Reverse Logistics Challenges for Sustainable Automotive Business Process

S. Sarifah Radiah Shariff
Malaysia Institute of Transport (MITRANS)
Universiti Teknologi MARA, 40450 Shah Alam, Malaysia
shari990@uitm.edu.my

Muhammad Hakimi Abdul Haris
Malaysia Institute of Transport (MITRANS)
Universiti Teknologi MARA, 40450 Shah Alam, Malaysia
hakimihariss95@gmail.com

Siti Meriam Zahari
School of Mathematical Sciences Studies
College of Computing, Informatic and Mathematics
Universiti Teknologi MARA, 40450 Shah Alam, Malaysia
sitimeriam@uitm.edu.my

Mohd Rizaimy Shaharudin
Faculty of Business and Management
Universiti Teknologi MARA (UiTM), Cawangan Kedah
Kampus Sungai Petani, 08400 Merbok, Kedah Darulaman, Malaysia
rizaimy@uitm.edu.my

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ABSTRACT

One of the biggest and most significant sectors in the world is the automobile industry. To make and deliver a vehicle, a number of supply chain operations are needed, such as sourcing and procurement, production, and logistics management. Ironically, not many automobile manufacturers have a satisfactory reverse logistics system for recovering and reusing returned vehicles. Basically, reverse logistics is a value added to the others industry meanwhile for manufacturing especially automobile still unclear is it can be profitable or not. The most important aspect to analyse in this aspect is that despite the obvious advantages of the reverse logistics to the industries of automobiles, not many manufacturers have successfully implemented the system of reverse logistics. As the year 2023 stood out as one of resilience and growth for the Malaysian automotive industry, both the manufacturers and its supply chain partners are playing important roles in ensuring the sustainability of the industry. Experts from the industries are asked for their experience and practicality of reverse logistics as value added activities in ensuring the sustainability of the industry. The findings show that priority as directed by the top management can be the main factor that drive the initiative.

Keywords: Reverse Logistics process, Automotive industry, Focus group discussion, Causal loop analysis

INTRODUCTION

The use of reverse logistics in the supply chains managed by automobile manufacturers is hampered by a number of issues.

These are the challenges cited by, Demirel, and Gokcen (2014) as the reasons why automakers are hesitant to engage in reverse logistics. As time goes on, it will be crucial to overcome these obstacles in order to most efficiently utilise the resources at hand (Chan, Chan & Jain, 2012). The following highlights a few of the most significant obstacles to the application of reverse logistics in the supply chains of automobile manufacturers.

Reverse logistics presents a problem in that the flow must be bi-directional. In order for it to work well, managers must build up the proper infrastructure. Software that can automate and monitor each phase of reverse logistics is frequently needed for this. In order to ensure efficiency, management must continue to monitor and assess the organization's reverse logistics procedures after the necessary infrastructure has been put in place. For a complete picture, businesses must monitor both inbound and outgoing logistics. The management of goods or raw materials arriving at the manufacturer from the supplier is known as inbound logistics. The procedures used to send finished items to the final consumer are known as outbound logistics. Reverse logistics can be a component of any point, but incoming and outward logistics are both measured from the manufacturer's perspective.

From past study they figure out, the minimum willingness to pay for the products is one of the most significant issues that highlight the use of reverse logistics. Consumers generally believe that remanufactured goods are inferior to newly produced goods in terms of effectiveness and utility. This presumption has a direct effect on consumers' willingness to pay for remanufactured goods. Consumers fundamentally think that remanufactured goods are inferior to their original counterparts in terms of value (Chan, Chan & Jain, 2012). When compared to real products, consumers are not at all willing to pay higher rates for such products. One of the biggest obstacles preventing firms from participating in

reverse logistics is this. Customers demand that businesses make it very obvious that the products are refurbished. Few buyers would buy remanufactured goods if they were priced too low because they would assume that the quality was poor.

Besides that, Technical barriers are issues and limitations relating to actual technical challenges. The truth is that not all parts or components can be recycled. The recycled materials may not be satisfactory if there are no technological recycling alternatives. The extent of the dismantling of returned automobiles is another technological limitation. A vehicle is made up of thousands of parts and components, including many different kinds of materials including plastic and non-ferrous metals. As a result, disassembling a car is more complicated than, say, disassembling a piece of personal technology. Finally, compared to other businesses, disassembling returned automobiles may necessitate large-scale tools or complex dismantling processes. Modeling and planning for disassembly is more difficult than preparing for assembly because the final product's use and market demands for recycled and used parts could have an impact on it (Tang & Caudill, R, 2002). Moreover, disassembly is accompanied by more uncertainty in system structures and component conditions than is assembly.

Consumer Perception, the attitudes of consumers are another significant difficulty for the field of reverse logistics. In this regard, it is important to comprehend the significance of consumer behaviour. Without being satisfied with the product's quality, consumers do not purchase things. According to Ahsan (2013), the prevalent consumer view is that remanufactured products are of low quality. This perception affects the sales of products that have been remanufactured (Lee & Lam, 2012). Thus, there is little purpose in involving consumers in the entire process if they are not prepared to purchase remanufactured goods. As a result, a

significant barrier for reverse logistics in the manufacturing industry is how consumers perceive products. When we talk about perspective barriers, we're talking about the varied ways that customers and original equipment manufacturers (OEMs) think about recycling or using remanufactured materials. Their opinions harm reverse logistics chances of success. To be fair, the strict safety regulations for vehicles are what led to the development of this impression. Even when the quality and performance of the car match the necessary criteria, customers may feel uneasy driving one made of recycled or reused materials. As a result, top management and marketing personnel face a significant issue in how to market such vehicles. Despite the aforementioned, people are now increasingly worried about environmental issues as a result of growing environmental awareness and the regulations around car disposal. However, many businesses believe that costs take precedence over reverse logistics requirements (Chan et al. 2010).

Ironically, not many automobile manufacturers have a satisfactory reverse logistics system for recovering and reusing returned vehicles. Basically, reverse logistics is a value added to the others industry meanwhile for manufacturing especially automobile still unclear is it can be profitable or not. Based on theoretical, reverse logistics have good impact towards many industries. The most important aspect to analyse in this aspect is that despite the obvious advantages of the reverse logistics to the industries of automobiles, not many manufacturers have successfully implemented the system of reverse logistics. The current implementation process at the manufacturers end needs to be analysed for improvement process; and analysed for its impact. As the previous studies proposed for the recycle of the components after being part of a finished product, the recycling process for the components is also of importance for its possibility being recycled

and of value added to an organization. Hence the objective of this paper is to determine the challenges in the reverse logistics process in the Malaysian automobile industry in ensuring its sustainability in years to come.

METHODOLOGY

For this purpose, five key managers, belonging to the different categories, as identified in the automobile industries will be brought together to participate in the group model building exercise. In this qualitative group model building approach, hexagons are used for systems thinking, based on Hodgson's (1994) use of hexagons for issue conceptualisation and Kreutzer's FASTbreakTM process (1995) for using hexagons to develop causal loop diagrams. In this qualitative group model building approach, the following four steps were used:

Step 1: Hexagon Generation

This step consisted of generating hexagons for each issue, opportunity or obstacle identified by the logistics manager or higher level. To help the stakeholders in generating hexagons, an organising question was used. During this step, hexagons were used as a facilitation tool. One of the authors acted as a facilitator and recorded issues, opportunities or obstacles identified by the participants.

Step 2: Cluster Formation

In this, hexagons that have something in common were identified by the manager or higher level. They grouped such hexagons together to form clusters. Then a descriptive name was given to each cluster.

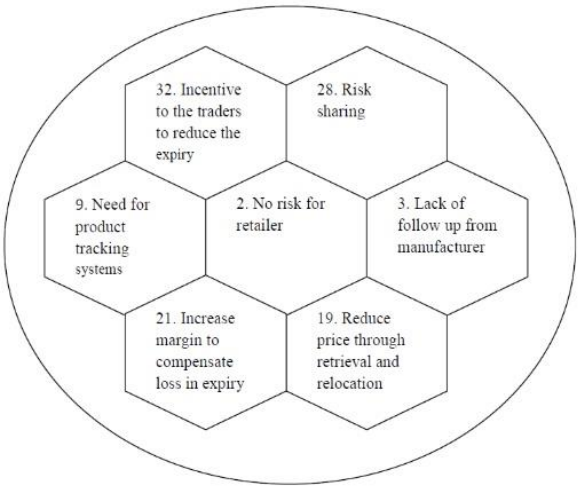

Figure 1. Example of a Cluster

Step 3: Variable Identification

In this step, the managers identified the variables associated with each cluster as summarised in Table 1.

Table 1. Variables used in this study

Variables	
1. Inspection time	6. Document preparation
2. Costs	7. Sorting time
3. Storage availability	8. Quantity return
4. Type of defects	9. Packaging
5. Duration of storage	10. Manpower

Step 4: Causal Loop Development

In this step, each manager was asked to establish possible links between variables. First to identify any two variables that

are related and provide a directed arrow between them. To generate a directed arrow, they will need to place a positive (+) sign near the head of the arrow if an increase (or decrease) in a variable at the tail of an arrow caused a corresponding increase (or decrease) in a variable at the head of the arrow. If an increase in the causal variable caused a decrease in the affected variable, a negative (-) sign will be placed near the head of the arrow. At the end of the group model building exercise, a general agreement that this model represented their shared view will be obtained from the manager or higher level.

Focus Group Discussion

In this study, total panel that participated in these focus group is 5 experts in few backgrounds of logistics and automobiles industries the details are shown in Table 2. The panel are selected based on their experience in the automotive industry.

Table 2. List of Interview's Panels

No.	Panel	Company	Designation
1	Panel 1	Petronas Lubricant	Logistics manager
2	Panel 2	Sufi Group	Founder
3	Panel 3	CJ Logistics Malaysia	Key Account Manager
4	Panel 4	CJ Logistics Malaysia	Assistant Manager
5	Panel 5	Volvo Malaysia	Project Manager

The discussion was conducted in 50 minutes at the meeting room and session was full of the questioning and answering in informality mode. Most of the panels were discussing in the

national language, Malay language to ensure comfortability in voicing their opinions and perceptions. The question was distributed earlier to the panel before the date of discussion.

RESULTS AND DISCUSSION

Analysing collected data from a focus group discussion involved several steps. First, the data needs to be transcribed from the audio or video recordings. Then, the data anonymized and coded for easier handling. After that, the data analysed using different methods and frameworks, such as thematic analysis, content analysis, discourse analysis, and grounded theory. Another advance method is using Atlas Ti. One common approach is to look for thematic patterns in responses and create categories. The next step is to sort responses into categories and identify the main ideas that recurred across the focus group discussions. Whereever possible, quotes that encapsulate themes were identified. It is important to draw a distinction between general trends and unique but significant outlier responses. Often, one unusual answer can illuminate a more common group trend. Finally, the findings that have potential outcomes and action points are reported and summarised. It is important to note that analysing qualitative data from focus groups can be challenging, as it involves interpreting and synthesizing complex and diverse information. However, it can provide valuable insights into customers' needs, preferences, opinions, and emotions.

The question has been established prior the discussion in order to ensure the research objectives are achieved. List of questions are as follows:

- What activity of reverse logistics is implemented in your organization?

- What are the benefits observed/perceived from the reverse logistics?
- What are the challenges faced by the organization in implementing the reverse logistics?
- Which area where major challenge take place in conducting reverse logistics?

The questioning session takes place with the researcher asking questions one by one and selecting a panel at random to answer the question. Every question and answer by researcher and panel is recorded.

What activity of reverse logistics is implemented on your organization?

Based on Panel 5 from Volvo Malaysia the activity of reverse logistics that regularly they implemented is the return of defect products to the supplier. Basically, the return of parts that have any quality issue that cannot be accepted by production line that give impact to any assembly process or appearance of the part. The return must manage by quality section to deal with the supplier until the parts is return or repaired. Quality section will contact the supplier request to return the defective part to ensure a smooth arrangement of return process. After that, defective part needs to properly package to prevent any further damage during transit. Use appropriate packaging materials and consider insuring the package for its value. The documentation must be attached with the return packaging this helps the supplier identify the part and process the return more efficiency. The return must use the same transportation that use by supplier to eliminate any additional cost and keep a record of the shipment, including the tracking number for company reference. After all the process return complete, they need to follow up on the return to ensure that supplier have

received the part and are processing the return according to their policies.

Panel 1 from Petronas Lubricant company he sharing his experience working at logistic Perodua almost 15th years, Perodua practices the reverse logistic by return the packaging item for example plastic, rack, polybox or cotton box. It is depending on the policy that have been agreed some suppliers may have specific requirement for returning item, such as returning with the quantity or within a certain timeframe. Make sure the rack is in the same condition it was when it bought or as stipulated by the supplier's return policy before returning it. The supplier may refuse the return or impose a restocking fee if the rack has been damaged or altered in any manner. Panel 3 from CJ logistic also practicing the return of plastic that use for packaging the parts by this can eliminate any extra cost for supplier to buy another packaging item by reuse it again. From Panel 2 some of the company have standard size of packaging to arrange the part at their storage if any vendor or supplier does not follow their standard size, they will return the part to change and follow their requirement during that situation the reverse logistics play their roles to return the part until to the vendor or supplier.

In summary, almost all the experts practice the reverse logistics in their company by returning the defect or reject product. The automobile business, it is essential for managing product recalls. It makes sure that the recall procedures are effective, including the identification, locating, and replacing of faulty or defective parts. This aids in reducing potential safety issues and preserving client confidence. Most of the activity of reverse logistics in the automobiles industries in Malaysia practice the reverse logistics due to defect parts that need to return to repairing or refurbishment to have the other value from the defect item instead of disposing the item. Requirement for packaging standard is

agreed by all expertise that need to be follow if not the parts need to be returned. Reverse logistics is a crucial component of the automobile sector that deals with the exchange and return of parts and accessories for vehicles, including those that are warrantied. The areas that reverse logistics cover in the automobile industry is product return, product recall, end-of-life vehicles, and remanufacturing. The emphasis on the need for reverse logistics has increased as the economic value of advance logistics for cars has diminished.

Table 3. Reverse Logistics Activity

No.	Activity	Panel 1	Panel 2	Panel 3	Panel 4	Panel 5
1.	Return of reject product					✓
2.	Return of packaging	✓		✓		
3.	Return of parts that do not follow requirement		✓			

Researcher is using software Atlas Ti and with the software researcher using the AI tools to generate summary from the overall focus group scrip. The result is moderator, and the others discuss the implementation of reverse logistics in their organizations. They talk about how complaints from operators or downline trigger the process of verifying and resolving the issue. The QC team plays a crucial role in determining part accuracy and coordinating the return of defective parts. They also discuss the importance of proper packaging and tracking in reverse logistics. Packaging

plays a significant role in ensuring the safe return of goods, and a tracking number is attached to the packaging for easy identification and monitoring. The use of the same truck for delivery and to collect returned goods from suppliers helps maintain efficiency in the process. Supplier involvement is highlighted, with panel 1 mentioning how they ensure suppliers take back their packaging materials to promote sustainability efforts. Panel 3 adds that the return of empty pallets is coordinated as part of the "white glove service". Two types of reverse logistics are mentioned: positive, where goods are returned for various reasons, and negative, where rejected goods need to be returned.

Figure 2. Reverse Logistics Activity

The group shares experiences of managing returns, including one where a vendor's incorrect label led to the return of an entire batch. Communication and site visits were instrumental in resolving the issue. The participants discuss the involvement of logistics service providers (LSPs) in managing returns, even if it is not their specific responsibility. Additional costs may be charged for such services. The conversation touches on the challenges of

predicting demand and managing rejected items. They discuss the need to find ways to repurpose or repair rejected items to reduce waste and improve efficiency. The discussion concludes with some humour regarding the impact of rejections on production quantities, highlighting the importance of effective reverse logistics processes in organizations.

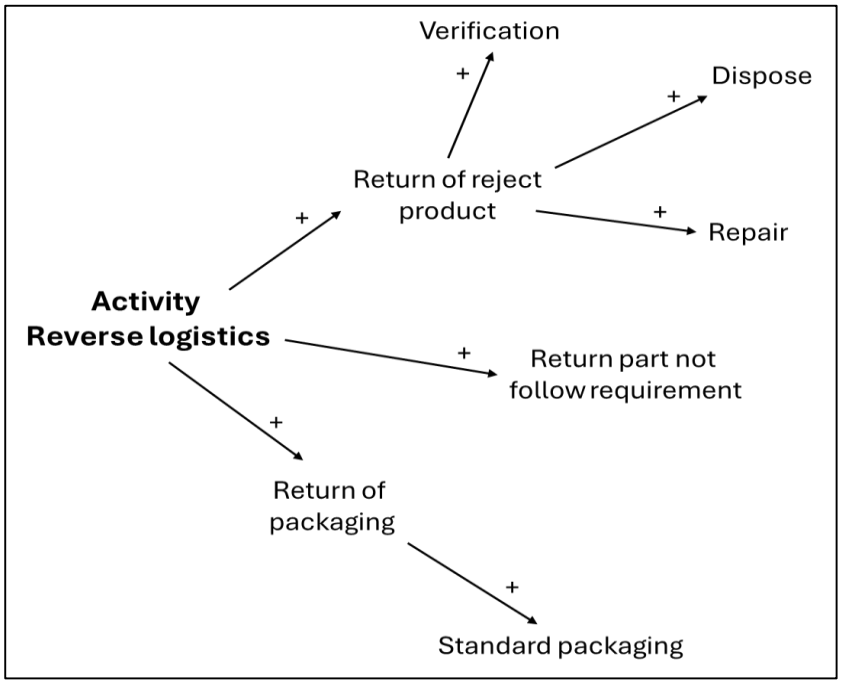

Figure 3. Causal loop reverse logistics activity

Figure above shows, the activity of reverse logistics is related with the return of reject product, return of part does not follow requirement and return of packaging. Return of reject product can increase due to need verification from the supplier or confirmation regarding the parts specification. Other than that, is due to dispose

the rejection item that cannot be use for production and for the last one for repair the defect part that can be use again after doing the refurbishment or rework on the parts.

What are the benefits observed/perceived due to reverse logistics practices?

Based on Panel 4 (Century Logistics) the benefits of reverse logistics are the defect item can be a valuable item besides of disposal the item could be recycle, refurbish and repaired. Reverse logistics offers several benefits, including cost reduction, supply chain optimization, and it can enhance sustainability by recovering parts or resources for new products, recovering unsold goods for resale, and returning packaging to manufacturers for reuse. Furthermore, any parts that return from customer that in perfect condition it can be resale again by managing the return and resale process. Recovering value from returned items, businesses can generate better returns on investment, reduce losses, and create new revenue streams. This can contribute to higher overall profits for the company.

From Panel 2 (Sufi Group) Reverse logistics can have a significant impact on a company bottom line this activity can increase their profits. For example, reverse logistics at the long-distance route give opportunity to another logistic supplier to have some profit by helping to return the item. Next reverse logistics can minimize the waste because we can reuse or recovery back the defect or reject item rather than throwing it away. For example, lubricant oil some manufacturer can recycle back this oil and sell it again. Furthermore, reverse logistics ensures sustainability, adherence to environmental rules, and improves customer satisfaction, while also aiding in resource optimization and positively impacting the sector's financial performance. Effective reverse logistics can lead to higher customer satisfaction by

providing a seamless returns process and demonstrating a commitment to customer service. This can ultimately improve brand loyalty and attract new customers.

Table 4. Benefits from Reverse Logistics

No.	Benefit	Panel 1	Panel 2	Panel 3	Panel 4	Panel 5
1.	Defect item can be a valuable item		✓		✓	
2.	Cost reduction				✓	
3.	Supply chain optimization		✓		✓	
4.	Enhance sustainability		✓		✓	
5.	Increase profit		✓		✓	
6.	Reduce waste		✓		✓	
7.	Increase customer satisfaction		✓			

In conclusion, both party from Panel 4 and Panel 2 agree that reverse logistics has a good impact and benefits to the industries. They keep mentioning that reverse logistics can keep environmental more sustainable by reduce the waste of material, parts and disposal of goods that can impact to the nature. Reverse logistics aids in cutting expenses by lowering the price of returns, repairs, and warranty claims. It reduces waste, streamlines repair procedures, and maximises the value recovery from returned goods, all of which lower costs for the automobile sector. Reverse logistics offers a range of benefits to businesses, including cost savings, improved customer satisfaction, enhanced brand reputation, risk reduction, sustainability improvements, and higher profits. By

effectively managing the reverse flow of products, businesses can create value and competitive advantage in their operations.

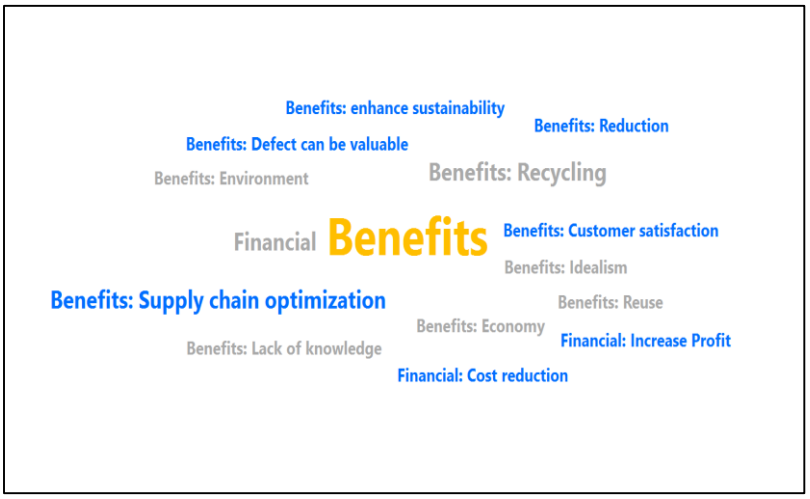

Figure 4: Reverse Logistics Benefits

From Atlas Ti, the speaker discusses the benefits of implementing reverse logistics in industries. Reverse logistics refers to the process of dealing with returned or unused products, such as disposal, recycling, or repair. The speaker explains that implementing reverse logistics can help reduce costs for manufacturers, improve efficiency in inventory management, and address environmental sustainability issues. They also mention that reverse logistics can involve various modes of transportation, including air, ocean, and land, and sometimes even human transportation. Additionally, the speaker mentions the importance of cost calculations and the challenges that arise when implementing reverse logistics, such as inconsistent clients and the need for proper documentation. Finally, the conversation touches

on how different industries, such as automotive and oil and gas, can benefit from implementing reverse logistics.

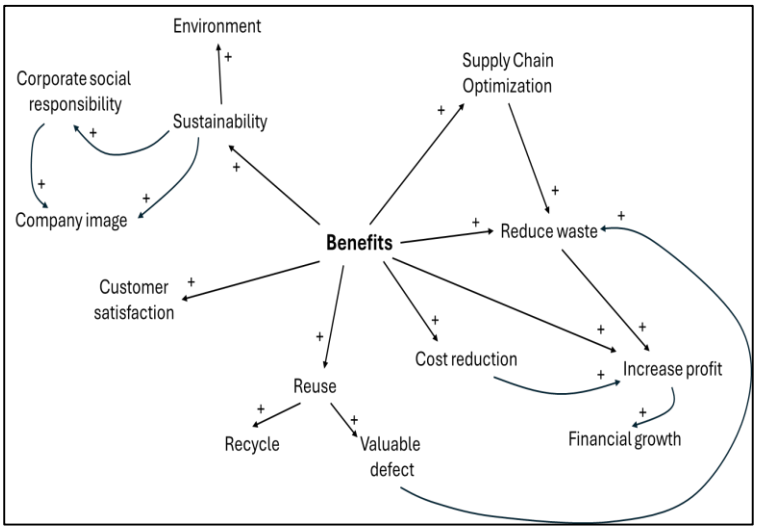

Figure 5: Causal loop reverse logistics benefits

Figure above shows, the causal loop for benefits of reverse logistics in the industries. Reverse logistics can increase the sustainability towards the environment and it also effecting the corporate social responsibility to the company that can give a good company image to the society and customers. Reverse logistics also increase the customer satisfaction because of additional services rendered on the possible damaged or quality defect products.

What are the challenges faced by the organization in implementing the reverse logistics?

From Panel 1 (Petronas Lubricant) one of the challenges is when the return of parts is in bulky condition. In automobile industry they will return all the reject part if need for vendor action

and improvement activity it depends on the lot size and lot date. The arrangement of return from that situation is very difficult in terms of transportation and documentation. Returning the parts in bulky need to consider the transportation capacity and timing depends on the size of the part because if the transportation capacity is not enough to collect the returning part, they need to arrange more bigger transportation or few times collecting. The timing also one of the challenges because at the customer also have delivery activity and vendor need to follow their timing if not it can cause congestion at the customer place. Next is, various regulations and legal considerations can complicate and impact the efficiency of reverse logistics operations. Strict of regulations governing the disposal and recycling of certain products, especially those containing hazardous materials. Companies engaged in reverse logistics must comply with these regulations to ensure environmentally responsible handling of returned goods. Different types of products may be subject to specific regulations. For example, electronics, pharmaceuticals, and automotive components may have unique requirements for handling, recycling, or disposal. Navigating these product-specific regulations can be challenging.

Based on Panel 4 he also agrees with Panel 1 statement because If reverse logistics operations involve the movement of goods across international borders, companies must comply with a complex set of customs, trade, and environmental regulations in each country. This can lead to delays, additional costs, and increased administrative burdens. To address these challenges, companies engaged in reverse logistics need to establish robust compliance management systems, invest in technology to track and manage returns efficiently, and maintain clear communication with regulatory authorities. Collaboration with logistics service

providers and legal experts can also help navigate the complex regulatory landscape associated with reverse logistics.

In summary, most of the challenge for reverse logistic is about compliance the regulation and rules. regulations for reverse logistics in the automotive industry and other sectors vary by region and country. To addressing these challenges requires a comprehensive and integrated approach to reverse logistics, incorporating technology, compliance management systems, and collaborative efforts across the supply chain. Additionally, staying abreast of technological innovations and evolving regulatory landscapes is essential for long-term success in managing reverse logistics in the industry.

Table 5. Challenges in Reverse Logistics

No.	Challenges	Panel 1	Panel 2	Panel 3	Panel 4	Panel 5
1.	Arrangement of return parts in bulky condition	✓				
2.	Return timing	✓				
3.	Regulations and legal considerations	✓			✓	

Summary from Atlas Ti, Moderator asks for opinions on the challenges of reverse logistics in the automotive industry. Panel 4 explains that if certain portions of imported goods are used, it becomes difficult to reverse the shipment in a full load. Panel 1 states that there are routine and management challenges, with sudden rejection due to changes in government requirements. He mentions that the implementation of Environmental, Social, and

Governance (ESG) standards has become necessary for many industries. Panel 4 adds that charges related to environmental concerns are increasing, and companies are starting to focus on sustainability in their operations. Panel 3 concludes by stating that having ESG elements is now a requirement for companies. In summary, most of the challenge for reverse logistic is about compliance the regulation and rules. regulations for reverse logistics in the automotive industry and other sectors vary by region and country. To addressing these challenges requires a comprehensive and integrated approach to reverse logistics, incorporating technology, compliance management systems, and collaborative efforts across the supply chain. Additionally, staying abreast of technological innovations and evolving regulatory landscapes is essential for long-term success in managing reverse logistics in the industry.

Figure 6. Reverse Logistics Challenges

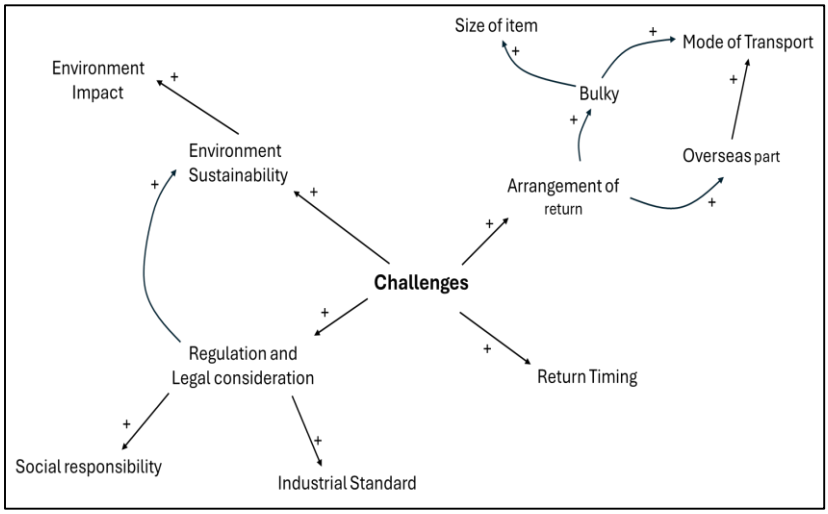

Figure 7. Causal loop reverse logistics challenges

Which area where major challenge take place for conducting reverse logistics?

From Panel 2 (CJ Logistics) the most delays parts during conducting the reverse logistics are when upon receiving returned products, thorough inspection and sorting are necessary, the sorting activity may take a long time to be done depends on the quantity and size. Some of the company they have their own procedure regarding return item to reduce of delays time waiting and confirming. This happens in industries with complex or regulated products that need to be taking of the quality strictly. For example, in the automobiles industries a car that have a major problem after sales need to recall back all the car based on lot date and to inspect one by one of the cars before returning the problem item. Delays may arise if the inspection process is time-consuming or if there is a backlog of returned items awaiting assessment. The physical movement of returned goods from customers to processing

centres or reverse logistics facilities can face delays due to transportation challenges. This may include issues such as scheduling, capacity constraints, or disruptions in the transportation network. Determining the appropriate disposition for returned items (such as refurbishment, recycling, or disposal) can be a complex decision.

In summary, delays in conducting reverse logistics can occur in various stages of the process, including processing, inspection, repair, recycling, repackaging, tracking, and warehouse management.

Table 6: Factors that Delay in Reverse Logistics Panels

No.	Delays	Panel 1	Panel 2	Panel 3	Panel 4	Panel 5
1.	Sorting time		✓			
2.	Inspection time		✓			
3.	Transportation challenges		✓			

In summary from Atlas Ti, the area in which reverse logistics takes the longest time to implement, such as documentation, packaging, and re-packaging. Panel 5 from Volvo mentioned that the cycle of inventory is the area that consumes the most time. Panel 1 from Petronas Lubricant added that abnormal returns, like calling back products that require special arrangements, can also take a long time. The group discussed the importance of complying with country requirements and the impact of branding on reverse logistics. They also mentioned examples of returning repair items and the need to communicate with customers about customs requirements. The session concluded with appreciation for the input from the experts.

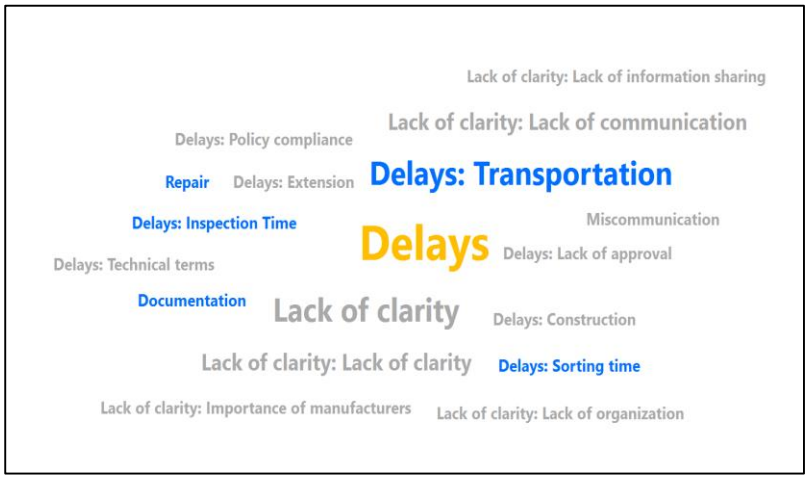

Figure 8. Factors of Delay in Reverse Logistics

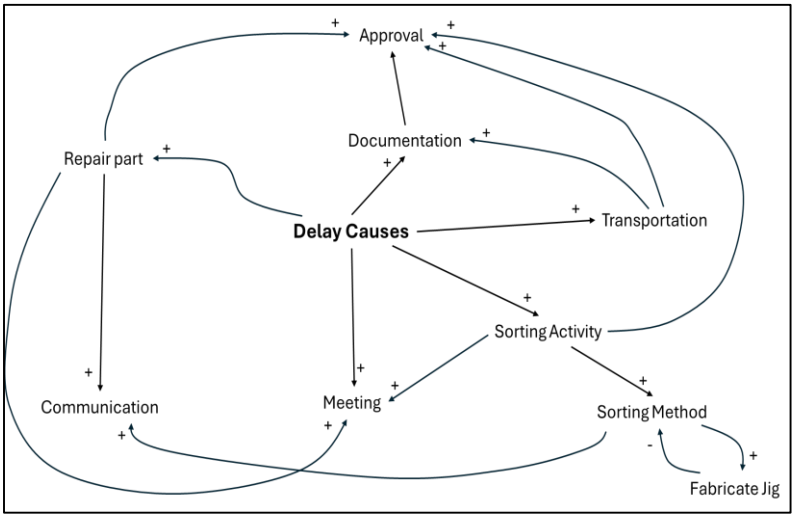

Figure 9. Causal Loop factors of delay in reverse logistics

CONCLUSION & RECOMMENDATION

Directive from the top management can be crucial factors in ensuring the value-added gain from the reverse logistics process in the automobile industry in Malaysia. The main factor identified is the delay in transportation and collection of the classified damaged or returned products due to non-priority of the reverse process. In this research, causal loop model developed from the feedback of practitioners and experts within the fields. As the approach relies upon expert opinions for developing contextual relation among identified variables, an expert's knowledge, his familiarity with industry and its operations may have affected the final results of the study. One of research implications of this study is that variables identified in this study are quite generic, and thus, with marginal adjustments, these can be used in the context of any other supply chain for increasing its productivity and performance.

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