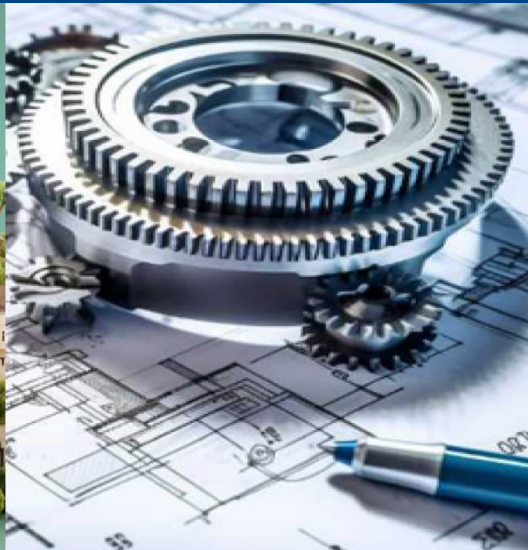
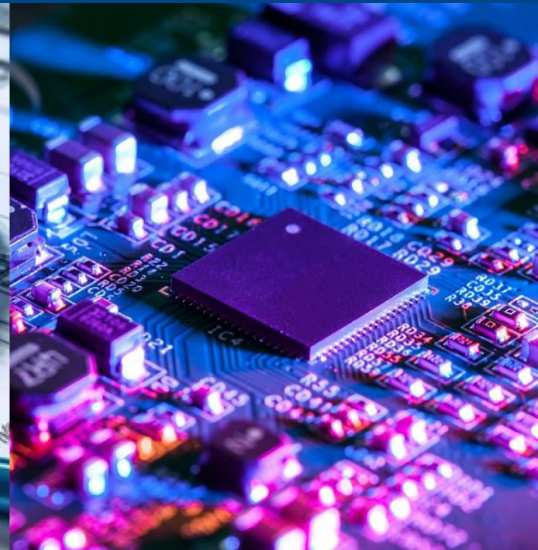
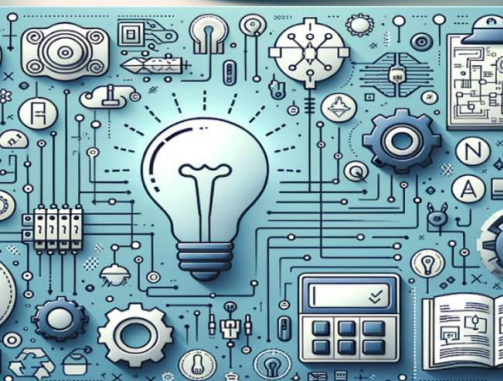




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Role of Reverse Logistics Practices on Customer Loyalty for Dairy Supply Chain

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ABSTRACT: The dairy industry is characterised by highly perishable products, frequent purchasing and the need to manage damaged, expired and returned products. Reverse logistics is therefore important not only for product recovery, waste management and supply-chain efficiency, but also for the customer experience when a product-related problem occurs. This study examines the customer-facing role of reverse logistics in the dairy supply chain, focusing on Product Recovery, Return Services/Service Speed and Convenience in Reverse Logistics and their influence on Customer Satisfaction. A quantitative research approach was adopted using a structured questionnaire and five-point Likert scale. Data were collected from 108 dairy consumers through convenience sampling and analysed using descriptive statistics, correlation analysis and multiple regression. The final regression results show that Return Services/Service Speed has a significant positive influence on Customer Satisfaction (coefficient = 0.348, $p = 0.001$), while Convenience also has a significant positive influence (coefficient = 0.268, $p = 0.007$). Product Recovery has a positive but statistically insignificant independent influence (coefficient = 0.013, $p = 0.877$). The overall model explains 34.1% of the variation in Customer Satisfaction ($R^2 = 0.341$). The findings indicate that timely return handling and convenient reverse-logistics procedures are particularly important for improving the customer experience in the dairy sector. Customer loyalty is considered as the broader long-term outcome in the research context, while the present empirical analysis focuses primarily on customer satisfaction.

KEYWORDS: Reverse logistics, dairy supply chain, product recovery, return services, service speed, convenience, customer satisfaction, customer loyalty.

I. INTRODUCTION

Reverse logistics concerns the movement of products, materials and information back through the supply chain for activities such as recovery, reuse, recycling, replacement or appropriate disposal. Unlike the forward flow of goods from suppliers to customers, reverse flows arise from damaged or defective products, expiry, incorrect supply, complaints, packaging recovery and other post-sale requirements. The literature has established reverse logistics as an important supply-chain activity linked with operational efficiency, resource recovery, sustainability and closed-loop supply chains.

The relevance of reverse logistics is particularly strong in the dairy industry. Products such as milk, curd, yoghurt and paneer are perishable and sensitive to time, storage and handling conditions. Dairy firms may therefore need to manage damaged or leaking packages, expired products, rejected deliveries, freshness-related complaints and packaging that requires recovery or appropriate disposal. A reverse-logistics process in this setting is consequently not limited to physically taking a product back; it also involves deciding how the product or packaging is handled and how the customer's problem is resolved.

From the customer's perspective, the reverse-logistics experience can become part of the overall service experience. When a customer receives a damaged product or faces a quality issue, the speed of response, ease of reporting the problem, communication and convenience of the return or replacement process can influence the customer's evaluation of the company. Research in e-commerce and other consumer sectors has associated reverse-logistics service quality, responsiveness, information sharing and convenience with customer satisfaction and repurchase-related outcomes.

However, the literature reviewed in the dissertation shows that dairy reverse-logistics research has often concentrated on sustainability, waste reduction, resource recovery, circular economy and closed-loop supply-chain design. Customer-oriented outcomes have received comparatively less attention. This creates a sector-specific research opportunity because



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findings from durable consumer products or e-commerce cannot automatically be transferred to dairy, where perishability and frequent purchasing make speed and ease of resolution particularly relevant.

The present study therefore examines three customer-facing reverse-logistics practices—Product Recovery, Return Services/Service Speed and Convenience—and their influence on Customer Satisfaction. The study also places customer loyalty in the broader research context because repeated satisfactory service-recovery experiences may contribute to continued purchasing and stronger customer relationships. Nevertheless, the empirical dependent variable tested in this study is Customer Satisfaction.

The paper is organised as follows. The next section reviews the relevant literature and identifies the research gap. The methodology section describes the research design, sample, questionnaire and analytical approach. The results section presents the regression findings and their interpretation, followed by the conclusion, implications and limitations.

II. RELATED WORK

Reverse logistics research has developed from a primarily operational concern into a broader field covering economic, environmental and customer-related outcomes. Agrawal, Singh and Murtaza highlight the breadth of reverse-logistics research, while Govindan and Bouzon identify multiple drivers and barriers that affect reverse-logistics implementation. Govindan and Soleimani and Guide and Van Wassenhove further connect reverse logistics with closed-loop supply-chain thinking and the recovery of value from products and materials.

The sustainability and circular-economy perspective is also important. Geissdoerfer et al. and Kirchherr, Reike and Hekkert discuss circularity, resource use and the movement towards systems that retain value and reduce waste. Dairy-focused studies in the dissertation similarly emphasise sustainable supply-chain management, closed-loop design, resilience and resource efficiency. These studies establish why reverse logistics is strategically relevant in dairy supply chains.

A second research stream focuses on the customer-facing side of reverse logistics. Hsiao links reverse-logistics service quality with customer satisfaction, while Waqas et al. examine the relationship between reverse-logistics service quality, customer satisfaction and repurchase intention. Dabeas et al. identify dimensions such as responsiveness, reliability and information sharing as important elements of reverse-logistics service quality. More recent studies cited in the dissertation also indicate that customer satisfaction and trust can form part of the relationship between logistics service quality and repurchase intentions.

Customer loyalty is relevant because satisfaction and service experience can affect longer-term customer relationships. Oliver provides a foundational perspective on consumer loyalty, while Rather and Hollebeek emphasise the importance of service experience and engagement in customer relationships. In reverse logistics, an effective recovery process may therefore have significance beyond the immediate return transaction.

Despite these developments, the dissertation identifies a gap between two streams of research. Dairy reverse-logistics studies commonly focus on sustainability, waste and operational efficiency, whereas customer-oriented reverse-logistics studies are concentrated more heavily in e-commerce, fashion and other consumer sectors. The present study addresses this gap by examining Product Recovery, Return Services/Service Speed and Convenience from the customer's perspective within the dairy sector.

III. METHODOLOGY

A quantitative research design was used to examine the influence of selected reverse-logistics practices on Customer Satisfaction. The study adopted a structured questionnaire and collected responses from dairy consumers. The questionnaire used a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree. The questions covered respondent information, Product Recovery, Return Services, Convenience in Reverse Logistics and Customer Satisfaction.



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Particular	Study detail
Research approach	Quantitative
Data collection	Structured questionnaire survey
Valid responses	108
Sampling technique	Convenience sampling
Target respondents	Dairy consumers with relevant product/return experience
Scale	Five-point Likert scale
Independent variables	Product Recovery; Return Services/Service Speed; Convenience
Dependent variable	Customer Satisfaction
Analysis	Descriptive statistics, correlation and multiple regression

The study used Product Recovery to represent the handling and recovery of returned, damaged, expired or otherwise unsuitable dairy products and associated materials. Return Services/Service Speed represented the efficiency and responsiveness of the return process, including complaint handling, collection and replacement. Convenience represented the ease and accessibility of the reverse process from the customer's point of view.

The hypotheses were tested using regression analysis at a significance threshold of $p < 0.05$: H1: Product Recovery has a significant positive influence on Customer Satisfaction; H2: Return Services have a significant positive influence on Customer Satisfaction; and H3: Convenience in Reverse Logistics has a significant positive influence on Customer Satisfaction.

The collected responses were organised and analysed using Microsoft Excel. Descriptive statistics were used to understand the general response pattern, correlation analysis was used to examine the direction and strength of relationships, and multiple regression was used to assess the independent influence of the three reverse-logistics practices on Customer Satisfaction.

IV. RESULTS AND DISCUSSION

The final analysis indicates that the selected reverse-logistics practices provide meaningful explanatory value for Customer Satisfaction. The overall multiple regression model produced an R^2 of 0.341, indicating that Product Recovery, Return Services/Service Speed and Convenience collectively explain 34.1% of the variation in Customer Satisfaction. The remaining variation may be associated with other factors not included in the model.

Variable	Coefficient	p-value	Interpretation
Product Recovery	0.013	0.877	Positive but not statistically significant
Return Services / Service Speed	0.348	0.001	Positive and statistically significant
Convenience	0.268	0.007	Positive and statistically significant
Overall model	$R^2 = 0.341$	—	Explains 34.1% of Customer Satisfaction

TABLE 2. FINAL REGRESSION RESULTS REPORTED IN THE DISSERTATION

Product Recovery recorded a coefficient of 0.013 with a p-value of 0.877. Although the direction of the coefficient was positive, the p-value was well above 0.05. Therefore, H1 was not supported. This result does not mean that product recovery is unimportant to the dairy supply chain. Rather, within the sample and regression model, Product Recovery did not demonstrate a statistically significant independent influence on Customer Satisfaction. Product recovery can still remain operationally and environmentally important through appropriate handling of damaged, expired and rejected products.

Return Services/Service Speed had a coefficient of 0.348 and a p-value of 0.001. The positive coefficient and p-value below 0.05 indicate a statistically significant positive influence on Customer Satisfaction, supporting H2. This is consistent with the customer-facing nature of service speed. When a customer encounters a dairy-product problem, prompt acknowledgement, collection, return processing and replacement can reduce additional inconvenience. The finding therefore suggests that timely resolution should be a priority in dairy reverse-logistics systems.



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Convenience recorded a coefficient of 0.268 and a p-value of 0.007. The relationship is positive and statistically significant, supporting H3. Customers may evaluate not only the final resolution but also the effort required to obtain that resolution. Simple complaint channels, clear instructions, convenient collection or return arrangements and fewer unnecessary steps can make the reverse process easier and may improve the overall customer experience.

Taken together, the results show that customer-facing dimensions of reverse logistics are important to satisfaction in the dairy context. Return Services/Service Speed had the strongest coefficient among the three predictors in the final regression, followed by Convenience. The results support the study's central argument that reverse logistics should be considered not only as a product-recovery or waste management activity, but also as part of the service experience.

V. IMPLICATIONS

The findings provide a practical indication for dairy companies. First, organisations can focus on reducing the time required to acknowledge complaints, arrange collection and provide replacements or other resolutions. Second, return procedures can be simplified so that customers do not face additional difficulty after experiencing a product problem. Third, communication and accessibility can be improved through clear complaint channels and straightforward instructions. Product recovery should continue to be managed appropriately even though it was not a significant independent predictor of satisfaction, because it remains relevant to waste reduction, resource recovery and responsible supply-chain management.

From an academic perspective, the study adds a dairy-specific customer perspective to a literature stream that has frequently examined reverse logistics through operational, environmental or e-commerce contexts. It also provides a basis for future research that directly tests whether Customer Satisfaction mediates the relationship between reverse logistics practices and Customer Loyalty.

VI. CONCLUSION

This study examined the role of reverse logistics practices in the dairy supply chain, with particular attention to Product Recovery, Return Services/Service Speed and Convenience and their influence on Customer Satisfaction. Based on 108 valid questionnaire responses, the final regression model explained 34.1% of the variation in Customer Satisfaction.

The results showed that Return Services/Service Speed and Convenience have statistically significant positive influences on Customer Satisfaction, while Product Recovery did not show a statistically significant independent influence. Accordingly, H2 and H3 were supported and H1 was not supported. The strongest predictor in the final model was Return Services/Service Speed, followed by Convenience.

The study concludes that an effective dairy reverse-logistics system should address both operational requirements and the customer experience. Timely service and convenient procedures can reduce the additional inconvenience associated with product problems and contribute to higher satisfaction. Customer loyalty remains an important broader outcome because repeated positive service experiences may support continued purchasing; however, loyalty was not directly tested in the present regression model.

VII. LIMITATIONS AND FUTURE WORK

The study has several limitations. Convenience sampling and a sample of 108 respondents may limit the representativeness and generalisability of the findings. The cross-sectional design captures customer perceptions at one point in time, while the use of self-reported responses may differ from actual operational performance. The model also includes a limited set of variables and focuses on the customer perspective rather than the internal operational challenges faced by dairy companies.

Future research can use larger and probability-based samples, include additional factors such as product quality, price, delivery, communication, trust and complaint handling, and compare different dairy companies. Future studies can also directly measure Customer Loyalty and repeat purchase behaviour and test whether Customer Satisfaction mediates the



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relationship between reverse logistics practices and Customer Loyalty. Qualitative interviews or focus groups could provide deeper insight into customer experiences.

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