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Designing A Reverse Logistics Monitoring System for Logistics Products at PT XYZ

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Abstract.
The process of product returns from suppliers is very urgent to reduce large company losses due to products returned from suppliers experiencing many problems. Therefore, this study aims to measure the supply chain performance in each backflow supply chain of telecommunication industry products in Indonesia. Analysis was conducted using the SCOR model and determination of value weighting using AHP. The results of the analysis with 10 indicators for the delivery and return process show that the total value of PT. XYZ's company performance is still far from the target. This indicator must be corrected because there is a need for an increase in company performance, namely the Delivery and Return indicators, one of which occurs in returns when the driver brings damaged goods taken from the supplier and repackages, or commonly called repackaging, the damaged product in the PT. XYZ warehouse. There is a shortage[A1] [A2] or lagging of some of these products. The results of the analysis also show that PT. XYZ has the lowest performance value on both criteria, namely delivery and return, where each of these values can be categorized as "poor" or can also be called bad. With this finding, what must be done to improve performance is the addition of Quality Control management so that the product you want to return or return for the repair process can be managed such that there is no shortage of product returns, does not take a long time, and does not cost much more money during the delivery process.

Keywords: distribution, KPI, quality control, supply chain management, reverse logistics

INTRODUCTION

Efforts to implement Standard Operating Procedures (SOPs) cannot be separated from various problems, such as known incidents of SOP services that result in disruptions in the delivery process (Kato et al., 2022; Mills et al., 2020; Tambunan Rudi, 2013; Tuck et al., 2009; Winata, 2016). Therefore, a management unit is needed, commonly known as Quality Control. In this time of competition in the supply chain sector, focus on innovation and creativity is essential. Reverse logistics is one of the problems that often arise in the supply chain, where reverse logistics has the ability to reduce costs and provide efficiency in expenses or costs. In general, currently there are still many studies that only discuss the forward logistics flow, namely the management carried out by the company in the supply chain from the supplier to the end consumer. Every company has a goal of improving its ability to compete globally (Boakai & Samanlioglu, 2023; Jovčić & Průša, 2021; Raut et al., 2018; Samanlioglu & Boakai, 2021).

Many do not understand that the reverse logistics model can be a solution in the development of supply chain networks, innovation, and cost efficiency, as part of the performance and value of the logistics chain. In other words, marketing activities include a very wide scope of activities that start from determining consumer needs and end with consumer satisfaction (Arianto & Octavia, 2021; Fernando & Aksari, 2017; Sutrsino et al., 2018; Tjia et al., 2018; Yulliyanie & Evyanto, 2022). At this time, many companies and researchers prioritize the topic of reverse logistics, where this topic should be a new breakthrough in the world of delivery or services. This makes it a consideration that reverse logistics deserves special attention in terms of manpower due to the lack of standardization and management that should be focused on innovative ways to handle returns. Quality at the time of delivery should be the main priority, and it is important[A1] [A2] for companies to do this so that the products sent are in accordance with the standards that have been set and carried out in the company and standards that have been set by local and international bodies that manage standardization. To measure supply chain management, the right approach is needed to provide good results and provide recommendations for improving company performance that has not been achieved (Alfian et al., 2023; Derlini & Nanda Nafrizal, 2019; Hastuti et al., 2020; Wigati et al., 2017; Wulandari et al., 2021).

Previous studies on supply chain management and logistics have tended to emphasize forward logistics, focusing on the movement of goods from suppliers to end consumers, while often neglecting the strategic importance of reverse logistics. Zareinejad & Javanmard (2013) demonstrated that efficient supply chain management is essential for companies seeking to enhance competitiveness globally, but their discussion primarily centered on forward logistics flows, leaving limited exploration of reverse logistics. Similarly, Ibrahim (2014) highlighted that reverse logistics has the potential to become a breakthrough in delivery services, particularly in addressing returns and quality issues, yet his study lacked a structured framework to standardize operations and link reverse logistics with broader supply chain performance.

The objective is to analyze reverse logistics as a critical component of supply chain management, while the benefit of this research lies in providing actionable recommendations for companies to develop standardized, innovative, and sustainable logistics practices that align with both local and international standards.

MATERIALS AND METHODS

This research applies a mixed methods approach as suggested by Creswell (2014), combining both qualitative and quantitative techniques to obtain a more comprehensive understanding of the research problem. The object of the study focuses on the management of goods delivery within the supply chain. The research population is heterogeneous, as it involves human subjects, specifically four operational staff members, who also serve as the study sample. The study uses the Supply Chain Operations Reference (SCOR) Model as the main analytical framework, covering Level 1, Level 2, and Level 3 mapping.

Pemetaan **Level 1** In this SCOR Level 1 Model, it displays the SCOR alphabet with the beginning of the letter "P" which explains the *Plan* process, then there is the letter "S" for the *Source* process, then the letter "M" for *Make*, then there is the letter "D" which explains the *Deliver* process, and there are the letters "R" and "E" where the letter "R" is *Return* and "E" explains *Enable*.

Pemetaan **Level 2** In this stage, it is called the configuration stage, where the main processes at this level are: ***Make-to-Stock*** **vs.** ***Make-to-Order*** **vs.** ***Engineer-to-Order*** to run the *Source*, *Make*, and *Deliver* processes. ***Defective product*** **vs.** ***MRO*** **vs.** ***Excess product*** for the *Return* process. The *Plan* is divided into 5 processes, namely: P1 – Supply chain plan, P2 – Purchase plan, P3 – Production plan, P4 – Distribution plan, and P5 – Return plan.

Pemetaan **Level 3** Then in this Level 3 mapping, the focus is on detailed activities. Stages that are carried out in a certain order in planning supply chain activities include holding raw materials for a product, making products, sending products and services, and carrying out product *Return* processes for damaged goods.

Data collection was carried out through observation, interviews, and documentation, while data analysis applied the SCOR framework to assess the efficiency and effectiveness of delivery and return processes. This systematic approach ensures that the findings provide accurate insights into weaknesses and opportunities for improving supply chain performance.

RESULTS AND DISCUSSION

Damaged *Goods* Return Process

The process of shipping goods has 3 processes in general, starting from *picking* goods to reaching customers. Here is the process with an average of 3 trips per week. *The Lead Time* requested from *suppliers* with the Greater Jakarta area is 1 day, if the returned goods are problematic / lost, they must return, *the Lead Time* needed is 2 (two) days.

The reason for returning goods is usually because the product from telecommunications has been damaged by the customer, and will be repaired by a *refurbished warehouse*, where the company PT. XYZ is a transportation vendor for the delivery of telecommunication products in Indonesia.

The following is the process of sending telecommunication product returns in an outline:

Administration: In this process, *the supplier* sends a letter of departure / *delivery order* for picking up goods at the warehouse.

Operational: In this process, the operational admin gives the *driver* an order with a pre-received road letter, and *the driver* will search for available trucks.

Delivery: In this process after *the driver* receives the road letter, *the driver* will go to the supplier center to pick up the damaged goods and will be sent to the *refurbish warehouse*/ repair warehouse.

Collection: In this process, after the damaged goods have been repaired by *the refurbished warehouse*, a new road letter will usually be sent for the collection of the goods to be returned to the *supplier*.

Damaged *Goods* Return Process

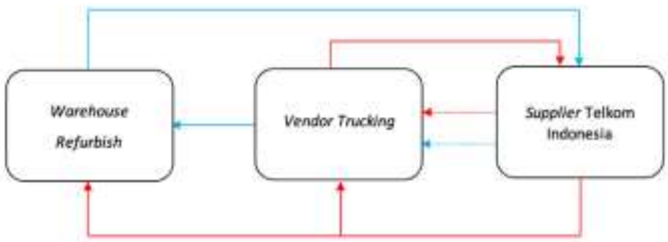
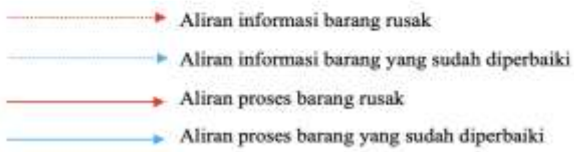


Figure 1. Supply Chain Process Flow of a Company

Information:



Determination of Performance Factors

At this stage in the process of shipping companies for the implementation of a continuous supply chain, the determination of performance factors must be carried out in accordance with the company's interests and based on the company's needs.

Table 1. Determination of Performance Factors

Previous Research	Plan	Source	Make	Deliver	Return	Enable	Characteristics
Paduloh et al., (2020)	-	-	-	Reliability, Responsiveness, Flexibility	Reliability, Responsiveness, Asset	-	Manufacturing Company
Agus Purnomo, (2015)	Reliability, Responsiveness	Reliability, Responsiveness, Flexibility	Reliability, Flexibility	Reliability, Responsiveness	Reliability, Responsiveness	-	Manufacturing Company

Previous Research	Plan	Source	Make	Deliver	Return	Enable	Characteristics
Jejen Zaenal Mutaqin & Sutandi, (2021)	Reliability	Reliability, Responsiveness, Flexibility	Reliability, Responsiveness, Flexibility	Reliability, Responsiveness	Reliability, Responsiveness	Reliability	Manufacturing Company
David Try Liputra et al., (2018)	Reliability, Responsiveness, Agility, Cost, Assets	Reliability, Responsiveness, Agility, Cost	Reliability, Agility, Cost	Reliability	Reliability, Responsiveness	-	Manufacturing Company
This Research	-	-	-	Reliability, Responsiveness	Reliability, Responsiveness	-	Distribution Company

Actual Performance Appraisal

The designed KPIs include the measurement of the company's performance of the entire Delivery process. KPI assessment is a KPI formula that is in accordance with the purpose or type of KPI.

Table 2 KPI Performance Indicators

No	KPI Number	KPI	Information	KPI Formula	KPI Type
1	D1.1	Perfect Order Fulfillment	Number of products/goods successfully delivered according to customer demand	(Number of Repaired Products Delivered / Total Delivery Requests) × 100	Bigger is better
2	D1.2	Order Accuracy	Accuracy of goods delivered to customers	(Number of Orders Fulfilled Accurately / Total Orders Fulfilled) × 100	Bigger is better
3	D2.1	% Utility of Truckload	Number of products that can be carried relative to vehicle capacity	(Number of Products Loaded / Vehicle Capacity) × 100	Bigger is better
4	D2.2	Delivery Cycle Time	Total delivery time of repaired products	Time of Delivery Process (Hours)	Smaller is better
5	D2.3	Total Delivery Cycle Time	Total completion time of repaired products from order until delivery to supplier	Total Delivery Time of Repaired Products (Hours)	Smaller is better
6	R1.1	Perfect Order Fulfillment	Number of returned products successfully delivered against consumer requests	(Number of Returned Products Delivered / Total Delivery Requests) × 100	Bigger is better
7	R1.2	Order Accuracy	Accuracy of returned goods delivered to customers	(Number of Return Orders Fulfilled Accurately / Total Orders Fulfilled) × 100	Bigger is better
8	R2.1	% Utility of Truckload Return	Ratio of returned goods collection compared to maximum collection capacity	(Number of Products Collected / Maximum Collection Capacity) × 100	Bigger is better
9	R2.2	Delivery Return Cycle Time	Total delivery time of returned products	Time of Return Delivery Process (Hours)	Smaller is better
10	R2.3	Total Return Cycle Time	Total completion time of returned products from order until arrival at refurbishing warehouse	Total Return Completion Time (Hours)	Smaller is better

Determination of Weights With AHP

AHP Skeleton Tree

In the model below, it can be seen that there are several levels/rows that form a hierarchy. The top level is to determine the performance of the company.

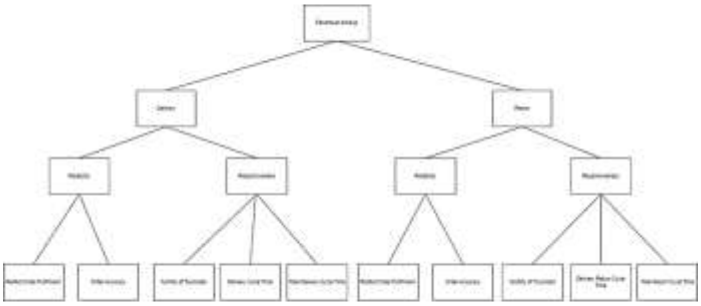


Figure 2. AHP Skeleton Tree

KPI Value Calculation Process

The KPI calculation process is determined to measure how much a company has achieved in implementing a sustainable delivery process. Identification of sustainable KPIs is carried out using supply chain operations references (SCORs) based on defined sustainability objectives. (Table 3).

Tabel 1. KPI Results

No	KPI	KPI Result
1	Perfect order fulfillment Delivery	100.00%
2	Order accuracy Delivery	81.01%
3	% Utility of truckload Delivery	11.18%
4	Delivery Cycle Time	2.31
5	Total Delivery Cycle Time	3.93
6	Perfect order fulfillment Return	99.49%
7	Order accuracy Return	81.08%
8	% Utility of truckload Return	11.09%
9	Deliver return cycle time	2.17
10	Total Return cycle time	4.05

Normalization Process of Snorm de boer

After calculating the KPIs above, the data is normalized with the *snorm de boer* model. At this stage, it is done to standardize the scale on each measure of each actual performance value, because each performance indicator has a different size scale.

Table 4. Description automatically generated2 Normalizes Data with *Snorm de boer*

No	KPI	Average	Normalized Data (*Snorm de Boer*)
1	Perfect order fulfillment Delivery	100.00	100.00
2	Order accuracy Delivery	81.01	72.13
3	% Utility of truckload Delivery	11.18	73.55
4	Delivery Cycle Time	2.31	50.97
5	Total Delivery Cycle Time	3.93	84.20
6	Perfect order fulfillment Return	99.49	87.13
7	Order accuracy Return	81.08	67.55
8	% Utility of truckload Return	11.09	73.13
9	Deliver return cycle time	2.17	53.15
10	Total Return cycle time	4.05	50.91

Determining Supply Chain Performance

Determining the performance of the Supply Chain is by multiplying all scores that have received results, with the weight of each criterion. (Table 5, Table 6, Table 7 and Table 8).

Table 3. Calculation of Deliver-Reliability Performance Value

No	Metrics	Score	Weight	Score × Weight
1	Perfect order fulfillment Delivery	100.00	16.34%	16.34
2	Order accuracy Delivery	72.13	13.35%	9.63
Total				**25.97**

Table 4. Calculation of Deliver-Responsiveness Performance Value

No	Metrics	Score	Weight	Score × Weight
1	% Utility of truckload Delivery	73.55	15.15%	11.14
2	Delivery Cycle Time	50.97	5.55%	2.83
3	Total Delivery Cycle Time	84.20	8.99%	7.57
Total				**21.54**

Table 5. Calculation of Return-Reliability Performance Value

No	Metrics	Score	Weight	Score × Weight
1	Perfect order fulfillment Return	87.13	11.48%	10.03
2	Order accuracy Return	67.55	8.83%	5.96
Total				**15.97**

Table 6. Calculation of Return-Responsiveness Performance Value

No	Metrics	Score	Weight	Score × Weight
1	Utility of truckload Return	73.03	6.97%	5.09
2	Return Cycle Time	53.15	5.49%	2.92
3	Total Return Cycle Time	50.91	7.85%	3.99
Total				**12.00**

In determining supply chain performance, the value obtained from the normalization of SCOR data using the Snorm de Boer model is multiplied by the weight of the results of the questionnaire addressed by 4 supervisors at PT. XYZ. This weight is obtained from the web-based AHP calculator for the calculation of AHP. The sum result of multiplying by weight is the result of the Company's total Supply Chain Performance.

It can be seen that the result of the Delivery-Reliability performance value is 25.97 which is the lowest weight in the Order accuracy Delivery criterion with a weight of 13.35%. Then the performance value in Deliver¬-Responsiveness is 21.54 which, with the lowest value is found in the Delivery Cycle Time criterion with a weight of 5.55%. Furthermore, the performance value in Return-Reliability is 15.97 which is the lowest weight in the Order Accuracy Return criterion with a weight of 8.83%. And finally, there is a performance value in Return Responsiveness of 12,005 which is the lowest weight in the Return Cycle Time criterion with a weight of 5.49%, from the result of all these weights are the weights that have the lowest level of each criterion obtained.

CONCLUSIONS

The findings reveal that supply chain performance in both delivery and return processes is categorized as "poor," with the Delivery Cycle Time KPI scoring the lowest at 50.97 (weight 5.55%) and the Total Return Cycle Time KPI scoring 50.91 (weight 5.49%). Delivery performance values reached only 25.97 in Delivery-Reliability and 21.54 in Delivery-Responsiveness, while return performance values were 15.97 in Return-Reliability and 12.05 in Return-Responsiveness. These results indicate weaknesses in employee skills, inadequate company oversight during delivery, and insufficient supervision and quality control. To address these issues, companies should strengthen Quality Control management, implement continuous employee training to enhance skills, and adopt stricter monitoring systems to ensure efficiency in delivery and return cycles. Additionally, investing in digital tracking technologies and setting standardized SOPs can help minimize errors, reduce cycle times, and improve overall supply chain responsiveness, thereby ensuring customer satisfaction and operational efficiency.

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