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Research on the challenges and  
opportunities of reverse logistics  
in the circular economy

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## ABSTRACT

This thesis explores how reverse logistics is being developed in the context of the circular economy, and the challenges and opportunities it will face. Now that companies are increasingly turning to the circular economy principles, the requirement to combine reverse logistics is critical to closing the loop on the product life cycle, minimizing waste, and maximizing resource efficiency.

This thesis first defines the basic concepts of reverse logistics and circular economy to establish a comprehensive framework for the study. Considering factors such as technological complexity, operational and economic benefits, and regulatory barriers, the thesis discusses in detail the many challenges to the successful implementation of reverse logistics practices under the circular economy model. Also, the thesis highlights the multiple opportunities presented by the intersection of reverse logistics and the circular economy, focusing on strategies to improve the efficiency of reverse logistics in the context of innovative technologies, resource optimization, and sustainable development. Practical insights are provided through successful case studies for companies seeking to operate in this highly diverse and complex field.

**Keywords:** reverse logistics, circular economy, innovation, recycling, challenges, opportunities, sustainability, resource efficiency.

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## 1 INTRODUCTION

In modern times, the circular economy has been attracting more and more attention. Differing from the familiar "take-make-dispose" method of a linear economy, a circular economy seeks to decrease waste and, therefore, increase resource efficiency by promoting the continuous reuse, remanufacturing, and recycling of products and resources. As is well recognized, an important aspect of a circular economy is the integration of reverse logistics, where used products and materials are systematically collected, sorted, and processed so that they can be reintegrated into the production cycle. By enabling the recovery and reuse of resources, reverse logistics reduces the demand for raw material extraction and can minimize the generation of waste.

As per a study by Tjahjono & Bernon (2017), the growth of online shopping, accompanied by easy-to-follow return policies and short product lifecycles, has resulted in a dramatic surge in returns, which is now becoming one of the more serious issues in the retail industry. Recent figures show that the cost of returns across the retail sector is a huge £5.75 billion per year. It is estimated that 5-20% of consumer purchases are returned (Tjahjono & Bernon, 2017).

Companies are facing a major challenge in balancing economic interests with environmental responsibility. Within this context, all these questions require in-depth research, such as how to handle returned products, how to optimize recycling processes, etc. However, if these issues can be successfully managed or solved, companies will be given opportunities they have never had before. By focusing on the challenges of reverse logistics, companies can strengthen their sustainability. Meanwhile, it could reduce their negative impact on the environment and even meet the higher expectations of consumers who care about our environment. Thus, reverse logistics is not a challenge but an area of great opportunity that can bring sustainable growth and social recognition to enterprises.

## **1.1 Aims and questions for this thesis**

The aims are twofold: first, to identify and analyze the main challenges facing reverse logistics in a circular economy, and second, to explore the opportunities that these challenges present for business, society, and the environment. By achieving these objectives, the thesis is expected to provide some helpful material for the current conversation on sustainable development and insights for business executives. The thesis is divided into several main sections after the introduction. It begins with the concepts of reverse logistics and circular economy, then analyses the interrelationship between circular economy and reverse logistics, continues with the challenges and opportunities of reverse logistics in a circular economy, and ends with a discussion of the future direction of reverse logistics.

The research covers the following questions:

1. What are the main challenges when implementing effective reverse logistics systems?
2. What opportunities are given by reverse logistics in a circular economy?
3. What are the gaps in future research?

## **1.2 Methodology**

This study takes a qualitative method to exploring the challenges and opportunities of reverse logistics in a circular economy. The research methodology includes an in-depth literature review (aimed at understanding the research status of reverse logistics in the circular economy) and selected some case studies (including case studies from published industry reports and other relevant academic works). This method will give a wide exploration of existing research and a comprehensive overview.

### **Scope of the Literature Review**

This part was designed to cover various topics within the key theme of reverse logistics and the circular economy. It included various aspects, including theoretical frameworks, experimental findings, case studies, industry practices, and policy discussions.

### **Data Sources**

The primary sources of literature included:

1. **Academic Journals:** Peer-reviewed journals are the primary source for academic articles. Databases such as ScienceDirect and Google Scholar were used to find relevant literature
2. **Case Studies:** Case studies published in academic journals or from industry reports will be analysed to understand the reverse logistics in different sectors in the real world, not only from theory.

### **Search Strategy**

All kinds of literature from different search engines for this search strategy:

1. **Keyword Searches:** Use a different combination of keywords related to reverse logistics, circular economy, sustainability, supply chain management, and environmental impact.
2. **Reference Tracking:** References and citations from relevant articles are tracked to identify additional literature.
3. **Analysis and Synthesis:** Analyse and categorize the collected literature. This process helps to give an overall image of the right level of knowledge in this area and identify areas where further research is needed.

This thesis is planned: Chapter 2 will provide a comprehensive conceptual framework for reverse logistics and the circular economy; Chapter 3 will outline the challenges; and Chapter 4 will present the opportunities. Chapter 5 names a few relevant cases, and Chapter 6 provides concluding remarks.

## **2 THE CONCEPTS OF CIRCULAR ECONOMY AND REVERSE LOGISTICS**

### **2.1 Circular Economy (CE)**

In 1996, the American economist Kenneth Boulding first introduced the concept of a "circular economy". His previous "Spaceship Economic Theory" which visualized a future economy similar to a spaceship with limited resources. In this model, the earth is viewed as a closed system with no infinite resources. Boulding emphasized the importance of reusing materials and minimizing waste, as opposed to the traditional linear economy, which emphasized a shift in consumer attitudes. (Boulding 1996)

Chapter 6 of the Green Supply Chain Management eBook, "Closing the Loop - Reverse Logistics and the Circular Economy," discusses Japan, the United States, and China's circular economy policies. Both Japan and the US have imperfect policies and lack corresponding initiatives. For example, Japan is concerned about resource conservation and land use, but this is only due to concerns about limited landfill space. In contrast, China then started to encourage "environmentally enterprises" in 1998 and tried to make a balance between environmental protection and economic growth. In 2002, the concept of the circular economy was formally adopted by the Chinese Government as an economic development strategy. In the 13th Five-Year Plan, China proposes to establish a complete collection system for waste, thus increasing the rate of waste recycling. (Sarkis & Dou 2017)

The Ellen MacArthur Foundation, a highly respected UK not-for-profit charity, is recognized as a pioneer in circular economy thinking: The original purpose of the circular economy was to achieve effective regeneration of materials and energy. She also explains that in our current situation, we take everything from the ground as raw materials and then use them to make products, which we at last throw away as waste. But in this kind of circular economy, we want to stop the production of trash and waste from the beginning. We must see everything on the planet as a valuable resource (Ellen MacArthur Foundation 2020).

This study defines a circular economy as the current economic structure in which we minimize resource inputs and waste emissions through recycling and product design. Figure 1 provides an example of this definition. (Geissdoerfer et al 2020)

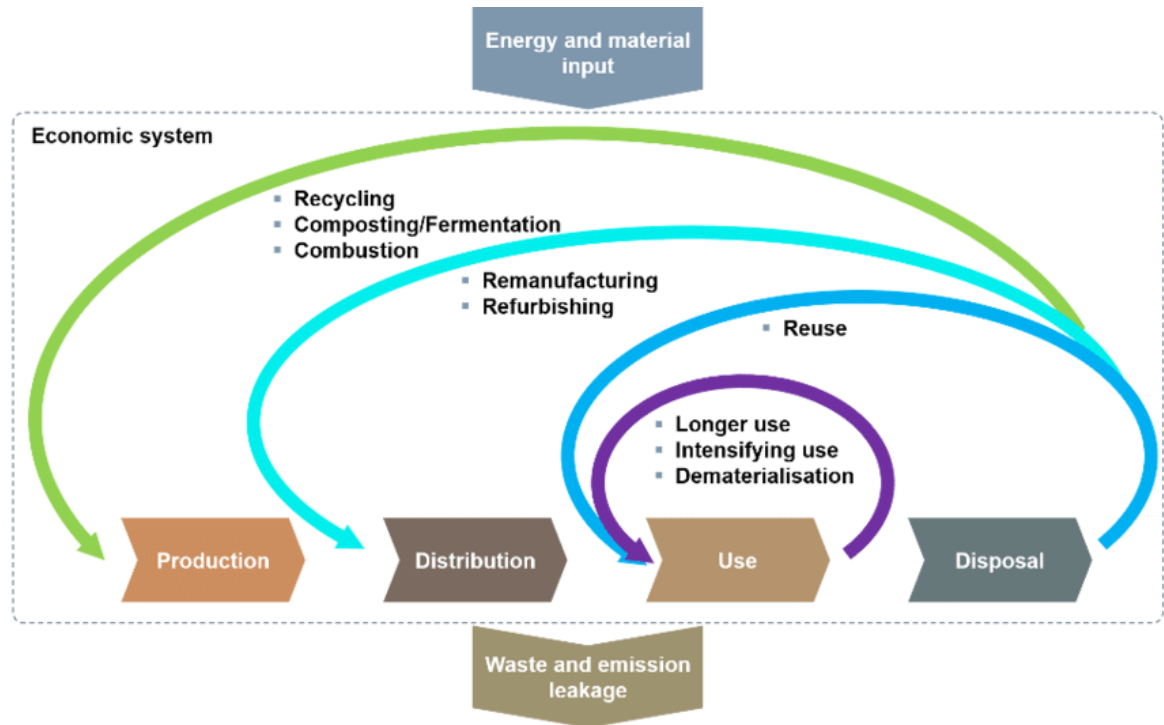


Fig. 1. The circular economy.

## 2.2 Reverse Logistics (RL)

Murphy and Poist (1989) provided the earliest description of reverse logistics and characterized it as the backward movement of goods. Subsequently, Pfohl and Stölzle (1992) defined reverse logistics as the utilization of logistical principles to oversee all activities involved in the spatial and temporal transformation of returned products, encompassing alterations in quantity and variety, to attain economic and environmental efficiency in the return process (Nguyen, 2012). Stork (1998) explains reverse logistics from a business logistics and engineering logistics perspective, like returning products, material replacement, reuse, waste clearance, refurbishment, repair, and remanufacturing. All these behaviors rolled into one (Colligan, 2015).



As research explored deeper and comprehension grew regarding the significance of supply chain operations, discussions about reverse logistics popped up in logistics literature reviews. According to Narashimman, "reverse logistics" first appeared in the 1990s and gradually changed over the next decade. Over the past three decades, the word has accepted its place in the supply chain sector. It means moving products from their usual destination back into the supply chain (Narashimman n.d.).

In the 2000s, more articles were published about improving reverse logistics development. One of the most significant views in these articles is the need for businesses to use more environmentally friendly methods in the reverse logistics process. Sarkis and Dou (2017), for example, used Carter and Ellram's 1998 definition of reverse logistics, which describes events done so that businesses can become more efficient by reducing, reusing, recycling, and remanufacturing.

Sarkis and Dou (2017) discovered that the most common reasons driving the introduction of reverse logistics are natural environmental conditions. Companies utilize reverse logistics for various reasons, including regulatory concerns, markets, and client constraints, improving our environmental sustainability. Goods variables also support the expansion of reverse logistics. Short product life cycles and a growing need to return things at the end of their lives need the development of new, adaptable reverse logistics channels. Overall, the focus on the need for reverse logistics is developing due to (1) environmental legislation requiring enterprises to take back products and process them for forward for landfilling, (2) the returned products in the production process benefit economic efficiency, (3) rising environmental knowledge and understanding among buyers and sellers, and (4) customer service's preference for flexible return policies.

#### Forward logistics vs Reverse logistics

	Forward Logistics	Reverse Logistics
Definition	It refers to the conventional flow of products from maker to end user. It includes the processes of production, warehousing,	It is the return of goods from the user or consumer to the manufacturing company or a designated facility for return, reuse, and resource recovery.

	distribution, and delivery of products to customers.	
Purpose and Goals	Its main aim is to deliver goods efficiently to meet customer needs, focusing on speed, cost-effectiveness, and reliability.	Aim to recover the value of used products and reduce environmental impact through recycling and waste management.
Supply Chain Processes	Includes the processes of raw material procurement, production, storage, and distribution to retailers or directly to consumers.	Involves returns policy management, returns processing, quality checks, refurbishment, recycling processes and waste disposal.
Value Addition	The process of converting raw materials into completed goods and delivering them to customers.	Recovering products for reuse, remarketing, or recycling to regain or maintain value extends product life cycles and reduces environmental impacts.
Technological and Informational Requirements	Technology is needed for managing orders, tracking shipments, and optimizing delivery routes.	More advanced technology is needed to track returns, assess product condition, and determine the next steps in the reverse process.
Environmental Impact	Reducing environmental impact through efficient routes, reduced packaging, and optimized fuel use is emphasized.	Directly supports the sustainability of the environment by encouraging recycling, cutting waste, and prolonging product life cycles.

The comparison above shows how reverse logistics differs mostly from forward logistics in terms of both concept and performance. Several procedures are involved in forward logistics when turning raw resources into finished goods. On the other hand, reverse logistics deals with getting returned goods from consumers back to recycling. Forward logistics and reverse logistics differ mainly in the following areas: quality, price, inventory, packaging, routing, forecasting, and cost. Narrowly speaking, reverse logistics is the actual management and movement of goods from the supplier to the client in reverse. Its emphasis is on logistics-related topics such as pickup and drop-off times, modes of transportation and routing, or using other logistics companies to enlarge logistical capabilities. Reverse logistics includes a broader range of actions that assist in managing old and used goods, such as sorting, recycling, and multiple reuses. Value recovery is no longer the key goal; instead, environmental and social management are.

Wilson (Wilson et al., 2021) provided the fundamental forward and reverse logistics flow in Figure 2, which he modified from Agrawal et al., 2015. He makes the point that, in reverse logistics, we think of four main tasks: network design, collecting, warehousing, and processing. These activities were chosen because they are often relevant to various sectors or organizational structures that use reverse logistics.

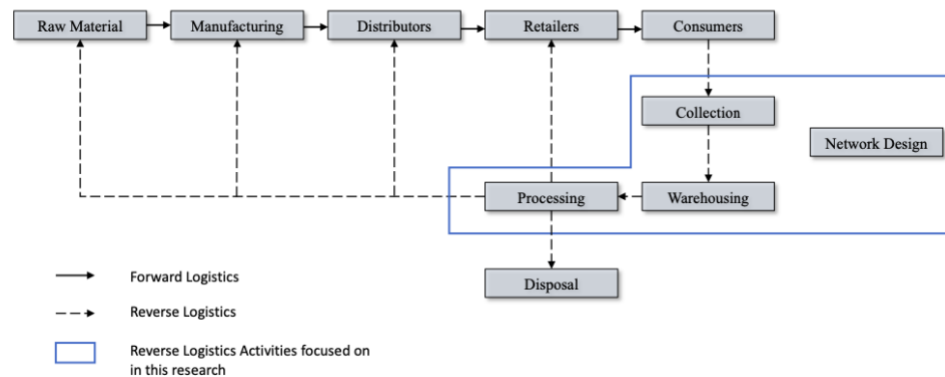


Figure 2. The basic flow of forward and reverse logistics (Wilson et, al 2021)

### 2.3 Interaction between reverse logistics and circular economy

Now, we can review the interaction between reverse logistics and the circular economy below by understanding the concepts in the previous paragraphs:

First, reverse logistics is closely related to the circular economy. Reverse logistics allows resources to operate efficiently in the business cycle, reducing pollution and bringing the best balance of costs and benefits. The circular economy can only succeed with reverse logistics; otherwise, the supply chain will break, and this economic cycle will not be realized.

Secondly, the circular economy requires rebuilding the nature of logistics. Reverse logistics has improved the one-way transportation model of logistics, and resource wastage and environmental protection have been improved.

Thirdly, the growth of reverse logistics also helps the circular economy. People are giving more attention to the use of resources, and the demand for reverse logistics is always increasing. This makes more opportunities and drives the continuous development of the circular economy.

These two concepts are interdependent and interact with each other in a few ways, conclusively contributing toward an extra sustainable and ecologically sustainable business model.

### **3 CHALLENGES OF REVERSE LOGISTICS IN THE CIRCULAR ECONOMY**

We all understand that reusing waste materials and stopping to allow them to go to waste is important to reverse logistics. This means improving the use of resources through recycling, reusing, and remanufacturing. However, these steps are far more complex than the forward supply chain. The process gets more complicated by the need for extra stages and technologies for reuse and remanufacturing (Sarkis and Dou 2017). However, reverse logistics presents challenges in a circular economy. These challenges are thoroughly examined in this chapter.

#### **3.1 Operational challenges**

One of the primary challenges is the logistical complexity of collecting and handling returned products. Unlike traditional logistics, reverse logistics requires a system capable of handling a wide range of items under different conditions, which is both logistically and financially demanding. Effective management of this complexity requires the development of an efficient and scalable reverse logistics network.

According to Aurdahl (2016), although there are many motivations for companies to practice reverse logistics, there are still a number of problems or barriers preventing the best implementation of a reverse logistics strategy. Based on the results of Rogers and Tibben-Lembke's (1999) survey of one hundred

companies, managers pay less attention to reverse logistics than other sides, which becomes a major problem in implementing reverse logistics activities. Many companies usually focus on traditional financial and operational business and neglect reverse logistics.

Unfortunately, the supply chain is not ready or willing to deal with these issues. Manufacturers yet developed products and packaging for reverse logistics. Most manufacturers do not have a department or function dedicated to reverse logistics. Some certain or some other reverse logistics services are not accepted by some companies, which means they are not unwilling to use them because reverse logistics is typically less profitable than forward distribution. Reverse logistics is costly, and customers are not willing to pay more for it. Retailers rely heavily on their own inventory management and often do not publicize their inventory lists. In general, reverse logistics capabilities are still limited. In the United States, only a few product management programs focus on reverse logistics as part of their instruction. Because of the high cost of reverse logistics, their recycling or refurbishing is often not profitable (Moigne, 2020).

### **3.2 Economic and financial challenges**

For the circular economy, from a conceptual point of view, reverse logistics does not only refer to in the opposite direction transportation, it's also a process of returning products from the end-user back to the manufacturer; after this, the manufacturer will can reuse or recycle these products that have been returned to. Thus, it will meet the main objective of the circular economy: to reduce waste and improve the efficiency of resources. However, when implementing reverse logistics, we also need to consider many factors, such as costs and benefits, including transportation costs, recycling efficiency, and technical feasibility - all these factors will be challenges.

Moigne (2020) concentrated the fact that there are so many challenges in handling returned goods, as they are usually neither taken apart nor packed. In addition, it is difficult to predict in advance the quantity and quality of goods to be

returned. Also, the storage of returned goods usually requires 20% more space than for new products. These challenges increase the difficulty and cost of reverse logistics.

That said, the quality and condition of returned products can be a huge challenge at this stage of reverse logistics. Because unlike brand-new products, returned products have different problems, like defective, damaged, or missing parts, those will make them unsuitable for second sale. Then companies need to put lots of money into repair or refurbishment processes to make sure those returned products are ready to be put back on the market. However, guaranteeing the quality and safety of remanufactured products still needs to maintain customer trust and comply with regulatory standards. Therefore, companies should make professional testing, inspection, and quality control to ensure that remanufactured products meet the required performance and safety standards. This requires additional resources and expertise, which adds to the cost and operational tasks for the business. Thus, focusing all details with attention about returned products is a must for reverse logistics.

We all know that nowadays product returns are a common problem in e-commerce. Some researchers (e.g. Bozzi et al., 2022) point out that the costs related to returning products are also very high. Fashion retailers often experience this problem. For example, in some cases, shoppers have purchased several pieces of clothing online, but the size or fit needs to be corrected. They usually try on different sizes in their bedroom or living room as a fitting room and then return the items that don't fit. Situations like this are common, and there are other costs to be paid to process returns. According to Vogue Business, like one online retailer sold \$500 million in 2019, but the cost of returns was \$600 million. This tells us that this kind of problem of returns is a serious challenge for retailers. However, this part of the cost is hard to track down because, after all, not all companies will care much about these costs.

So, here increased sales do not certainly turn into increased profits due to their increased return percentage amount. The increase in return made those companies focus on their reverse logistics supply chains and plan to investigate reverse logistics to meet this challenge. Of course, this kind of investment can be costly and complicated when considering many steps to processing returns, like collection, transportation, and sorting (Eriksson & Käck, 2023). However, if they want to address this challenge, companies may take measures such as optimizing their reverse logistics processes to improve efficiency and cut costs.

### **3.3 Technological challenges**

Reverse logistics is highly related on infrastructure and technology, the lack of which could be a major limit. Deficiencies in infrastructure for collection, recycling, storage, and transportation, and even road conditions, may have a general impact on recyclability. (Mallick et al., 2022).

Digital technology do help change the supply chain, especially when applied to the delivery of goods. Companies have preferred technology to improve forward logistics but have yet to pay equal attention to reverse logistics. As a result, there needs to be more use of digital technology in reverse logistics, which means that we face the challenge of a lack of digital technology support when returning.

For example, if company wants to integrate reverse logistics technology with their existing supply chain management systems, they will certainly face some challenges. This is because, as we can imagine, forward logistics and reverse logistics flows are very different in both system design, operational objectives and data management. Reverse logistics technology usually requires specific software and hardware, but these may not be compatible with company's existing systems. Once there is an incompatibility between the reverse logistics technology and the existing management system, there will definitely be problems with data integration and synchronization. Consequently, it also affects

the collection and processing of various data, including product information, customer returns and even inventory levels. Therefore, failure to integrate and synchronize this data well can lead to differences and errors in the reverse logistics process.

Although all managers know the importance of reverse logistics to their business operations, many still need support in reverse logistics technology. Most of them have gaps in awareness and need to learn about this kind of skill. These challenges may come from logistics technology changing so fast that it makes it difficult for managers to keep up with the latest technological trends. They need to learn what is happening, and the difficulty of reverse logistics adds to the struggle of implementing reverse logistics technology. So, to better help with facing these challenges, supply chain managers need to always improve their knowledge of reverse logistics technologies and update, and of course also should improve their own related knowledge and skills to try to adapt to the ever-changing business environment. This means they need to explore new technologies actively and continually educate themselves to maintain a competitive advantage in reverse logistics.

### **3.4 Legal and regulatory challenges**

Regulatory compliance can also be a challenge, especially in industries with strict environmental regulations. Gradually, Government requests for waste disposal and recycling are pushing companies to deal with more complex reverse logistics laws and regulations. These companies may need to check out their reverse logistics processes if they are compliant with all relevant laws and regulations, but these regulations can be quite different from one region to another. For example, if we lack standardization, it makes a block for companies operating in multiple regions that need to search the web for these complicated regulations - after all, different countries and regions have different rules and regulations on the collection, transport, and how to dispose of these used products. Complying with these regulations is costly and time-consuming, so companies must constantly monitor and adjust to the changing legal landscape. In addition, the



lack of clear instructions on product labelling, packaging, and tracking hinders the efficient movement of products through reverse logistics networks.

Company policies and rules also have a great impact on the implementation of reverse logistics. Many companies just focused on producing and selling products on the markets and were less concerned about how to handle returns or reuse for the company. Just because they get used to a single-use policy rather than thinking about recycling and reusing products. This attitude makes the implementation of reverse logistics more difficult (Aurdahl, 2016).

Take another example from Alamerew (2020): Technological improvements are making battery reuse technology available daily, and the demand for batteries in life is growing. This brings new opportunities for the battery market. However, our governments must do something or have legislated regulations slowly. This attitude made manufacturers unwilling to improve the technology and gave up the idea of reusing batteries. For example, the manufacturer's obligation policies must be clarified when a battery has been used once. This means that there are no exact rules to tell us who will handle batteries after reuse and remanufacturing. Also, the rules for reusing batteries have yet to be confirmed. In the EU, the law focuses mainly on recycling used batteries. So, this tells us that policy is critical in developing new business models and recycling e-waste. In Japan, on the contrary, the Japanese Government promptly introduced and ran its policy actions to develop its battery recycling industry when it saw the popularization of electric vehicles and the advancement of battery technology in its society. Give some examples. The Government has made laws and regulations to standardize recycling and reusing batteries; they want to ensure safety and environmental protection quickly. Besides, the Government has encouraged more companies to try harder to invest in the battery recycling industry by providing financial support and tax incentives. These moves certainly helped the battery recycling industry's success in Japan and provided assistance for sustainable economic growth and the effective utilization of resources.

## **4 OPPORTUNITIES OF REVERSE LOGISTICS UNDER THE CIRCULAR ECONOMY**

Reverse logistics is part of the circular economy and can bring different kinds of benefits and opportunities to the environment and the economy society.

The European Monetary Fund makes this point: If everyone could try to recycle, reuse, and remanufacture during work or life, our society may earn hundreds of billions of extra dollars annually by 2025 and create thousands of new jobs. This way, companies can make more profits, help more people get jobs, and ease the social unemployment problem. Thus, the circular economy can help enterprises save costs and open more business and job opportunities. At the same time, a circular economy will also protect enterprises from resource shortages and price fluctuations, making them more stable. Furthermore, a circular economy can stimulate innovation, increase productivity, and conserve energy better (Tjahjono & Bernon, 2017).

By 2030, the global population is expected to reach a surprising 9 billion people. Such a population explosion will put huge pressure on our resources and, of course, will force us to rethink how we live and consume. But in a circular economy, every item is seen as a limited resource that is no longer wasted easily but is given a new life cycle. So, it means that nothing produced is considered waste, while it will be designed to be sustainably used and recycled to reduce the need for new resources and minimize the burden on the environment. From this point the concept of a circular economy has thus become one of the key strategies for dealing with resource scarcity and environmental problems.

### **4.1 Reduce the use and waste of resources**

Reduced resource use and waste are the purposes of the circular economy.

Companies must find new approaches to accomplish this. For instance, companies can reduce resource waste by reusing abandoned goods, components, and materials. This method reduces waste's harmful effects on the environment and helps in the wise use of energy and raw materials.

Companies may reprocess waste materials and then turn them into renewable resources by taking recycling and remanufacturing programs. By doing so, they also extend the lifespan of their products by cutting down on the number of new resources that are needed. A couple of companies, for instance, recycle the parts and components of out-of-date equipment and put them together as new goods, so that they can be used for a second time, thus we have not wasted them anymore but increase resource efficiency.

#### **4.2 Innovation in product design and manufacturing**

Most products are not specifically planned for use in reverse logistics; they usually need more optimized performance in the recycling and reuse process, e.g., it is not easy to compress or adjust truck loading during transportation. Furthermore, the packaging of these products is often designed with something other than reusability in mind but instead focuses more on the product's original packaging. Consequently, the packaging of products is often difficult to reuse in reverse logistics. Besides, we also need more information when meeting the challenge of recycling products. It is usually difficult to obtain accurate information about whether returned products can be reused or are suitable for recycling, which adds a certain degree of complexity to the management and operation of reverse logistics.

#### **Technological Innovation**

New technologies surely have been begun to change reverse logistics totally. According to Krstić et al. (2022), these advanced new technologies have been designed more than to meet new challenges; they have also allowed logistics service providers to think again how to design their supply chains better and have let companies think about how to well manage with competitive pressures in the future. New technologies like barcode scanning, RFID tags, blockchain, IoT, and Artificial Intelligence will make reverse logistics smarter and more efficient. With these, companies can now easily track and monitor every flow step during reverse logistics. If we want to identify or categorize products, these technologies

can really be more accurate and will also help companies better predict and manage the flow of returns.

Many electronics manufacturers in their business have started using IoT technology to track the location and condition of their items backward. By adding chip technology in cell phones, for instance, some industries or companies be able to right identify and monitor used devices and reprocess or disassemble them to recycle the materials in them. This lets them to run the recycling and reuse of their products more efficiently during their business.

Another example is tried to use of artificial intelligence (AI) algorithms to optimize reverse logistics tracks. Some large retailers use intelligent algorithms to analyze returns data to find the best reverse logistics road and how to send them back in a better or efficient way. These algorithms will use a variety of details, like which kind of product type is, what its location, and what is the customer preference, and use these details to let products are returned as quickly and efficiently as possible to the appropriate processing center for the next step.

Besides, some companies are using blockchain technologies to improve tracking and transparency in reverse logistics. For example, a beverage company has tested how to use blockchain in a sample market to track the supply chain for bottled beverages from production to consumer and then to recycling to ensure that each process step is accurately recorded and tracked, thus driving the reuse of recyclable materials.

### **Remanufacturing and refurbishment techniques**

Reverse logistics encourages manufacturers to rethink the life cycle of their products when they are first designed. This method of course will help innovative improvements in materials and manufacturing technologies that make these products easier to recover and reuse. At the same time, if efficient remanufacturing and recycling techniques are used, this extends the life of the product and reduces the need for new materials.

Kalverkamp and Young note that, without remanufacturing, new products would be needed to meet demand. Remanufacturing "prolongs the use of returned old parts (known as "cores") which go through a series of steps to become as good a quality product as a brand new one. (Kalverkamp & Young, 2019).

Refurbishment is the condition in which goods can be fixed to the same quality level as a brand-new product. This process is usually done when a product is close to end-of-life and wants to reuse its functional status and bring it back to the best condition for use. This will decrease the demand for new resources and reduce waste as much as possible.

### **4.3 Enhanced sustainability**

In 2019, the European Commission had a big plan on how to make the entire European region greener. From that point on, they had come up with a long-term investment plan to get the entire European climate to a neutral place within the next 30 years. It means that Europe's carbon emissions will no longer make a negative influence on the climate. So, under this consideration these steps will be taken like this: First, companies will try to change product manufacturing to be more sustainable, and companies should use more techniques to reduce waste and emissions during their production. Then secondly, they will also encourage people or consumers to accept greener lifestyles by reducing energy consumption and waste. Additionally, the European Commission still wants more businesses to get into eco-friendly technologies. Put it another way, if more companies will use those renewable energy as much as possible and it helps to make innovative manufacturing processes and technologies. If achieved as planned, these moves will give new more opportunities for companies and provide consumers with greener products and services (Ciliberto, et al 2021).

According to Hubbard (2009), about three-quarters of big international companies are stressed to think about sustainability. These companies need to focus on

making money while also need to consider their environmental and social effects. For this challenge, they rethink their business plans and marketing strategies as they need to find new ways to balance economic development and environmental protection to ensure that they still keep competitive in this field in the future. Thus, many companies have begun to take greener, more socially responsible actions to meet changing market demands. This shows that sustainability has become the key to future success (Banihashemi, et al 2019).

#### **4.4 Facilitating the improvement of new business models**

Previously, companies only be concerned about producing, selling, using, and disposing of their products. However, many businesses are gradually realizing that there is something very wrong with this single-use method, which is both inefficient and puts a huge pressure on the environment. Therefore, businesses nowadays try to find one way to let resources more efficiently with sustainable development. Of course, this is not easy to do since recycling products takes a lot of time and money. Also, companies will not be willing to put more money and effort into reverse logistics if they do not benefit financially from it. However, this can be done through innovative business models. For example, companies work with the Government to value materials collected from reverse logistics. These recycled materials can be reused as renewable secondary raw materials after processing. Besides working with the Government, companies could also refine their business strategies to facilitate the development of reverse logistics. For example, they can work with logistics service suppliers to find ways to reduce costs and improve efficiency.

Because like we always thought, companies have only provided the sale of products. But now, they could offer more services in order for customers to enjoy the features of product without having to buy it with the rise of reverse logistics. In this way, businesses can keep ownership of the product and conveniently recycle, renew the products when they cannot be used any more. At the same time, it provides companies with the opportunity to make more profit through leasing, maintenance and repair services.

Of course, this kind of service-oriented business model is more suitable for modern consumers' demands. After all, nowadays, consumers are more care about their real experience and convenience when use the product, but care less about whether they own the product. Therefore, the introduction of reverse logistics will extremely help promote the development of a circular economy and drive a shift in business models towards a more sustainable and service-oriented way.

Thus, we can tell reverse logistics provides us with many opportunities to be sustainable in business or in life. If we can make good use of these opportunities in our lives, reverse logistics can work better in the circular economy. That is, it can reduce our requirement for new resources while reducing damage to the environment. Reverse logistics also provides new business opportunities for companies, like with recycling and reusing products to create value.

## **5 CASE STUDIES**

The following case studies provide an overview of these ideas in action and how organizations are responding to the challenges of limited resources and environmental issues.

### **5.1 Apple Trade In**

In our today's society, technology products are being updated faster and faster. Apple has always been working to push for technological improvements. In order for users could experience the latest technology and features, they launched a recycling program called "Apple Trade-In". This program lets to encourage users to trade into their new devices with the old one, meantime, Apple also want to recycle customers' old devices as new "material", which means users can give their old devices back to the Apple and then buy new ones at a discounted price.

Usually when our phone broke or get replaced, we often put the old or broken phone in our homes or some places for years until we think about it or see it

again, and then we throw it away like a trash. However, Apple has decided to take a different way to these old phones by taking old devices apart and use valuable parts for this kind of recycling program.

The recycling program is truly simple to do. Users only need to choose to participate in the recycling program when purchasing a new device, and then they just need to bring their old devices to an Apple store or deliver them to Apple via the official website, and after evaluation, Apple will give them a certain discount, which they can use to buy new devices. This way, users can have the latest tech products, but they no heavy pressure to buy, which also allows them to get the latest tech products at a cheaper price.

Once the devices are collected, they are sent to a special breaking down center. This place has experts who will use advanced technological equipment to break down these devices. In this disassembly center, the workers will break down the devices into different parts. Interestingly, Apple has very advanced technology and equipment that can make this disassembly process more efficient. They are able to make sure that every valuable part is extracted so that the value of the device can be maximized.

The core idea of this Apple Trade-In program is to reuse users' old devices instead of simply throwing them away or leaving them unused. Apple foresight and discovery this serious problem of e-waste generation and is determined to take positive measures to reduce the burden on the environment. By recycling old devices, Apple can increase and reuse the number of valuable parts and components in a device.

## **5.2 Furniture retailer**

This case study analyses a well-known furniture retailer (hereinafter referred to as the retailer) and its journey regarding making reverse logistics an essential



part of its circular economy strategy. It mainly focuses on the challenges is faced and opportunities throughout the process.

### **Background and Objectives**

The main objectives are to reduce landfill waste, extend the life of furniture products, and try to a sustainable business model through the resale and refurbishment of returned items.

### **Implementation of Reverse Logistics**

The retailer makes a rule that let customers to return their old furniture in exchange for store credit. These returned items are then evaluated by quality, refurbished if necessary, and resold at a discounted price. This method requires a strong logistics network to manage the collection, transportation, and disposal of oversized or heavy furniture.

### **Challenges Encountered**

A major challenge is the complicated nature of logistics and cost for handling oversized or heavy items, these factors often causing in a struggle between economic possibility and sustainable goals. Another challenge is the quality and condition of returned furniture, which does affect its resale value and refurbishment potential. Quality control and customer perception also pose challenges. It always needs to make sure that refurbished items must meet quality standards and appeal to customers for the best, which also requires a careful balance between cost and process.

### **Opportunities Realized**

While retailers have had some challenges along the way, they have also found some opportunities worth taking advantage of. they have seen some innovations in improving refurbishment techniques and logistics management, and these new approaches have made them more efficient as well as reducing the cost outlay of their business. They have successfully opened up a new and affordable market

for sustainable furniture that appeals to eco-conscious consumers and brings in a fresh revenue channel for their business. Moreover, this program also helps to strengthen customer loyalty because the program provides insights into consumer habits and products' lifespan, providing a valuable reference for future design and manufacturing decisions.

Also, this reverse logistics program taken by the retailers has greatly reduced waste and successfully resold or recycled most of the returned furniture. This does in particular help them to achieve their sustainability goals and provides a way for the business to utilize resources more efficiently. By recycling furniture materials and parts, they have reduced the need for new resources and reduced the environmental impact of their products. This move has also triggered an industry-wide conversation about sustainable practices and has given other companies an inspiration to consider and follow a similar model.

### **5.3 Nespresso's capsule recycling program**

Nespresso's used capsule recycling is based on setting up convenient collection points like at recycling stations, to the in-store recycling points, and mail-in options, making it easier to recycle used capsules. The customers can bring used capsules back to the store when shopping or sending them via the mail option, people can feel easily return used capsules to Nespresso in their daily lives without additional or specialized scheduling, simply placing the capsules in the designated recycling containers and completing the recycling process. This convenience does increase people's willingness to recycle, as well as reduce the number of capsules that are discarded or misplaced due to the difficulty of recycling.

These collected capsules are sent to Nespresso's own specialized recycling sites, which use advanced equipment. From here, the capsules are carefully sorted and processed. At the first step, the capsules are divided into different categories for subsequent processing. Then, using efficient sorting technology, the aluminum material is separated from the coffee grounds.

Like planed, the aluminum material is then sent to the special processing area for melting and reprocessing. These processes need to ensure the purity and quality of the aluminum material. All these done, then this recycled aluminum material is used in the production of new capsules or other aluminum products, while providing a sustainable source of material for the manufacture of high-quality products.

As for the coffee grounds' part, they will be converted into organic fertilizer or bioenergy by careful processing. These coffee grounds are reused in agriculture to provide nutrients to the soil or in projects such as power generation and biofuels.

## **6 CONCLUSION**

This paper focusing upon reverse logistics has undergone a great evolution over the last many years. Originally associated with sustainability, it's now closely tied to the circular economy. This change is driven by society's increasing focus on environmental protection and a growing preference for sustainable practices. There is an obvious increase in businesses' attention to reverse logistics and the circular economy. They realize their importance and are actively exploring them in practice.

While reverse logistics promotes sustainable development, companies still face challenges in its implementation. The complicated nature of reverse logistics poses challenges for product recovery, processing, and reuse. In order to better understand this field, we need more research in the field, especially analyzing the cases of different companies from different countries, and more cooperation between companies and researchers to draw more general conclusions from business practices.

Although reverse logistics is growing, many companies have yet to fully recognize its importance. However, over time, perceptions of this will change because of the many advantages it can bring to companies. Therefore, it is highly valued to continue writing similar papers and emphasizing the ongoing contribution of the relevant literature to the field. This helps to increase the understanding of the importance of reverse logistics and gives additional insights and directions for future research.

### **Proposal for further research**

As the thesis tends to be primarily a theoretical framework, the existing literature (mainly from journals based on industrial ecology) addresses a range of principles primarily centered around product design and material composition. However, a clear gap in the current body of knowledge is the limited consideration of the customer perspective in this exposition. The literature identified overlooks how consumers interact with and respond to the circular economy and reverse logistics principles.

Though we have made some progress in reusing and sustainability, many people still take used or useless products as waste rather than valuable resources. This attitude makes us lose a lot of opportunities to reuse and as well makes the environment problem more difficult to solve. In my opinion, this has to do with the consumer culture in which we live. People are forced to buy new furniture and electronic goods, and everything frequently needs to be replaced. This attitude of wanting always to have something new makes people tend to think that once products have done what they were originally way to be used for, they have lost all value. Therefore, customers conditionally dispose of old items as waste, without considering twice whether they have any other use or value. This careless of used products has led to a huge waste of resources.

In order to change this, we need to rethink our consumerism and build rational and sustainable consumption habits. This means going beyond careful consideration when purchasing new items, and using old items for as long as

possible, or finding ways to recycle them when they are no longer needed. Only in this way can we make better use of our resources.

As we turn to future research efforts, there is an urgent need for all of us to bridge this gap by exploring the crossover between the theory and practical of circular economy initiatives from the consumer's perspective. Suppose we can discuss things from a consumer perspective, such as their attitude and behaviors. In that case, we can better understand how to enrich this part of the theory foundation. Also, based on their feelings, we can find various cases and ideas from their lives. This research method will make our theory section closer to reality and quickly help finish our sustainable development goal. Of course, by taking a consumer perspective, we can also better understand their expectations, needs, and challenges towards the circular economy, thus giving more robust support to circular economy policies and practices.

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