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The Challenges for LSP to Support Robust and Sustainable Distribution System^{*}

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Abstract

Purpose: Increasingly limited environmental resources encourage all sectors to implement robust distribution systems, including Logistics Service Provider (LSP) as a company that manages customer logistics activities. However, efforts to achieve a robust distribution system have many challenges. To overcome these challenges, as a first step, LSP needs to classify and analyze the challenges faced and find solutions. Knowledge of the challenges in managing robust logistics is still not widely researched in developing countries. This paper explores existing research gaps in the region. **Research design, data and methodology:** The research enquiries used are a questionnaire and in-depth interviews. In the field study, surveys, observations, interviews related to robust logistics implementation in the LSP were carried out. **Results:** The results of the study show that although robust logistics is recognized as very important, understanding among LSPs is still very diverse. The main challenges found in this study come from the economic aspect and the internal conditions of the organization. **Conclusion:** LSP is advised to carry out internal strengthening of the company, especially for economic and organizational aspects therefore they can implement robust and sustainability practices more intensively. LSP needs to have good financial support in order to implement the aspects on an ongoing basis.

Keywords: Challenge, Distribution, Logistics, LSP, Supply Chain, System

JEL Classification Code: L52, L61, L87, L91, O14

1. Introduction

The pursuit of robust and sustainable business has permeated numerous industries, including the LSP business. Logistics, as one of the sector's most intense activities,

contributes significantly to the implementation of the idea of robustness and sustainability. The rapid growth of the economy on both the local and foreign markets has led to an expansion in logistical operations. The logistics business has become one of the pillars of economic growth and social wellbeing in a nation (Dai & Gao, 2016). On the one side,

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logistics industry activities contribute to economic growth, while on the other side, they also have significant environmental repercussions (Evangelista et al., 2017). Distribution and transportation activities that utilize nonrenewable natural resources are logistical operations that have a negative influence on the environment and society. These activities have negative effects on the health and safety of citizens, contribute to pollution, and create traffic congestion. The actions of the logistics business should not only be aimed toward achieving economic and social gains, but also toward reducing environmental problems. In order to attain robust and sustainable development objectives, it is necessary to address problems coming from the logistics business (Abbasi & Nilsson, 2016).

Presently, environmental sustainability is becoming an increasing concern for the global society (Gaziulusoy et al., 2013). This stipulation encourages the logistics sector to limit the environmental impact of its operations (Eltayeb et al., 2011). Logistics service providers (LSP) are encouraged to provide solutions to rising environmental issues in order to achieve more robust and sustainable logistics (Anttonen et al., 2013) in order to accomplish robust and sustainable development.

One of the elements that must be addressed by logistics companies is robust and sustainable development. As a participant in the logistics industry, LSP must ensure the future availability of natural resources. LSP can make a valuable contribution if it can make efficient use of resources to promote economic, ecological, and social elements of sustainability projects (Mehmann & Teuteberg, 2016).

LSP plays a crucial role in the creation of robust and sustainable logistics (Evangelista et al., 2017). LSP's contribution in the form of robust and sustainable logistics implementation assists partner companies in mitigating the negative impact of their logistics activities (Centobelli et al., 2017). LSP is predicated on efforts to reduce the negative impact of logistics activities (Govindan et al., 2021). To achieve this objective, LSP must comprehend the challenges associated with implementing robust and sustainable logistics and adopt logistics activities that incorporate sustainability considerations (Laguir et al., 2021).

Even though the role of LSP in creating robust and sustainable value in the supply chain is regarded as crucial, sustainability issues are rarely addressed in the research pertaining to this sector. Sustainability concerns in the logistics industry are the subject of only a few articles. New environmental issues only arise on a global scale in the logistics industry (Evangelista et al., 2017). There is a dearth of research in this field in developing nations such as Indonesia. Studies in developing nations on the perspective of sustainability in the LSP business sector can be compared to research in developed nations (Huemer, 2012).

When discussing supply chain systems from developed countries to developing countries or vice versa, all supply chain stakeholders must support the successful implementation of sustainability aspects. Consequently, this circumstance demonstrates the significance of investigating the topic of sustainability in LSPs in developing nations (Froio & Bezerra, 2021). On the basis of this research gap, this study was conducted in Indonesia, a developing nation, using LSP firms as research objects. This research aims to provide an overview of the obstacles LSP Indonesia faces in implementing sustainability aspects. The theoretical framework is the next section of this paper, followed by the research methodology. It is followed by a discussion of the results and a conclusion.

2. Literature Review

2.1. Robustness and Sustainability as a Business Goal of Industry

Robust and sustainable business is a business practice that aims to reduce the negative environmental, social, and economic impacts of business activities. In addition to utilizing resources efficiently and in an environmentally responsible manner, business processes must also consider social considerations. A robust and sustainable enterprise seeks to enhance the quality of human life and preserve resources. In a strategy for robust and sustainable development, environmental consciousness is crucial. This is achievable through corporate social responsibility. The use of renewable energy sources, the utilization of recycled materials, and the reduction of pollution are examples of sustainability-focused business practices. The issue of sustainability is currently of great importance to LSP; therefore, sustainability policies must be incorporated into LSP's vision.

Diverse perspectives on the implementation of sustainability features are held by LSP. Some view robust and sustainable business as an opportunity to reduce business expenses, while others regard it as a new source of expenditure. Some LSPs believe that adopting robust and sustainable components will result in increased firm competitiveness and economic benefits (Fürst & Oberhofer, 2012). Several further LSPs continue to ponder how to apply a sustainability strategy to lessen the negative impact of logistical activities. Business practitioners are continually debating the paradigm surrounding the benefits a robust and sustainable business may provide. Real efforts that LSP can make in adopting a sustainability plan require more in-depth research (Evangelista et al., 2017) so that logistics activities can contribute to the attainment of robust and sustainable development.

Robust and sustainable logistics development requires economic and social benefits, as well as the capacity to minimize environmental losses (Froio & Bezerra, 2021). A number of factors, including government policies, customer demands, and environmental concerns, necessitate that LSPs integrate a sustainability strategy into their supply chain. If LSP can use environmental concerns as one of the company's selling points, it will have more business opportunities than competitors. LSP must demonstrate a significant commitment to economic, environmental, and social sustainability. To achieve robust and sustainable development (Abbasi & Nilsson, 2016; Evangelista et al., 2017), i.e. development that aims to meet the needs of the current generation without jeopardizing the needs of future generations, LSPs must strive to create business activities that have a positive impact on the entire supply chain.

2.2. The Main Challenges to Implement Robust and Sustainable Distribution

In order to achieve robust and sustainable development, LSP must establish long-term, trustworthy relationships with all relevant business partners. If attained, this will enhance the quality of business processes for all stakeholders. Thus, LSP plays an important role in shaping the future. LSP contributes to ensuring the availability of current resources and bolstering long-term growth. Within this framework of thought, LSP must confront and overcome numerous challenges, including economic, ecological, social, legal, technological, management, and organizational issues (Mehmann & Teuteberg, 2016; Orji, 2019; Orji et al., 2019; Orji & Ojadi, 2023).

The economic challenge is whether adopting robust and sustainable practices can result in financial benefits for LSP (Eltayeb et al., 2011). This financial benefit may include cost reductions throughout the ordering of raw materials, production, and delivery processes. The difficulty for LSP is minimizing all costs. How, from a time perspective, can LSP assist with on-time delivery and lead time reduction? Delivery on time and a shorter lead time demonstrate LSP's skill in planning transportation and distribution processes. Regarding the quality of products received by customers, LSP's dependability in carrying out the delivery process is one of the determining factors. If the process of transporting and handling goods is carried out correctly, the quality of the goods received by the customer will be consistent with what the company promised. In the field of transportation and distribution, product quality is a formidable challenge. Another challenge is the development and design of future services; given the variety of services offered by comparable LSPs, LSPs must be creative in developing new services while maintaining a focus on sustainability (Govindan et al., 2013, 2021; Mehmman & Teuteberg, 2016).

During the process of integrating sustainability into the supply chain, ecological issues also arise. The ecological challenge consists of efforts to reduce pollution in the form of air emissions, liquid and solid waste, and dangerous substances. In order to extend the availability of natural resources such as energy and materials, their consumption must be properly managed. The design of the provided services must also consider aspects of sustainability, specifically how the provided services prioritize environmentally friendly aspects. LSP must implement an environmental management system in order to properly and systematically manage all environmental aspects. This system contributes to the process of controlling the implementation of the concept of sustainability. From the planning process to the evaluation and improvement processes, its implementation is meant to form a continuous improvement cycle for all elements (Govindan et al., 2013, 2021; Mehmman & Teuteberg, 2016).

Social challenges pertain to making all stakeholders aware of the process of adopting a robust and sustainable business model. These obstacles include good employment practices, such as adjusting working conditions to employees' needs and ensuring their occupational health and safety. Culture, social conditions, and the local economy all have an impact on the implementation of business sustainability. Additionally, an intensive level of communication is required to establish businesspeople's cooperation. These factors have a substantial effect on the successful implementation of sustainability in LSP (Ciliberti et al., 2011; Govindan et al., 2013, 2021; Mehmman & Teuteberg, 2016).

LSP efforts to achieve sustainability are also faced with challenges related to the legal dimension. Inadequate network security can impede the implementation of robust and sustainable logistics, both in terms of data security and security during the physical delivery process. One of the barriers to implementing a sustainability strategy is the lack of a legal shield that can be used to protect the achievement of sustainability objectives. Inadequate legal frameworks, particularly pertaining to data privacy and security concerns, pose a significant obstacle to the implementation of sustainability policies (Gupta & Barua, 2018; Orji, 2019; Polzin, 2017).

As long as such technology is available, LSPs can benefit from technology that promotes the adoption of robust and sustainable practices. Lack of technology integration can hinder the logistics industry's implementation of sustainability policies. Having access to a reliable database can also aid in the adoption of sustainability at LSP. The absence of a reliable database can be a significant barrier to achieving sustainability in this industry. Lack of global standards for data sharing protocols poses a significant threat to the logistics industry's

implementation of sustainability. Inadequate infrastructure facilities also threaten the success of sustainability implementation (Dekoninck et al., 2016; T. C. Kuo & Smith, 2018; Orji, 2019; Pacheco et al., 2018).

The availability of management support and dedication is one of the greatest challenges in this dimension. The sustainability adoption process will not be successful if management's support and commitment are inadequate. Additionally, a sufficient budget must be allocated for this program. The element of uncertainty supporting the attitudes, behavior, competence, knowledge, and expertise of employees is a further obstacle that arises when implementing business sustainability. Organizations' reluctance to implement sustainability strategies is due to a lack of understanding of the significant ramifications of sustainability practices (Gardas et al., 2019; Orji, 2019; Orji & Ojadi, 2023). Table 1 and 2 outlines a few of the challenges encountered during the implementation of robust and sustainable ideas.

3. Research Method

3.1. Research Design

The process carried out in this research begins with selecting objectives. After that, the process is followed by determining the research object, creating research instruments, data collection and analysis. This research focuses on LSP in East Java as a case study object with the consideration that East Java has a large number of LSP industries. East Java has several quite large ports and diverse industries. The next process is determining the selection criteria.

The identification of the research object begins by looking at the list of LSP industries in the East Java region. From the list of available LSP industries, companies with a reasonably complete database, including a website and contact number, are identified. Out of 291 companies, 108 companies have a reasonably complete database and can be contacted. The company was then contacted to inquire about its willingness to provide details about the logistics activities. Only 75 of the 108 companies responded and were willing to provide information regarding the priority challenge of robust and sustainable supply chain system.

After the process of identifying the challenges faced by LSPs in implementing robust and sustainable supply chains, the next step is to analyze further information about why each of these aspects is a challenge in implementation. For this reason, each LSP was asked for their willingness to participate in in-depth interviews. Of the 75 LSPs, only 20 LSPs said they were willing. The LSPs were contacted to inquire about their availability for the interview process.

Figure 1 show the response rate of respondent. They were requested to assess the difficulties in managing robust and sustainable supply chain. One informant was taken from each LSP. The selected informants from each LSP are at least a supply chain manager or a position responsible for managing sustainability aspects.

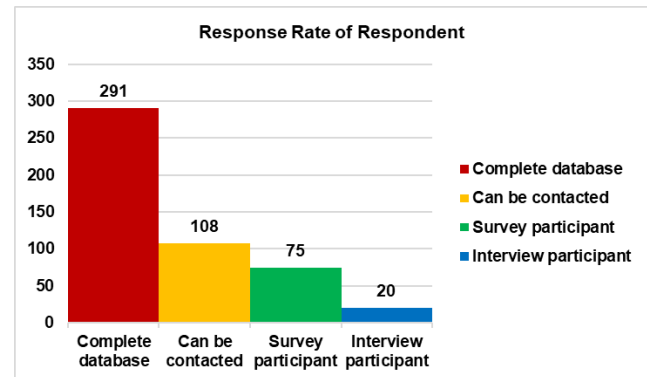


Figure 1: Response Rate of Respondent

3.2. Research Object

Informants from each LSP who were willing to be involved in the research process were asked to carry out an analysis comparing the level of importance of the challenges faced by LSP in implementing sustainability. A total of 20 LSPs also stated that they were willing to be involved in an in-depth interview which identified in more detail the challenges faced by LSP in implementing sustainability practices. The detailed criteria for the LSP involved are as follows, 1) LSP have been in operation for more than 10 years; 2) LSP provides various logistics services; 3) LSP understands current sustainability issues; 4) LSP is willing to be involved in the research. This criterion is determined as a process to achieve external validity.

3.3. Research Instrument

This study uses questionnaires and in-depth interviews as a mode of inquiry. The questions asked in the questionnaire for LSP include 1) key person data; 2) company profile; 3) efforts that have been made to achieve a sustainable company. The questions asked in the pairwise comparison assessments and in-depth interviews are the challenges faced in implementing sustainable practices.

A series of tests were carried out on the questionnaire and interview draft prior to use. The pilot project was carried out by involving academics and experts in the field of logistics prior to data collection. Several changes to the sentence structure in several questions were corrected according to input during the pilot project.

Table 1: Economic, Ecological and Social Challenges in Robust and Sustainable Distribution Implementation

Aspect	Challenges	References
Economic	<ul style="list-style-type: none"> Cost (Order, Production & Logistics) Time (Order, Process, Delivery) Quality Complex future services 	Sustainable distribution faces a multifaceted challenge involving the interplay of cost, time, quality, and the complexity of future services. Balancing cost-efficiency with environmental sustainability often demands investments in green technologies and infrastructure, which can increase upfront expenses but promise long-term savings and ecological benefits. Time constraints add pressure to optimize delivery speeds while minimizing carbon footprints, often requiring innovative logistics solutions and real-time data analytics. Ensuring high-quality service further complicates this balance, as maintaining product integrity and customer satisfaction necessitates meticulous planning and execution. Additionally, the evolving landscape of future services, with increasing consumer expectations for rapid, reliable, and eco-friendly deliveries, requires ongoing adaptation and innovation. This dynamic interplay creates a challenging yet essential framework for achieving sustainable distribution that aligns economic viability with environmental stewardship (Eltayeb et al., 2011; Govindan et al., 2013, 2021; Ho et al., 2010; Mehmman & Teuteberg, 2016).
Ecological	<ul style="list-style-type: none"> Complex environmental management system Complex resource management Pollution prevention Challenging eco design 	The concepts of a complex environmental management system (EMS), complex resource management system, pollution prevention, and eco-design play significant roles in achieving sustainable distribution. An EMS is a framework that helps an organization achieve its environmental goals through consistent review, evaluation, and improvement of its environmental performance. It typically includes policies, procedures, and practices that address how the organization manages its environmental impacts. A resource management system involves the planning, allocating, and managing of resources (such as raw materials, energy, and labor) in a way that maximizes efficiency and minimizes waste. Pollution prevention focuses on reducing or eliminating the production of pollutants at the source rather than managing them after they have been created. This can be achieved through changes in production processes, materials substitution, conservation techniques, and other strategies. Eco-design involves designing products with consideration for their environmental impacts throughout their life cycle, including raw material extraction, production, distribution, use, and disposal. When these systems and practices are integrated into a distribution strategy, they collectively contribute to a more sustainable distribution network (Bai & Sarkis, 2010; Eltayeb et al., 2011; Govindan et al., 2013, 2021; R. J. Kuo et al., 2010; Mehmman & Teuteberg, 2016; Nikolaou et al., 2013; Tseng & Chiu, 2013).
Social	<ul style="list-style-type: none"> Complex employment practices Logistics partners influence Stakeholder influence 	Sustainable and robust distribution faces significant challenges due to complex employment practices, logistics partners, and stakeholder influence. Complex employment practices, such as managing a diverse workforce and ensuring fair labor standards across different regions, can lead to operational disruptions if not handled properly. Logistics partners play a crucial role, and any inefficiencies or lack of reliability on their part can result in delivery delays, increased costs, and difficulties in meeting sustainability goals. Stakeholder influence, including demands from customers, investors, and regulatory bodies, adds another layer of complexity as companies must navigate varying expectations for transparency, accountability, and sustainable practices. Balancing these factors requires careful coordination, strong partnerships, and a commitment to continuous improvement to maintain an effective and sustainable distribution network (Aloise & Macke, 2017; Bai & Sarkis, 2010; Ciliberti et al., 2011; Govindan et al., 2013; Gupta & Barua, 2018; Luthra & Mangla, 2018; Mehmman & Teuteberg, 2016; Moktadir et al., 2018; Nikolaou et al., 2013; Orji, 2019; Polzin, 2017; Ravi, 2015; Wilts et al., 2013; Yenipazarli, 2017).

Table 2: Legal, Technological, Management and Organizational Challenges in Robust and Sustainable Distribution Implementation

Aspect	Challenges	References
Legal	<ul style="list-style-type: none"> Poor legal framework Complex legal issues Poor security network 	Sustainable and robust distribution is significantly challenged by poor legal frameworks, complex legal issues, and inadequate security networks. A poor legal framework can lead to inconsistent regulations and enforcement, creating uncertainty and operational inefficiencies for businesses trying to comply with varying standards across regions. A poor legal framework can hinder robust distribution by creating uncertainties and inconsistencies in regulatory compliance, leading to potential legal disputes and operational inefficiencies. This lack of clear, enforceable laws can also discourage investment and innovation, impacting the overall effectiveness and reliability of distribution systems. Complex legal issues, such as intellectual property rights, trade restrictions, and contract disputes, further complicate distribution processes, potentially causing delays and increased legal costs. Additionally, a poor security network heightens the risk of theft, fraud, and cyber-attacks, threatening the integrity and reliability of the supply chain. These challenges necessitate robust risk management strategies, enhanced legal compliance measures, and strengthened security protocols to ensure a resilient and sustainable distribution network (Aloise & Macke, 2017; Gupta & Barua, 2018; Luthra & Mangla, 2018; Moktadir et al., 2018; Orji, 2019; Polzin, 2017; Ravi, 2015; Wilts et al., 2013; Yenipazarli, 2017).

Aspect	Challenges	References
Technological	<ul style="list-style-type: none"> Poor technology infrastructure and facility Lack of technology integration Lack of robust database Lack data sharing protocols standard 	Sustainable and robust distribution is hindered by poor technology infrastructure and facilities, lack of technology integration, inadequate database systems, and absence of standardized data-sharing protocols. Poor technology infrastructure results in inefficiencies, such as slow communication, limited automation, and inadequate tracking capabilities, all of which impede the smooth operation of distribution networks. The lack of technology integration across various components of the supply chain prevents seamless information flow and coordination, leading to delays and errors. Additionally, the absence of robust databases and standardized data-sharing protocols makes it difficult to maintain accurate and up-to-date information, crucial for decision-making and forecasting. These challenges necessitate significant investments in technology, improved integration strategies, and the establishment of uniform data-sharing standards to enhance the efficiency, reliability, and sustainability of distribution systems (Dekoninck et al., 2016; Fernando & Wah, 2017; Ghaffar et al., 2018; T. C. Kuo & Smith, 2018; Orji, 2019; Pacheco et al., 2018; Triguero et al., 2013).
Management and Organizational	<ul style="list-style-type: none"> Low management support and commitment Low workforce support and commitment Low knowledge for implementation Poor funds support 	Sustainable and robust distribution is challenged by low management support and commitment, low workforce engagement, insufficient knowledge for implementation, and inadequate funding. Without strong management backing, initiatives to improve distribution processes often lack strategic direction and the necessary resources to succeed. Similarly, a disengaged workforce, lacking motivation and commitment, can result in lower productivity and resistance to change. Insufficient knowledge and expertise in implementing advanced distribution strategies further impede progress, as employees and managers may struggle to adopt new technologies or practices. Additionally, inadequate funding limits the ability to invest in essential infrastructure, technology, and training programs, which are critical for building an efficient and sustainable distribution network. Overcoming these challenges requires fostering a culture of commitment at all levels, enhancing training and development programs, and securing adequate financial support to drive continuous improvement (Gardas et al., 2019; Lee et al., 2012; Mahtani & Garg, 2018; Orji, 2019; Orji et al., 2019; Vieira de Souza et al., 2018; Vieira et al., 2016).

Changes to the wording of some of the questions were made to make it easier for respondents to understand. This process is carried out to ensure the validity of the construct.

3.4. In-depth Interview Process

At the time of the initial communication conveyed about the purpose of the interview and the description of the research in general. During this process, there were 20 LSPs who agreed to be interviewed. The interview lasted about 60 minutes. Before the interview process is carried out, information to be confirmed to the company is collected from various sources, such as the company's website.

In order for the interview process and its interpretation are effective and efficient, 3 documents were prepared, 1) protocol for the interview; 2) database for interviews; 3) report on the results of the interview. The protocol contains research objectives, company name, company address, and interview questions. The database contains data collection results such as documentation from the website and interview transcripts. The report contains all the results of interpretation and analysis of the interviews. This process is carried out in order to obtain internal validity.

After the interview was carried out, the transcript process was carried out. The transcript was then confirmed back to the key person at the company to make sure what was written was as intended by the respondent. After all was confirmed, an analysis of the results was carried out.

4. Results and Discussion

4.1. Challenges Faced by LSP in Implementing Robust and Sustainable Distribution

When LSP tries to implement sustainability practices, there are many challenges that must be resolved so that the implementation of sustainability can achieve the desired results. From the results of data processing using the Analytic Hierarchy Process obtained from 20 key persons from 20 LSPs, the order of challenges faced from the largest to the smallest is obtained as shown in table 3.

Table 3: The Sequence of Challenges in Implementing Robust and Sustainable Distribution

Priority	Aspect
1	Economic
2	Management and Organizational
3	Technological
4	Social
5	Ecological
6	Legal

4.1.1. Economic Challenge

The largest obstacle faced by LSPs in Indonesia is primarily economic in nature. Customers prioritize services that offer the lowest price, the quickest turnaround time, and high-quality service over the need for sustainability implementation. Customers are becoming less interested in ongoing programs. Customers are unconcerned with the

LSP's sustainability program because they recognize that logistics services must be rendered quickly and affordably. Uncertainty regarding the financial benefits of sustainability practices is one of the factors that discourages LSP from implementing these practices. This condition results in the prioritization of customer services provided by LSP. Amidst a high level of competition, LSP finds it difficult to strike a balance between efforts to minimize costs and time and efforts to implement sustainability practices. In order to overcome this challenge, the table 4 show initial solution.

Table 4: Initial Solution for Economic Challenge

Priority Economic Challenge	Initial Solution
Customer need for lowest price	Optimization among idealism of sustainability, service quality and cost
Customer need for lowest price quick response	
Customer need for lowest price high quality service	

4.1.2. Management and Organizational Challenge

The development of sustainable logistics services faces obstacles posed by management and organizations. This is the second difficulty encountered while implementing the sustainability program at LSP Indonesia. Given that the industries served by LSP are highly diverse and have distinct characteristics, LSP must be able to adapt its management and structure to meet the needs of its customers. Additionally, the logistics industry involves a large number of service providers. Working with multiple partners requires adaptable management and organization due to this condition. LSP believes that the current level of management commitment and support for sustainability programs tailored to the needs of customers and partners is insufficient. Currently, customers and partners require service and cooperation that is flexible. The workforce's lack of support for the sustainability program presents the following difficulty. The limited knowledge of employees regarding how to implement sustainability is one of the issues. LSP requires adequate organizational and management support to facilitate the adaptability of its services and partnerships. Due to the limited support available for the sustainability program, this program is unable to operate effectively. One of the most significant obstacles to achieving logistical sustainability is inadequate support from management and organizations. In order to overcome this challenge, the table 5 show initial solution.

Table 5: Initial Solution for Organizational Challenge

Priority Organizational Challenge	Initial Solution
Service flexibility	Adequate organizational and management support
Adaptability to partnership	

4.1.3. Technological Challenge

The next obstacle in implementing sustainability practices for LSPs in Indonesia is technological support. The implementation of sustainability requires technological infrastructure and facilities that are effective and efficient for the implementation of sustainability practices. For instance, when the integration of modes of transportation necessitates government support for the development of adequate infrastructure (Lam & Gu, 2016). Less-supportive infrastructure and technological facilities are the greatest obstacles that LSP Indonesia faces. Energy conservation is impeded by uncertainty regarding the availability of eco-friendly alternative energy sources. The next obstacle is the lack of technology integration used by logistics industry organizations, inadequate database availability, and the absence of global data sharing security standards. In order to overcome this challenge, the table 6 show initial solution.

Table 6: Initial Solution for Technological Challenge

Priority Technological Challenge	Initial Solution
Technological Infrastructure	Effective, efficient and integrated technology
Technological facilities	
Alternative energy source	
Availability of database	
Data sharing security	

4.1.4. Social Challenge

This difficulty relates to social factors that impact the sustainability of logistics. Complex labor practices pose the greatest obstacle in the social dimension for LSP in Indonesia. The complexity of communication and collaboration between LSPs and partners is the next obstacle. A lack of effective communication channels among logistics industry professionals can impede the achievement of sustainability objectives. The least difficult challenge in this dimension is the influence of stakeholders other than the involved partners. In order to overcome this challenge, the table 7 show initial solution.

4.1.5. Ecological Challenge

This difficulty arises from the ecological aspect of implementing sustainability practices. The complexity of managing the environmental management system poses the greatest challenge for LSPs in Indonesia. An environmental management system necessitates an effective planning and management procedure in order to support a sustainable program that is continuously enhanced. In addition to the environmental management system, the next obstacle is the company's resource management complexity. Implementing sustainability practices is often hampered by a lack of resources. All of these complexities complicate pollution prevention and the design of products and processes that

fully adhere to ecodesign principles. In order to overcome this challenge, the table 8 show initial solution.

Table 7: Initial Solution for Social Challenge

Priority Social Challenge	Initial Solution
Complex labor practices	Increased ability and intensity of communication among stakeholders
Complexity of communication among stakeholders	
Complexity of collaboration among stakeholders	
Lack of effective communication channel	
Interdependence among stakeholders	

Table 8: Initial Solution for Ecological Challenge

Priority Ecological Challenge	Initial Solution
Complexity of environmental management system	Sharing resources among partners
Complexity of resource management	
Implementation of eco-design principles	

4.1.6. Legal Challenge

The next obstacle faced by LSPs in Indonesia is legal in nature. LSP believes that there are currently no clear regulations regarding the implementation of sustainability in its business. Regulations regarding delivery time limits for heavy vehicles and policies on loading and unloading hours result in an imbalanced shipment flow. This condition requires the fleet to emit emissions despite the fact that it does not transport goods. LSP must adapt to existing regulations in order for its business operations to continue running smoothly and for it to implement the concept of sustainability. LSPs in Indonesia will not take the risk of investing too heavily in sustainability programs if there is no clear policy direction regarding regulations implementing sustainability. The availability of policies and government support for the implementation of sustainability in the form of legal umbrellas can encourage the intensity of implementing sustainability practices. The next difficulty posed by this dimension is the legal and security complexities of poorly protected distribution networks. In order to overcome this challenge, the table 9 show initial solution.

Table 9: Initial Solution for Legal Challenge

Priority Legal Challenge	Initial Solution
Unclear regulation for delivery time	The availability of policies and government support
Unclear regulation for loading and unloading hours	
Complexity of legal aspect for distribution networks	
Complexity of security aspect for distribution networks	

4.2. Research Implication and Future Research

The practical implication of the results of this research is that LSP needs to determine the priority scale of challenges that will be faced first by considering that the resources owned by the company are quite limited. The response given needs to consider the most powerful resources owned by the company. LSP should focus on the top ranking challenges and allocate sufficient resources to address those challenges for maximum sustainability results. LSP needs to ensure that the mechanisms used to achieve sustainability are implemented in a systematic, efficient and effective manner.

In general, the main challenges in implementing sustainability practices come more from the economic aspect and the internal conditions of the organization. For this reason, LSP needs to strengthen internally in the company first, especially those related to economic and organizational aspects to respond to market, customer and partner needs. The process of overcoming challenges needs to be carried out in a systematic and well-planned manner. LSP must have good financial support in order to implement sustainability aspects successfully and sustainably. This study provides an overview of the priority challenges that need to be faced by LSPs in Indonesia in implementing sustainability practices. For LSPs operating in Indonesia or planning to develop their business in Indonesia, they will get an overview of what needs to be prepared in the process of implementing sustainability practices.

The implication of this research is that sustainable logistics will not emerge without support from financial, market and collaborative relationships with other stakeholders in a supply chain. The sustainability strategies and challenges of one stakeholder influence and are influenced by other stakeholders. In order to overcome all identified challenges and obstacles, it requires the will and cooperation of all stakeholders involved. This study can be used for comparison with research in other areas regarding the challenges faced by LSPs in implementing sustainability. From the comparison of these studies it appears that there are slightly different variations in terms of the challenges faced by LSPs

As befits a research, this study has several limitations. Taking into account that this research is based on the results of the analytic hierarchy process assessment and interviews from only a few LSPs, the results may only represent certain LSP segments. Further research can be carried out using other research methodologies which will reveal more comprehensive and detailed results regarding some of the unanswered questions in sustainability discussions at LSP, for example by using a survey with a larger number of respondents and a dynamic system that can provide an overview of the system.

5. Conclusions

LSP can determine priority scales to respond to challenges in implementing sustainability practices. Priority challenges come from economic and management aspects. To respond to these challenges, LSP can increase organizational and management support and financial readiness to improve the implementation of sustainability practices amidst conditions of price competition pressures and uncertain economic conditions. The role of the government is also highly expected in the form of regulatory clarity and incentive support so that it can raise customer awareness and LSP to collaborate in realizing sustainability practice implementation.

Overall, the results of this study indicate that there are slightly different variations in the challenges faced by LSPs in Indonesia compared to previous studies in other countries. The output of this research provides an overview for LSP to determine the next steps in implementing sustainability practices in logistics companies, especially in Indonesia. Sustainable logistics requires support from financial, market and collaborative relationships with other stakeholders in a supply chain including customer companies.

References

- Abbasi, M., & Nilsson, F. (2016). Developing environmentally sustainable logistics. Exploring themes and challenges from a logistics service providers' perspective. *Transportation Research Part D: Transport and Environment*, 46, 273–283. <https://doi.org/10.1016/j.trd.2016.04.004>
- Aloise, P. G., & Macke, J. (2017). Eco-innovations in developing countries: The case of Manaus Free Trade Zone (Brazil). In *Journal of Cleaner Production* (Vol. 168, pp. 30–38). Elsevier Ltd. <https://doi.org/10.1016/j.jclepro.2017.08.212>
- Anttonen, M., Halme, M., Houtbeckers, E., & Nurkka, J. (2013). The other side of sustainable innovation: Is there a demand for innovative services? *Journal of Cleaner Production*, 45, 89–103. <https://doi.org/10.1016/j.jclepro.2011.12.019>
- Bai, C., & Sarkis, J. (2010). Integrating sustainability into supplier selection with grey system and rough set methodologies. *International Journal of Production Economics*, 124(1), 252–264. <https://doi.org/10.1016/j.ijpe.2009.11.023>
- Centobelli, P., Cerchione, R., & Esposito, E. (2017). Environmental sustainability in the service industry of transportation review and research directions. *Transportation Research Part D*, 53, 454–470.
- Ciliberti, F., De Haan, J., De Groot, G., & Pontrandolfo, P. (2011). CSR codes and the principal-agent problem in supply chains: Four case studies. *Journal of Cleaner Production*, 19(8), 885–894. <https://doi.org/10.1016/j.jclepro.2010.09.005>
- Dai, Y., & Gao, H. O. (2016). Energy consumption in China's logistics industry: A decomposition analysis using the LMDI approach. *Transportation Research Part D: Transport and Environment*, 46, 69–80. <https://doi.org/10.1016/j.trd.2016.03.003>
- Dekoninck, E. A., Domingo, L., O'Hare, J. A., Pigosso, D. C. A., Reyes, T., & Troussier, N. (2016). Defining the challenges for ecodesign implementation in companies: Development and consolidation of a framework. *Journal of Cleaner Production*, 135, 410–425. <https://doi.org/10.1016/j.jclepro.2016.06.045>
- Eltayeb, T. K., Zailani, S., & Ramayah, T. (2011). Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resources, Conservation and Recycling*, 55(5), 495–506. <https://doi.org/10.1016/j.resconrec.2010.09.003>
- Evangelista, P., Colicchia, C., & Creazza, A. (2017). Is environmental sustainability a strategic priority for logistics service providers? *Journal of Environmental Management*, 198, 353–362. <https://doi.org/10.1016/j.jenvman.2017.04.096>
- Fernando, Y., & Wah, W. X. (2017). The impact of eco-innovation drivers on environmental performance: Empirical results from the green technology sector in Malaysia. *Sustainable Production and Consumption*, 12, 27–43. <https://doi.org/10.1016/j.spc.2017.05.002>
- Froio, P. J., & Bezerra, B. S. (2021). Environmental sustainability initiatives adopted by logistics service providers in a developing country – an overview in the Brazilian context. *Journal of Cleaner Production*, 304. <https://doi.org/10.1016/j.jclepro.2021.126989>
- Fürst, E., & Oberhofer, P. (2012). Greening road freight transport: Evidence from an empirical project in Austria. *Journal of Cleaner Production*, 33, 67–73. <https://doi.org/10.1016/j.jclepro.2012.05.027>
- Gardas, B. B., Raut, R. D., Cheikhrouhou, N., & Narkhede, B. E. (2019). A hybrid decision support system for analyzing challenges of the agricultural supply chain. *Sustainable Production and Consumption*, 18, 19–32. <https://doi.org/10.1016/j.spc.2018.11.007>
- Gaziulusoy, A. I., Boyle, C., & McDowall, R. (2013). System innovation for sustainability: A systemic double-flow scenario method for companies. *Journal of Cleaner Production*, 45, 104–116. <https://doi.org/10.1016/j.jclepro.2012.05.013>
- Ghaffar, S. H., Corker, J., & Fan, M. (2018). Additive manufacturing technology and its implementation in construction as an eco-innovative solution. In *Automation in Construction* (Vol. 93, pp. 1–11). Elsevier B.V. <https://doi.org/10.1016/j.autcon.2018.05.005>
- Govindan, K., Khodaverdi, R., & Jafarian, A. (2013). A fuzzy multi criteria approach for measuring sustainability performance of a supplier based on triple bottom line approach. *Journal of Cleaner Production*, 47, 345–354. <https://doi.org/10.1016/j.jclepro.2012.04.014>
- Govindan, K., Kilic, M., Uyar, A., & Karaman, A. S. (2021). Drivers and value-relevance of CSR performance in the logistics sector: A cross-country firm-level investigation. *International Journal of Production Economics*, 231. <https://doi.org/10.1016/j.ijpe.2020.107835>
- Gupta, H., & Barua, M. K. (2018). A framework to overcome barriers to green innovation in SMEs using BWM and Fuzzy TOPSIS. *Science of the Total Environment*, 633, 122–139. <https://doi.org/10.1016/j.scitotenv.2018.03.173>
- Ho, W., Xu, X., & Dey, P. K. (2010). Multi-criteria decision making approaches for supplier evaluation and selection: A literature

- review. *European Journal of Operational Research*, 202(1), 16–24. <https://doi.org/10.1016/j.ejor.2009.05.009>
- Huemer, L. (2012). Unchained from the chain: Supply management from a logistics service provider perspective. *Journal of Business Research*, 65(2), 258–264. <https://doi.org/10.1016/j.jbusres.2011.05.028>
- Kuo, R. J., Wang, Y. C., & Tien, F. C. (2010). Integration of artificial neural network and MADA methods for green supplier selection. *Journal of Cleaner Production*, 18(12), 1161–1170. <https://doi.org/10.1016/j.jclepro.2010.03.020>
- Kuo, T. C., & Smith, S. (2018). A systematic review of technologies involving eco-innovation for enterprises moving towards sustainability. *Journal of Cleaner Production*, 192, 207–220. <https://doi.org/10.1016/j.jclepro.2018.04.212>
- Laguir, I., Stekelorum, R., & El baz, J. (2021). Proactive environmental strategy and performances of third party logistics providers (TPLs): Investigating the role of eco-control systems. *International Journal of Production Economics*, 240. <https://doi.org/10.1016/j.ijpe.2021.108249>
- Lee, P. T. W., Lin, C. W., & Shin, S. H. (2012). A comparative study on financial positions of shipping companies in Taiwan and Korea using entropy and grey relation analysis. *Expert Systems with Applications*, 39(5), 5649–5657. <https://doi.org/10.1016/j.eswa.2011.11.052>
- Luthra, S., & Mangla, S. K. (2018). Evaluating challenges to Industry 4.0 initiatives for supply chain sustainability in emerging economies. *Process Safety and Environmental Protection*, 117, 168–179. <https://doi.org/10.1016/j.psep.2018.04.018>
- Mahtani, U. S., & Garg, C. P. (2018). An analysis of key factors of financial distress in airline companies in India using fuzzy AHP framework. *Transportation Research Part A: Policy and Practice*, 117, 87–102. <https://doi.org/10.1016/j.tra.2018.08.016>
- Mehmann, J., & Teuteberg, F. (2016). The fourth-party logistics service provider approach to support sustainable development goals in transportation - A case study of the German agricultural bulk logistics sector. *Journal of Cleaner Production*, 126, 382–393. <https://doi.org/10.1016/j.jclepro.2016.03.095>
- Moktadir, M. A., Rahman, T., Rahman, M. H., Ali, S. M., & Paul, S. K. (2018). Drivers to sustainable manufacturing practices and circular economy: A perspective of leather industries in Bangladesh. *Journal of Cleaner Production*, 174, 1366–1380. <https://doi.org/10.1016/j.jclepro.2017.11.063>
- Nikolaou, I. E., Evangelinos, K. I., & Allan, S. (2013). A reverse logistics social responsibility evaluation framework based on the triple bottom line approach. *Journal of Cleaner Production*, 56, 173–184. <https://doi.org/10.1016/j.jclepro.2011.12.009>
- Orji, I. J. (2019). Examining barriers to organizational change for sustainability and drivers of sustainable performance in the metal manufacturing industry. *Resources, Conservation and Recycling*, 140, 102–114. <https://doi.org/10.1016/j.resconrec.2018.08.005>
- Orji, I. J., Kusi-Sarpong, S., Gupta, H., & Okwu, M. (2019). Evaluating challenges to implementing eco-innovation for freight logistics sustainability in Nigeria. *Transportation Research Part A: Policy and Practice*, 129, 288–305. <https://doi.org/10.1016/j.tra.2019.09.001>
- Orji, I. J., & Ojadi, F. (2023). Assessing the effect of supply chain collaboration on the critical barriers to additive manufacturing implementation in supply chains. *Journal of Engineering and Technology Management - JET-M*, 68. <https://doi.org/10.1016/j.jengtecman.2023.101749>
- Pacheco, D. A. de J., Caten, C. S. ten, Jung, C. F., Navas, H. V. G., & Cruz-Machado, V. A. (2018). Eco-innovation determinants in manufacturing SMEs from emerging markets: Systematic literature review and challenges. *Journal of Engineering and Technology Management - JET-M*, 48, 44–63. <https://doi.org/10.1016/j.jengtecman.2018.04.002>
- Polzin, F. (2017). Mobilizing private finance for low-carbon innovation – A systematic review of barriers and solutions. In *Renewable and Sustainable Energy Reviews* (Vol. 77, pp. 525–535). Elsevier Ltd. <https://doi.org/10.1016/j.rser.2017.04.007>
- Ravi, V. (2015). Analysis of interactions among barriers of eco-efficiency in electronics packaging industry. *Journal of Cleaner Production*, 101, 16–25. <https://doi.org/10.1016/j.jclepro.2015.04.002>
- Triguero, A., Moreno-Mondéjar, L., & Davia, M. A. (2013). Drivers of different types of eco-innovation in European SMEs. *Ecological Economics*, 92, 25–33. <https://doi.org/10.1016/j.ecolecon.2013.04.009>
- Tseng, M. L., & Chiu, A. S. F. (2013). Evaluating firm's green supply chain management in linguistic preferences. *Journal of Cleaner Production*, 40, 22–31. <https://doi.org/10.1016/j.jclepro.2010.08.007>
- Vieira de Souza, W. J., Scur, G., & Hilsdorf, W. de C. (2018). Eco-innovation practices in the brazilian ceramic tile industry: The case of the Santa Gertrudes and Criciúma clusters. *Journal of Cleaner Production*, 199, 1007–1019. <https://doi.org/10.1016/j.jclepro.2018.06.098>
- Vieira, J. G. V., Mendes, J. V., & Suyama, S. S. (2016). Shippers and freight operators perceptions of sustainable initiatives. *Evaluation and Program Planning*, 54, 173–181. <https://doi.org/10.1016/j.evalprogplan.2015.07.011>
- Wilts, H., Dehoust, G., Jepsen, D., & Knappe, F. (2013). Eco-innovations for waste prevention - Best practices, drivers and barriers. *Science of the Total Environment*, 461–462, 823–829. <https://doi.org/10.1016/j.scitotenv.2013.05.096>
- Yenipazarli, A. (2017). To collaborate or not to collaborate: Prompting upstream eco-efficient innovation in a supply chain. *European Journal of Operational Research*, 260(2), 571–587. <https://doi.org/10.1016/j.ejor.2016.12.035>