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Implementation of Milk Run Theory for Enhanced Logistics Efficiency: A Case Study in the Plastic Packaging Manufacturing

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ABSTRACT

This research investigates the impact of implementing the Milk Run method in the plastics industry supply chain, focusing on PT RPI. By reducing the distance by 48 km per day, equivalent to 1,200 km in one month of deliveries, the results are significant in terms of logistics efficiency, cost savings, and reduced carbon emissions. Logistics are improved with more connected travel patterns, allowing trucks to combine pickups or deliveries from multiple sources in a single trip. Distance reduction strengthens transportation cost efficiency by reducing fuel consumption and vehicle maintenance costs. Assuming a fuel consumption rate of 7 km per liter and carbon emissions of 2.68 kg CO2 per liter, a distance reduction of 1,200 km results in a substantial reduction in carbon emissions. This study provides a foundation for future research, including route and scheduling optimization, in-depth environmental impact analysis, and application of the Milk Run to other industries. The results provide a complete picture of the effectiveness of the Milk Run in the context of the plastics industry, highlighting operational excellence, economic impact and the company's commitment to sustainability.
Keywords: Milk Run, Logistics Efficiency, Cost Savings, Distance Reduction

Introduction

The rapid growth of the plastics industry over the past few decades has created new challenges in supply chain management and increased the need for sustainable practices. Despite efforts to improve logistics efficiency and reduce environmental impact, there is still a void in research focusing on the application of specific strategies such as Milk Run in the context of the plastics industry.

The plastics industry, as an integral part of various economic sectors, plays an important role in providing everyday consumer products. However, the rapid growth in this industry also poses challenges in supply chain management, including efficient logistics management and significant environmental impacts. In this context, the Milk Run concept, which combines the collection or delivery of goods from multiple sources in a single trip, is emerging as a potential approach to improve logistics efficiency and reduce carbon footprint.

Milk run in logistics refers to a delivery or collection system designed to cover multiple sources or destinations in one efficient trip. The term "milk run" comes from the practice of rural milk delivery, where milk trucks would collect milk from multiple farmers in a single trip. In the context of logistics, the milk run approach is used to optimize the use of transportation time and resources.

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For example, within an enterprise, delivery trucks can be designed to pick up goods from multiple suppliers at once before delivering them to the production facility. This helps reduce transportation costs and improve logistics efficiency by minimizing unnecessary trips. Implementing the milk run concept helps create a more efficient supply chain that is responsive to production needs, while reducing lead times and transportation costs associated with uncoordinated deliveries.

This research makes a novel contribution by looking specifically at the implementation of Milk Run in the plastics industry supply chain. Its focus on aspects of sustainability, logistics efficiency and innovation in supply chain management practices makes a significant contribution to the existing literature. The research also seeks to provide practical guidance for plastics companies in improving operational performance.

While much research has been conducted in the domain of supply chain management and sustainability, there is still a void in the understanding of the application of Milk Run in the context of the plastics industry. This research attempts to fill this gap by providing in-depth insights into how Milk Run can be applied to improve logistics efficiency and sustainability in the plastics supply chain.

Despite the rapid growth of the plastics industry, challenges remain in optimizing supply chain management and addressing environmental sustainability concerns. There is a significant gap in the research landscape regarding the specific application of Milk Run strategies in the plastics manufacturing sector. The need for a comprehensive investigation into the efficiency improvements and sustainability impacts of implementing Milk Run in the plastics supply chain is clear. This study aims to address this gap by exploring how the implementation of Milk Run practices can improve logistics efficiency and contribute to sustainable practices in the plastics industry.

Method

In revealing the impact of implementing Milk Run in the plastics industry supply chain, this research chose a case study approach to provide a more in-depth picture. The sample was carefully selected to include plastic manufacturing companies of various sizes and management practices to ensure the representativeness of the research results. The data collection process involved direct observation of shipping and collection activities, in-depth interviews with relevant parties, and analysis of internal company documents related to Milk Run practices and supply chain management.

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The qualitative data collected from various sources was then thematically analyzed to identify patterns, trends and key findings around the implementation of Milk Run. To ensure the accuracy of the findings, data triangulation was conducted by comparing results from multiple sources. In addition, the sustainability aspects of Milk Run implementation were assessed using a framework that encompassed environmental, social and economic impacts, providing a thorough understanding of the practice's contribution to sustainability.

The importance of ethical aspects in this study was also emphasized, with the research being conducted in compliance with applicable research ethics principles, including data protection and participant consent. By combining all these elements, the research is expected to provide a holistic insight into the effects of Milk Run in the plastics industry, providing a foundation for companies to optimize logistics efficiency and support more sustainable supply chain practices.

Result & Discussion

The impact of implementing the Milk Run method in the plastics industry supply chain is discussed, with a focus on logistics efficiency, cost savings, and carbon footprint reduction. Improved efficiency in the delivery and collection process has a positive impact not only in terms of reduced operational costs, but also in contributing to more sustainable supply chain practices.
Currently, in the prevailing delivery scenario, the truck travels from the factory to customer 1 to make a delivery of goods, and after completing the delivery, the truck returns empty to the factory. This process is repeated for the next customer, where the truck departs from the factory, delivers goods to customer 2, and returns empty to the factory. This pattern goes on sequentially for each customer in a cycle that can be considered sub-optimal in terms of logistics efficiency and resource utilization.

Under current conditions, the map of truck trips from the factory to the customer forms a linearly organized pattern. So if viewed in a map it would be as follows:

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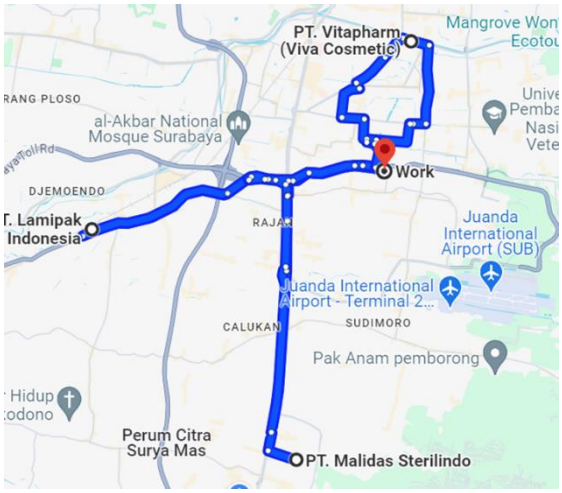

Figure 1: trips from the factory to the customer forms a linearly organized pattern.

The current pattern if made into a table to show the number of trips taken is as follows :

Route	Trip	Customer Location	Distance (km)
Customer 1	PT RPI- SIER	Mejoyo - Surabaya	25
Customer 2	PT RPI- SIER	Buduran - Sidoarjo	40
Customer 3	PT RPI- SIER	Taman - Sidoarjo	32
Total distance (Km)			97

Table 1 Distance delivery to customer

In the simulation results using the current delivery system to three customers, the total distance traveled was 97 km per day. The current delivery scenario shows that trucks travel from the factory to each customer separately, returning empty after each delivery. This pattern creates a series of fragmented trips and ultimately leads to a significant total distance. This analysis provides a concrete picture of the effects of the current delivery system on logistics efficiency and resource utilization.

In an effort to improve efficiency and optimize truck usage, a change in delivery strategy can be proposed. One approach that can be applied is the Milk Run method, where trucks can be organized to collect or deliver goods to multiple customers in a single trip. Thus, the truck does not need to return empty after each delivery to an individual customer, but rather can combine multiple points in a single route. This can not only reduce the number of empty trips, but also improve overall logistics efficiency. With this approach, each truck trip becomes more optimized, providing benefits both in terms of cost savings and reduced environmental impact.

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With the implementation of the Milk Run pattern, truck trips from PT RPI to three customers are planned more efficiently. The truck will start its journey from the factory, deliver goods to customer 1, then continue the journey to customer 2 to make a delivery of goods, and so on to customer 3. Only after completing the series of visits to all customers, the truck will return to PT RPI. This travel pattern creates a more connected and efficient route, minimizing the number of empty trips and optimizing truck usage. With the Milk Run approach, it is expected that the total distance traveled can be significantly reduced, bringing cost-saving benefits and better logistics efficiency.

PT RPI's factory as the center point, and the connecting lines formed illustrate the route connected from the factory to customer 1, customer 2, and customer 3. If seen in the map will be drawn as follows:

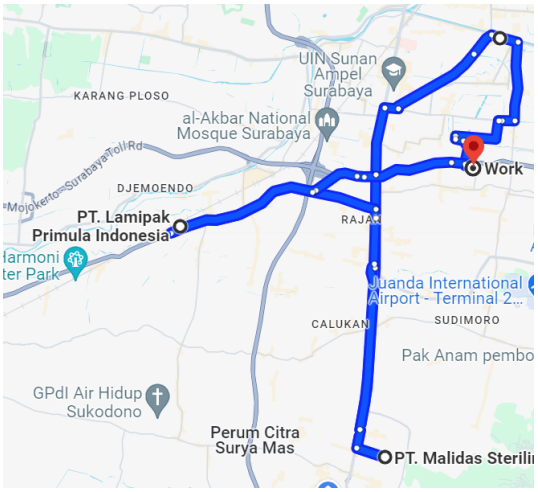

Figure 2: Connecting line from factory to customer

This efficient and connected travel pattern stretches between factory and customer locations, creating an optimal route to minimize travel distances and improve overall logistics efficiency. This can be seen in the following table:

Route	Trip	Customer Location	Distance use new method (km)
Customer 1	PT RPI- SIER	Mejoyo - Surabaya	7
Customer 2	Mejoyo - Surabaya	Buduran - Sidoarjo	14
Customer 3	Buduran - Sidoarjo	Taman - Sidoarjo	13
End	Taman - Sidoarjo	PT RPI- SIER	15

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Total distance traveled (Km)	49

Table 2 Distance delivery to customer using new method

The implementation of the Milk Run method in the plastics industry's supply chain brought about revolutionary changes, especially in terms of logistics efficiency, cost savings, and ongoing efforts to reduce the carbon footprint. The reduction in distance of 48 km per day is staggering, and when applied to deliveries that occur on an average of 25 days a month, the total distance reduced reaches a staggering 1,200 km. The tremendous improvement in logistics efficiency comes as delivery trucks are now able to combine picking up or delivering goods from multiple sources or destinations in a single trip.

On a practical level, this results in the reduction of unnecessary trips and reduced waiting times that may occur in conventional delivery systems. A more connected and integrated logistics network emerges as a result, creating the opportunity to optimize every truck visit. A further impact is seen in transportation cost savings, where more efficient travel reduces fuel consumption, vehicle maintenance costs, and other associated costs.

To provide a concrete illustration, we can calculate the carbon reduction resulting from this 1,200 km distance reduction. If we assume a truck fuel consumption rate of about 7 km per liter and a carbon emission rate of about 2.68 kg CO2 per liter of diesel fuel, we can estimate the carbon reduction by multiplying the fuel volume saved by the carbon emission rate per liter.

Thus, the implementation of Milk Run not only opens the door to remarkable operational efficiency, but also creates a positive impact on the sustainability and economic balance of the company. In addition, the reduction in distance also leads to a reduction in carbon emissions generated by the transportation fleet. By optimizing travel routes, fuel usage can be minimized, reducing the company's carbon footprint and supporting efforts to achieve environmental sustainability goals. This is in line with consumer demands and regulations that increasingly emphasize the need for environmentally friendly business practices. The results of this analysis show that the implementation of the Milk Run method not only brings operational cost savings, but also makes a real contribution to efforts to reduce environmental impacts through reduced carbon emissions. This is a positive step towards more sustainable and economically efficient supply chain practices.

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Conclusion

In the conclusion of this study, it can be explained that the implementation of the Milk Run method in the supply chain of the plastics industry, specifically at PT RPI, resulted in a significant positive impact. The reduction of distance by 48 km per day, which is equivalent to 1,200 km in an average shipping month, brings profound changes in logistics efficiency, cost savings, and the company's efforts in reducing its carbon footprint.

First of all, the implementation of Milk Run improves logistics efficiency by establishing a more connected and integrated travel pattern. Delivery trucks are now able to combine the pick-up or delivery of goods from multiple customers in a single trip, optimizing the use of time and resources. This reduces unnecessary travel and waiting time, creating a more efficient supply chain system that is responsive to customer needs. Furthermore, this reduction in distance has a positive impact on transportation cost savings. More efficient travel reduces fuel consumption, vehicle maintenance, and other associated costs. As such, companies experience significant economic benefits, improving profitability and competitiveness in an increasingly tight market.

Moreover, the environmental aspect is no less important. By minimizing empty-load travel, this distance reduction directly contributes to the reduction of carbon emissions. Assuming a carbon emission rate of approximately 2.68 kg CO2 per liter of diesel fuel, a distance reduction of 1,200 km results in a substantial reduction in carbon emissions. Overall, the implementation of the Milk Run method at PT RPI proved to be a smart and sustainable move. It not only forms the foundation for more efficient and cost-effective operations, but also conveys the company's commitment to environmentally-friendly business practices. Through this research, we can conclude that Milk Run is not just a logistics strategy, but also an investment in a smart future, combining efficiency, economy and sustainability in one step forward.

Based on the results of this study, several potential avenues for future research can be explored to deepen the understanding and drive innovation in plastics industry supply chain management using the Milk Run method:

1. Route and Scheduling Optimization: Further research could focus on developing algorithms or mathematical models for route optimization and scheduling in the context of Milk Run. This approach can help improve logistics efficiency and provide more optimized results in time and resource management.
2. Deeper Environmental Impact Analysis: An in-depth study of the environmental impact of implementing a Milk Run could be valuable research. This includes product lifecycle

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analysis, a thorough carbon footprint assessment, and exploration of additional strategies to improve operational sustainability.

3. Comparative Study with Other Logistics Methods: A comparative study between the Milk Run method and other logistics methods can provide richer insights into the advantages and disadvantages of each approach. This can help companies to choose the strategy that best suits their needs and operational characteristics.
4. Application to Other Industries: Further research could test the applicability of the Milk Run concept to other industries beyond the plastics industry.
5. Social and Economic Impact Analysis: Studies on how the implementation of Milk Run may affect social and economic aspects, including its impact on employment, economic distribution at the local level, and other social benefits.

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