recycling and reusing products. The process also facilitates the responsible disposal of products. It is also possible to define reverse logistics as activities related to remanufacturing and refurbishing. Reverse logistics and its network design have emerged as a pertinent discussion point due to existing gaps in logistics literature (Nanayakkara et al., 2022). As illustrated in Figure 3, the term reverse logistics refers to the process of returning, repairing, recycling, or disposing of products or materials after they have been delivered to a customer or end user.

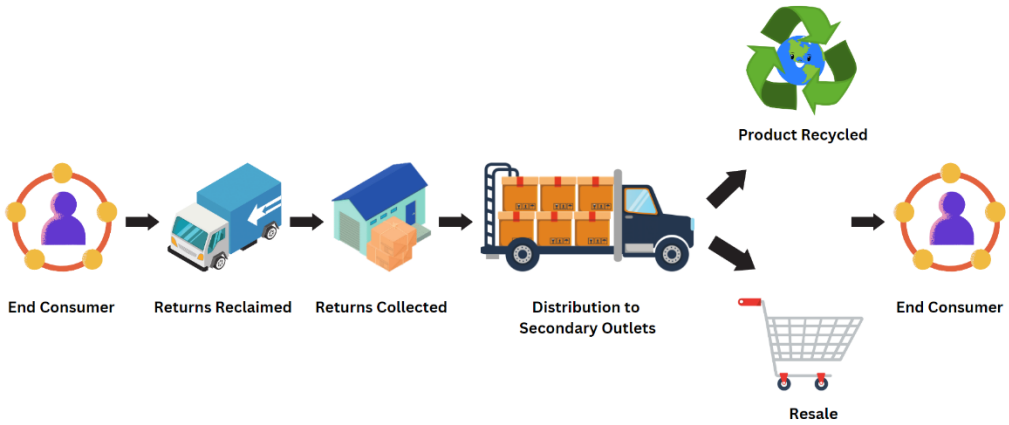

Figure 3. Overview of reverse logistic in the manufacturing industry

2.5 Upstream and Downstream Supply Chain

Each supply chain incorporates an upstream OS company and a downstream freight forwarder (Zhang et al., 2023). Moving products or services from the time of conception to the point of delivery to the client involves a number of phases and actions. In supply chains, both upstream and downstream refer to the many elements that affect how products and services move from one location to another. Supply chain risks reduce supply chain vulnerability or increase the profitability of the entire supply chain (Bugert et al., 2023). These phrases are regularly used in relation to supply chain management. The upstream supply chain of an organisation is in charge of supplying raw materials, components, and other inputs. A thorough analysis of the target company's internal processes and suppliers is the first step in this procedure. Production planning, supplier management, and inbound transportation and storage are several processes that define supply chains in the upstream industry. Supply chains upstream are responsible for ensuring an effective and dependable flow of inputs. Purchasing supplies from suppliers, establishing agreements, keeping an eye on inventory levels, and dealing with contracts all help to establish a healthy supplier connection. It is essential to optimise input cost, quality, and availability for the manufacturing process to run successfully.

Figure 4. A close relationship and mutual dependence exist between upstream and downstream supply chains

This concept states that the processes, actions, and organisations that transport completed goods to their final location form the downstream supply chain. Producing products and delivering them to clients make up this process. Relations with customers, sales, and outbound logistics all play crucial roles in the downstream supply chain. The supply chain in the downstream phase is concerned with the timely, effective, and acceptable delivery of goods and services to customers. This study is expected to handle completed items, monitor stocks, process orders, transport goods, and offer after-sales

assistance as part of the job description. To maximise customer happiness, it is crucial for businesses to fulfil the clients' needs and guarantee their contentment. The efficacy of the upstream supply chain influences how well the supply chain downstream will run. Production holdups, late order fulfilment, and dissatisfied clients can be caused by delays in the upstream supply chain. Furthermore, supply chain may be efficiently optimised by coordinating upstream and downstream partners. Such objectives can be accomplished by exchanging information, coordinating manufacturing and inventory plans, effectively communicating, and forging strong bonds with suppliers and clients. Supply chain managers need to understand upstream and downstream principles in order to achieve superior efficiency and customer satisfaction. Figure 4 shows that both the downstream and upstream supply networks are highly interconnected and dependent on one another.

3.0 CASE STUDY

3.1 Company Background

Advanced electronics and professionals manufactured products are created and produced by Company X for high-performance applications. In an effort to create a sustainable future, Company X is working to provide solutions that are more effective, intelligent, and clean. The firm is one of the top producers of medical and surgical devices used in the diagnosis, treatment, and prevention of illnesses, offering design and manufacturing solutions for a broad variety of diagnostic, surgical, and direct medical equipment.

Consumers depend on Company X to optimise their supply networks, boost productivity, and sell cutting-edge, intelligent goods to increase the effectiveness of their supply chains. The industries in which they invest and expand the most include healthcare, aerospace, and defence, as well as technological advancement and electrification. Products in this category help to improve energy efficiency, resource efficiency, and pollution levels. Additionally, it consists of goods that advance connectedness, health, and productivity. As part of its universal services, Company X also offers manufacturing and technical solutions that are specifically designed to satisfy the requirements of each of its product divisions and clients whose products need smaller numbers and more diversity. Integrated product assembly, testing solutions, engineering value, and design services are several intricate product and engineering service integrations that are available. As a result of this evolution, Company X now has influence over many different international marketplaces. The business has offices and facilities in London, America, Sweden, and Asia, and its facilities have over 20 design and production capabilities.

3.2 Issue of the Case

This case study discusses the issue of a company collecting and storing returned products. A number of challenges and potential drawbacks are related to this practice, including inventory management and inventory tracking, which are challenging to manage and track when storing returned products. When items are not properly categorised and organised, it is extremely difficult to identify specific items, track their condition, and determine their value for resale, refurbishment, or recycling purposes. Moreover, returns may suffer from deterioration and obsolescence when they are stored for extended periods of time as returned products are susceptible to deterioration and damage. Subsequently, they become less useful for reuse or resale, have a decreased value, and may be more expensive to repair or refurbish. The logistics process can be further complicated by the storage of returned products. As a result, the supply chain is likely to experience bottlenecks and higher costs due to the additional resources needed for transportation, sorting, and storing.

As a means of addressing these problems, the company needs to consider implementing a reverse logistics system that is more efficient and streamlined. Among the steps that may be taken are the establishment of a dedicated returns management process, the use of more effective inventory tracking and categorisation methods, the adoption of timely disposition strategies for returned merchandise, and the implementation of technology solutions for improved visibility and data analytics. Thus, the company will be able to take advantage of the returned products by improving its return management, reducing costs, and maximising the value derived from them.

All returned products from the customers will be inspected by the Quality Assurance operator before being sent to the rework department for rework. The rework department will ensure that the product is fixed or replaced before sending it back to the customers. During the first inspection, the failed Printed Circuit Board (PCB) will automatically be scrapped and sent to storage. The successfully tested PCBs will be delivered to the rework department after the initial inspection where professionals will replace or fix the defective components. Before being sent to the client, the repaired PCBs undergo a second round of testing to confirm that they meet the required quality requirements. A logistic management system monitors and keeps track of the procedure. The method aids in making sure that the goods are delivered quickly and effectively. Figure 5 depicts the logistic process for returning defective products that is currently implemented by Company X.

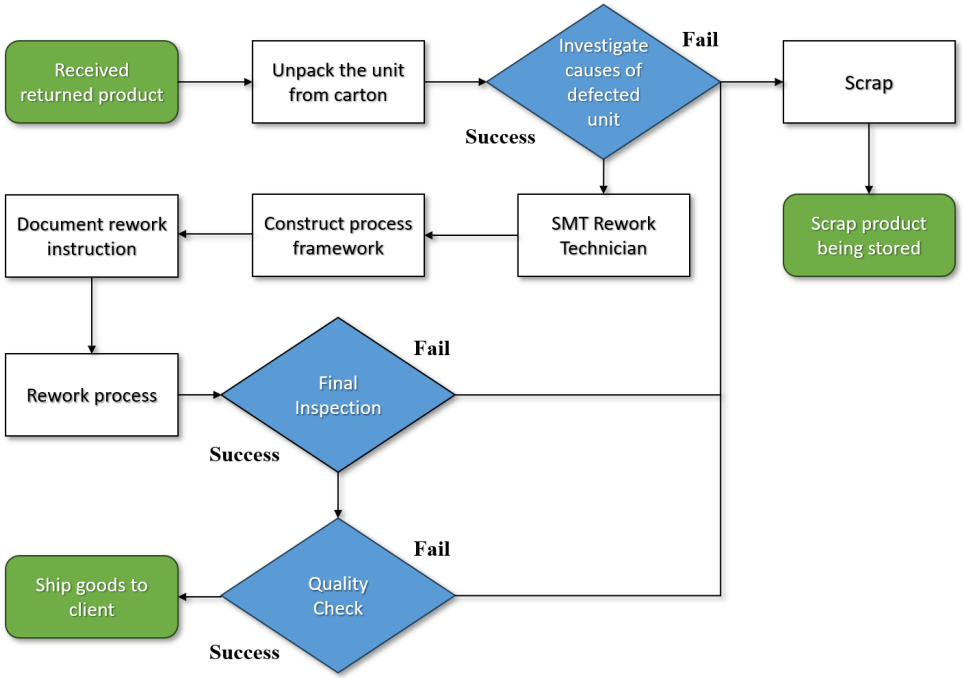

Figure 5. Overview of the current logistics process for returned defective products of Company X

4.0 METHODOLOGY

Qualitative technique in the form of interview was used in this case study to gather the needed data that would answer the research questions. The interviewer was able to address any problems that arose along the route because they had direct control over the process flow throughout the interview. A number of supplementary questions were added to the interview to highlight several additional points that should be discussed. Unlike quick yes or negative responses, the respondent had a greater opportunity to express themselves during a semi-structured interview. Furthermore, interviews have the advantage of yielding an enormous amount of data.

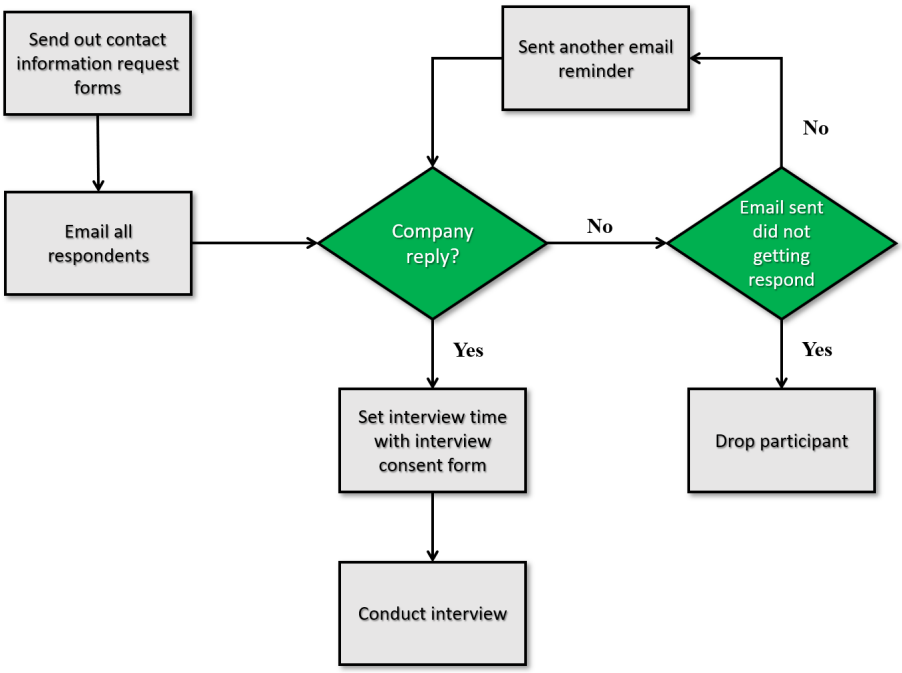

Figure 6. Procedures before conducting the interview

A face-to-face interview was held upon request by the case company. Initial consent to conduct the case study was obtained from the company's general manager. A case study specialist was employed to conduct the interview. Three personnel from the company were interviewed: a quality control engineer, a supervisor in charge of the production department, and a manager in charge of logistics and supply chain management. The first respondent was a supervisor who works in production, who was deemed a wonderful fit for the case study as it focused on the logistics division of the company. All respondents had consented to the interview and they were given enough time to complete the interview.

A brief overview of the research and its objectives was conducted with all respondents prior to the actual procedure. It was followed by an explanation of the main notion about product returns during the first part of the interview. The interviews lasted for approximately one hour and fifteen minutes and were tape-recorded upon the respondents' permission. The recordings were transcribed and cross-case analysis was used to analyse the data using the 5 Why analysis. Figure 6 illustrates the procedures that were conducted before the interviews.

5.0 RESULTS AND FINDINGS

As shown in Figure 7, the 5 Why analysis was utilised to delve into the bottom of the issue that has been bothering Company X. One of the reasons why product returns are being stored is the existence of no proper waste management for processing and handling the PCBs. PCBs are electrical components present in nearly every electronic device. They do, however, contain dangerous compounds that make proper disposal challenging. These hazardous compounds can endanger both human health and the environment if suitable waste management procedures are not adhered. As the investigation continued, the second why was asked to elicit the reason for the lack of a proper return management system. One likely explanation is a breakdown in communication between the departments in charge of managing goods returns. When separate teams are not communicating with one another, misunderstandings and blunders may occur. For example, if the customer service staff fails to correctly communicate the specifics of a return to the warehouse team, the incorrect product may be replenished or the consumer may not receive their reimbursement on time.

Another inquiry was made to understand why the return product stored was not helped by the current logistics processes. This appears to be the result of a lack of assigned duty for managing returns. It can be difficult to guarantee that returns are handled swiftly and effectively without a dedicated department or team in charge of managing product returns. This might cause delays in processing returns, affecting both the consumer experience and the general business performance. Responses from the interview further denoted that there is no specific department in charge of managing product returns. This is a serious problem since it might result in disappointed consumers and a lost in revenue. It is critical for Company X to have a clear protocol in place for dealing with returned merchandise. One possible answer is to undertake research to identify why the items are being returned before devising a strategy to remedy the concerns. This may include enhancing product quality, delivering better customer service, or providing customers with more thorough product information.

It was also found that the company did not perform extensive market research since they were more concerned with getting their product to market as soon as possible. As a result, they did not make analysing consumer behaviour and return patterns a priority. This lack of attention to market research might have resulted in severe failures for the organisation as they may not have completely grasped the target audience's preferences and needs. In order to get its product to market as soon as possible, the corporation neglected to analyse consumer behaviour and return tendencies. This mistake resulted in a lack of awareness of the target audience and their demands, resulting in a product that fell short of the clients' expectations. Due to the company's haste to introduce the product, it did not take the time to do a thorough competition study, leaving it exposed to competitors with a better grasp of the industry. Finally, the company's hurry to bring its product to market proved to be an expensive blunder that could have been avoided if it had conducted rigorous market research.

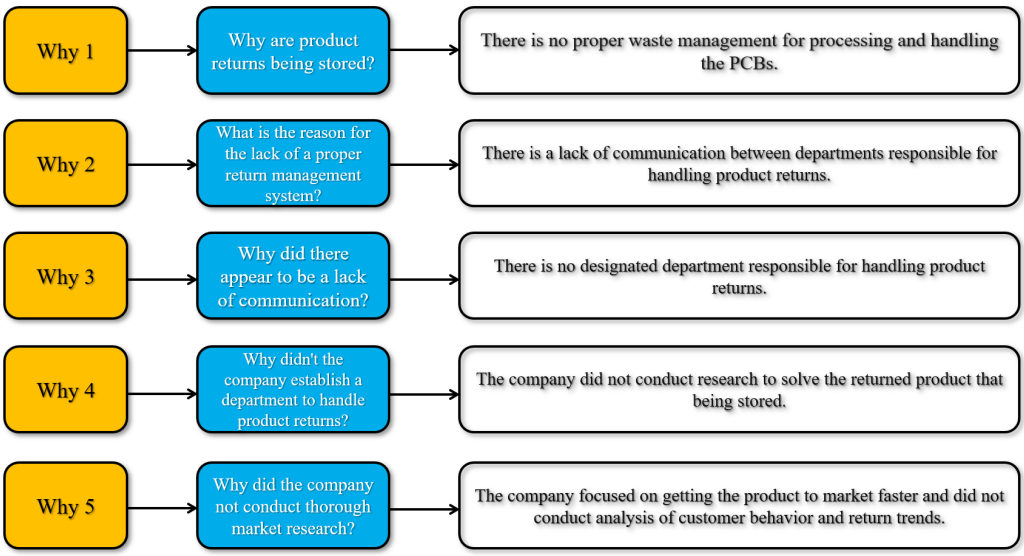

Figure 7. 5-Why analysis of the product return problem in Company X

Table 1 summarises the number of items returned to the firm throughout 2022 and 2023. Different brands employ different types of PCBs, each having unique properties. Such data enables the study of return rates for each brand and finding product problems that are widespread across brands. Understanding the features of each PCB can improve the

capacity to guarantee superior product quality. The data can also enhance the return processes and pinpoint areas for improvement in addition to spotting trends. This analysis will help the paper to develop methods for minimising the rate of returns and ensuring high-quality items. The firm values repurposing and reusing returned goods. Returns are accurately evaluated and, in accordance with a system they have in place, are either reworked or recycled. Products that cannot be reworked are processed by a licenced recycling business. As a result, the company may lower returns-related expenses and guarantee that waste materials are disposed of properly. Additionally, unsellable scrap materials are stored without any further care. These objects not only occupy precious warehouse space but also may increase storage expenses. To further save costs and prevent the use of priceless storage space, it is critical to establish solutions for the effective disposal of returned goods.

Table 1. Total product returns received by Company X from April 2022 to March 2023

	Brand A	Brand B	Brand C	Brand D	Brand E	Brand F
Apr-22	60	24	12	19	13	14
May-22	65	44	16	22	15	23
Jun-22	37	18	23	23	21	17
July-22	45	28	25	24	9	21
Aug-22	31	17	23	12	23	10
Sept-22	50	13	14	25	13	23
Oct-22	39	19	12	23	10	20
Nov-22	25	13	34	17	11	14
Dec-22	52	13	22	28	24	32
Jan-23	43	27	28	12	20	32
Feb-22	64	16	14	34	8	21
Mar-22	24	16	13	12	21	30

Similarly, scrap items cannot be sold or further processed and are kept in storage. These items may require more room in the warehouse, which might increase storage expenses. Returning goods responsibly will save money and prevent them from taking up precious storage space. Every day, there are growing numbers of returns, which is creating an increasing number of issues. The efficient and cost-effective disposal of these goods requires the application of various additional tactics. Storage space is getting scarce due to the rising number of returns, thus increasing expenses. Effective disposal techniques should be used to do away with the necessity for extra storage and warehouse space in order to reduce these expenses. Companies may reuse, recycle, and repurpose reusable, recyclable, and remanufactured items by using circular reverse logistics. By decreasing waste, lowering expenses, and maximising resource reuse, it also decreases the requirement for the production of new items while reducing the need for storage space. Companies can also reduce the requirement for extra storage space by comprehending consumer wants and preferences and avoiding product returns. If not further processed, the non-recyclable scrap goods have the potential to gather dust, lose quality, and decay. A subpar product might be produced as a result of dust build-up and the degradation of discarded items. When improperly disposed, such products can become hazardous trash and cause health problems. Additionally, harmful elements may emerge and endanger the environment.

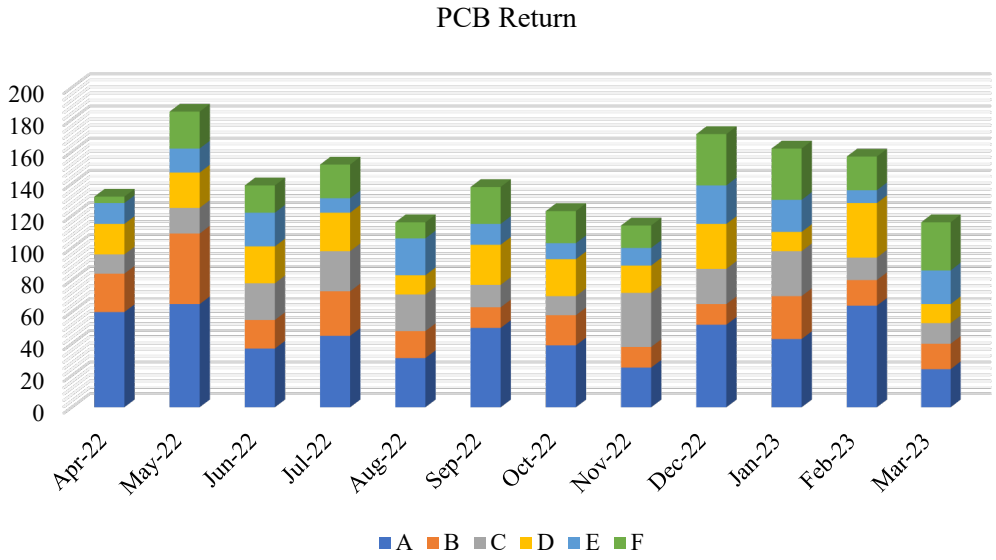

Figure 8. Overall total of products that were returned to the company

Aside from taking up precious storage space, keeping waste goods that cannot be sold or further processed can lead to a number of problems. This is especially true when the waste products in question cannot be sold. Figure 8 displays the pattern of goods returned from 2022 to 2023. It demonstrates that there were significant increases and decreases in the quantity of returned goods throughout the time period. This indicates that there were many returned items in the first quarter of 2022. Holding discarded objects without further processing can lead to rubbish build-up, which over time can result in a significant amount of waste being produced. A congested and disorganised work atmosphere might occur making it more difficult to operate and handle other things. The price of holding unsold waste items might rise significantly due to the higher expense of doing so. Additionally, because of the increased expenditures involved, the cost of renting or managing extra warehouse facilities can have a negative influence on the financial performance of a company's budget. The rising cost of keeping unsold waste products can cause storage expenses to rise significantly.

Due to the higher expenses involved, the cost of employing or maintaining additional storage facilities may have a detrimental effect on the financial performance of a company's budget. The risks associated with scrap products depend on their nature. If left unprocessed and kept for a long period, scrap items might pose a safety risk to workers. Because of their flammability, negative impacts, or sharp edges, certain materials can be dangerous to workers if they come into contact with them, increasing the possibility of them sustaining injuries. There may be particular regulations controlling the scrap products' storage and disposal, depending on their constitutional and environmental status. If these rules are not fulfilled, a person may suffer legal repercussions in addition to environmental issues, particularly if the materials are stored in a way that puts the local ecosystem or population at risk. Unprocessed waste materials often possess the potential to be recycled or used again; in fact, there is a good chance that they can.

If extra methods are not pursued, there is a danger that valuable resources may not be recovered or other uses for the materials may not be found, leading to less waste and less opportunity to make money. To lessen these worries, it is essential to implement effective waste management practices. For instance, unsold scrap materials can be rapidly evaluated, recycled, and disposed of. Frequent inventory inspections, coordinating with recycling providers, and researching storage solutions can help to decrease unprocessed scrap. It is also important to think about recycling unwanted objects, including using leftover resources to create new products or perform repairs. Finally, businesses should work to limit their overall output of discarded materials.

6.0 DISCUSSION

6.1 Challenges of Implementing Circular Reverse Logistics to Handle Product Return

Circular reverse logistics, a technique used to address the issue of significant product returns, has a number of drawbacks. Primarily, integration of the reverse supply chain can be challenging. This is because the integration of the forward and reverse supply chains is often required for circular reverse logistics. It can be challenging to connect these systems and processes, particularly if the current systems and practises were created primarily for the forward movement of commodities. It is crucial for communication channels, data exchange techniques, and a coordinated strategy to be created among the departments and stakeholders when a firm engages in both forward and reverse supply chains.

Furthermore, circular reverse logistics relies heavily on effective logistics and transportation. Businesses must establish a broad network to gather returned goods from various locations. When dealing with a lot of returned goods, coordinating collection schedules, determining acceptable routes, and guaranteeing timely delivery can be difficult tasks. Firms may need to partner with a number of logistics providers or invest in particular reverse logistics skills. Environmental considerations must be taken into account before developing circular reverse logistics. While reverse logistics refers to the circular reduction of waste while promoting sustainability, implementing environmentally friendly practices is not always straightforward.

Companies should also establish an acceptable waste management plan, such as recycling or responsibly discarding non-recoverable products. Ensuring that dangerous or hazardous goods are handled properly in accordance with environmental regulations is also essential. A company's ability to implement circular reverse logistics would require careful planning, effective operations, and collaboration across various divisions to address the issue of product returns being stored. They will be able to optimise resource utilisation, reduce waste, and improve customer satisfaction if it can get beyond these challenges.

6.2 Implications of Implementing Circular Reverse Logistic to Handle Product Return

Numerous issues may arise when circular reverse logistics is implemented to handle the problem of product returns being stored. A circular reverse logistics approach maximises the value of products while minimising waste by controlling their return, remodelling, and redistribution. Circular reverse logistics improves and automates the handling of returns, making it feasible to quickly sort, evaluate, and categorise the items based on their current state and potential for recycling or reuse rather than keeping them in vast numbers. Using a recurring reverse logistics process, the company can identify items that can be repaired, reconditioned, or remanufactured and then offered. The idea of expanding the lifespan of products and lowering the requirement to extract and produce raw materials ensures resource efficiency. In terms of the amount of space required, maintaining the inventory, and major write-offs, keeping returns might be highly expensive. By utilising or reintroducing returned items to the market or by distributing them as quickly as possible, the company can save money on storage thanks to this recurring reverse logistics technique.

A successful circular reverse logistics operation will also raise consumer satisfaction. Effective supply chain management (SCM) has become a potentially valuable way to secure competitive advantage and improve organisational performance because the competition is no longer between organisations but rather between supply chains (Cahyono et al., 2023). Customers should find it easy to return things. Good supply chain integration enables organisations to make reliable deliveries and distribute products to the market quickly. Competitive advantage can lead to high levels of economic performance, customer satisfaction and loyalty, and relationship effectiveness (Cahyono et al., 2023). Customer access to refunds or replacement goods is accelerated by the use of circular reverse logistics, which also improves the customers' overall experience. Circular reverse logistics decreases waste and the environmental effect of rejected goods, which complies with sustainability criteria. To avoid the need for disposal, the firm should refurbish or recycle returned goods, ultimately cutting down on waste and the company's carbon impact. Circular reverse logistics must be put into place as soon as possible to capitalise on the secondary market.

6.3 Suggestions

This paper suggests that Company X should implement circular reverse logistics to address the issue related to product returns being stored. As previously discussed, circular reverse logistics is the process of gathering, transporting, and redistributing previously owned items to optimise the value of returned products while limiting the amount of waste produced. By implementing such an approach, businesses will be able to reduce the amount of storage space required for returned products and the costs of disposing these products. Figure 9 depicts the management of product returns, which shows how circular reverse logistics works. Establishing a system for the collection of returned goods is the first phase in implementing Circular Reverse Logistics. This system should be created to make sure that all returned products are identified and sorted accurately. After products have been categorised, they can be transported to the logistics centre for further processing. It is possible to determine the state of the returned items by evaluating them at the location where they are processed. Products that are still in usable shape can be remanufactured and put back on the market. Whereas, products that are not in excellent condition can be dismantled and the individual components can either be reused or recycled. This allows for the products to be brought back into good condition. E-waste is considered in reverse logistics, allowing electronics to be recycled or repaired (Sarkar et al., 2023). In the event that PCBs cannot be reworked upon second inspection, a number of approaches can be used to reduce the amount of waste generated, hence addressing the issue of returned products being stored. This is aligned with circular reverse logistics practices, including but not limited to mending, reusing, remanufacturing, and recycling. Reducing waste and getting the most out of the product that has been sold back to businesses can be accomplished by reusing as many of these products as possible. The application of such a method will ensure that returned products are used in the most productive manner. This can considerably reduce the environmental impact of the products' lifespan and contribute to the sustainability of businesses. It can also be advantageous to the business by reducing the costs associated with refuse disposal and the production of new goods.

PCB recycling is the procedure of reclaiming valuable materials, such as metal copper, silver, gold, and other metals, from obsolete or discarded PCBs. Such a process is crucial for multiple reasons. First, PCBs contain materials that can be reprocessed, such as valuable metals. Therefore, PCB recycling can reduce the need to extract and process Earth's natural resources. It also aligns with the United Nations Sustainable Development Goal 12 (SGD 12) whereby reusing and recycling PCBs can reduce plastic waste. Connectors and insulating materials made of plastic are just two examples of PCB components that can be recycled or used in energy recovery. Furthermore, companies that generate a vast amount of electronic waste, such as scrap PCB boards, can partner with organisations that recycle such materials. These organisations often have sophisticated methods and equipment for recycling PCBs and extracting precious elements.

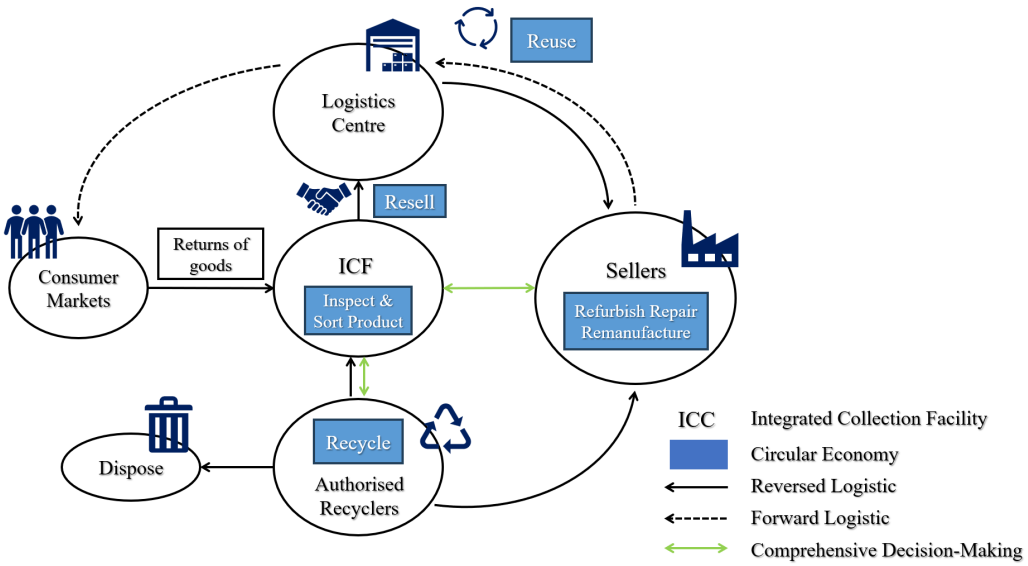

Figure 9. Managing product returns with circular reverse logistics

Another method is to determine which electronic components that can be reused before salvaging them from the PCB board. Components like capacitors, resistors, and other integrated circuits and connections can be de-soldered and tested to determine whether they are operational. These components can be resold to individuals or firms who specialise in the repair of electrical devices, either on an individual basis or in mass. Another option to reduce waste is by reusing PCB boards in another project. For instance, the boards can be trimmed down and repurposed as the foundation for a new circuit board; alternatively, it can be incorporated as a decorative component into an artistic endeavour or an object that is intended for use in the household. For example, a picture frame created using a scrap PCB board. Regardless of the method used, it is crucial to manage scrap PCB boards with care and responsibility.

7.0 CONCLUSIONS

The results of this case study illustrate the advantages of developing a circular reverse logistics system and its importance in developing effective and long-lasting mechanisms for managing product returns. There are several challenges that business owners must overcome when processing returned goods. In this study, the reverse logistics system was examined to identify methods for improving the efficiency of the circular reverse logistics system. The results demonstrated how companies may enhance product labelling and packaging, speed up the return process, and build connections with key stakeholders to maximise their reverse logistics operations. These adjustments, which cut costs and help to boost customer satisfaction by being diligent rather than reactive, are also consistent with the principles of circular economy since they encourage the preservation of biodiversity and the reduction of waste.

This case study also highlights the prominence of completing this method using a comprehensive plan that takes into account all phases of the circular reverse logistics process. This is because many elements of the circular reverse logistics process, such as collection and transportation, are interdependent and must be handled in cooperation to produce an efficient conclusion. A comprehensive approach also offers more accurate cost and value predictions for each stage and a better understanding of how to effectively optimise the whole process. To recover the maximum possible value while simultaneously protecting the environment, each step of the process, from examining the items to sorting, fixing, and discarding of the product, must be carefully considered.

This paper also demonstrates how technologies can be utilised for many purposes to automate and improve reverse logistical procedures. Businesses may increase their overall operational performance by using sophisticated data analysis, electronic tracking systems, and intelligent algorithms for routing to effectively manage product returns, recognise established patterns and trends, and make data-driven choices based on data. A more circular reverse logistics system may benefit businesses in numerous ways, including lower costs, increased customer happiness, and greater brand recognition. Furthermore, companies may help create a future that is more environmentally conscious and sustainable by incorporating sustainable practices and circularity concepts into their organisational practices.

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9.0 CONFLICT OF INTEREST

The authors declare no conflicts of interest.

10.0 AUTHORS CONTRIBUTION

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

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