Assessing the Impact of Reverse Logistics Service Quality on Customer Satisfaction: A Servqual-Based Analysis

Mohamad Afiff Johar[1], Atikah Saadah Selamat[2], Mehran Doulatabadi[3], Nor Azah Abdul Aziz[4*]

[1,2,3,4]Fakulti Pengurusan Teknologi dan Teknousahawanan, Universiti Teknikal Malaysia Melaka

***Corresponding Author**

DOI: https://dx.doi.org/10.47772/IJRISS.2025.92800016

Received: 08 November 2025; Accepted: 14 November 2025; Published: 18 December 2025

ABSTRACT

Reverse logistics has become a critical component of modern supply chains due to increasing activities of logistics locally and globally. Hence, frequency of product returns also increase because of various reasons, including damaged or defective items, items not meeting expectations (wrong size, color, or fit), incorrect items being sent, misleading advertisements, buyer's remorse, or difficulty using the product defects. Due to these, customers expect for efficient service recovery. This study investigates the factors that influence customer satisfaction in returning defective products. Using survey-based quantitative analysis, this research examines the roles of quality of replacement product, timeline of refunds, customer service quality, clarity of return policy, and demonstration of understanding as independent variables and customer satisfaction in returning defective products as dependent variable. By applying SERVQUAL model as underpinning theory, this study found that all the hypotheses are supported except for the timeline of refunds. The findings provide theoretical contributions in growing body of literature on reverse logistics and customer satisfaction by providing empirical evidence on the factors influencing customer satisfaction in the context of returning defective products. For practical contributions, companies may enhance their return processes and improve customer loyalty.

Keywords: Reverse Logistics; Determinants of Customer Satisfaction; SERVQUAL Model

INTRODUCTION

Reverse logistics, especially in managing the return of defective products, has become a vital component of customer service and operational effectiveness. As e-commerce expands and customer expectations rise, businesses face pressure to optimize return procedures for smooth experiences. The rapidly expanding e-commerce sector and heightened rivalry among retailers have profoundly altered consumer expectations and habits, especially in relation to returns of products (Smith, 2020). Customers in today's market anticipate a simple return process, particularly when they are faced with the disappointment of getting defective products. Reverse logistics, which handles the return of items from customers to the source for a variety of uses such recycling, disposal, or repair, has become more significant as a result of this change in expectations (Johnson, 2019). Although reverse logistics is essential for addressing customer concerns, there is a significant research gap about the customer's experience and the difficulties involved in returning defective products through these channels (Robinson, 2017). The whole return trip, from making the request to getting the final answer, is included in reverse logistics. It is essential to comprehend the customer's experience throughout this procedure for several of reasons. Firstly, customer satisfaction and loyalty may be greatly increased by having a simple and effective return policy for defective products. Consumer satisfaction with the entire shopping experience and repeat business are positively correlated with a prompt and simple resolution of their issue (Garcia, 2019). Secondly, manufacturers and merchants may get useful information from research on consumer experiences with returning defective products. Reverse logistics operations may be improved by firms by identifying unique difficulties that consumers confront throughout the return process (Lee, 2020). This may result in customer-focused and more effective procedures. Last but not least, efficient reverse logistics can guarantee the correct recycling or disposal of defective products, helping to minimize waste and the environmental impact of modern society (Clark, 2022).

Research explicitly looking at customer satisfaction and the difficulties involved in returning defective products through these channels is still lacking, although the fact that reverse logistics are essential in handling product returns. Previous research recognises the significance of reverse logistics in resolving customer issues; yet, there is a deficiency of information about the intricacies involved in returning defective products (Smith, 2020). According to Brown (2021) firms find it challenging to manage customer complaints and improve their reverse logistics strategies if they lack a comprehensive comprehension of the aspects that influence customer experience and the challenges consumers face throughout the return process. The difficulties and consumer experience associated with returning damaged items via reverse logistics hence make empirical study imperative. Hence, the purpose of this research is to close this knowledge gap by examining the difficulties and customer experiences associated with using reverse logistics to return defective products. The study hopes to clarify the particular difficulties faced in the return procedure by focusing on the particular context of defective products, which will eventually lead to better customer service strategies. Hence, the Research Objectives are:

1. To examine the determinants of customer satisfaction for reverse logistics.
2. To analyse the relationship between the determinants and the customer satisfaction for reverse logistics.
3. To investigate the most significant determinant of customer satisfaction for reverse logistics.

This research focuses on understanding customer experience within reverse logistics, specifically for returning defective products in Melaka, Malaysia. We exclude broader aspects like product sorting and disposal. Our investigation centres on key areas influencing customer satisfaction: ease of initiating returns, speed and convenience of return shipping options, clarity of the return policy regarding defective items, processing speed for returned products, and the quality of customer service interactions throughout the return journey. By identifying these factors' impact on customer satisfaction, the study aims to help businesses in Melaka, Malaysia refine their reverse logistics strategies and ultimately enhance customer experience when returning defective products.

LITERATURE

Supply Chain Management (SCM)

It is the process of managing and overseeing the whole manufacturing flow of products and services. From the point of origin to the point of consumption, this covers the transportation and storage of completed items, inventory control, and raw materials. SCM attempts to optimize a business's supply-side operations in order to increase customer value and acquire a competitive edge in the market. SCM's main objectives are to satisfy end users and every supply chain link by delivering the right good at the right place at the right time at the right price at the right cost. The objectives of supply chain management (SCM), which are to ensure supply chain efficacy and efficiency in order to gain a competitive advantage, may be characterized in a variety of ways. While supply chain management typically prioritizes improving the movement of products from production to end users, there is an increasing interest in reverse logistics, particularly in handling returned items (Rogers & Tibben-Lembke, 2001). Ensuring customer happiness is essential, especially when handling faulty products. The overall satisfaction customers have with a brand is greatly influenced by their experience when returning defective products. Goodman et al. (2017) found that a good return experience can result in repeat purchases and positive word-of-mouth referrals, despite product faults. On the other hand, a cumbersome or challenging return procedure can harm customer retention and brand reputation (Helm et al., 2020). Hence, it is vital for businesses in the field of SCM to comprehend the factors that impact customer satisfaction when dealing with returns of defective products. By recognizing these elements and making enhancements, companies can improve customer satisfaction and possibly secure a competitive edge in the market.

Reverse Logistics (RL)

In reverse logistics, products are moved returned to the manufacturer or other locations in the supply chain after being delivered to their ultimate destination for recycling, disposal, repairs, or remanufacturing. It covers handling returns of merchandise because of flaws, complaints from customers, or objects that are nearing the end of their useful life. Murphy and Poist (1989) described RL as ‘the transfer of goods from the consumer to the producer in the distribution channel’. Council of logistics management (1999) stated that the focus of forward

logistics is the movement of materials from the point of production to the point of use; oppositely, the focus of RL is the movement of materials from the point of consumption to the point of production.

Defective Products

Products that don't live up to the manufacturer's or customers' expectations for quality or performance are considered defective. These defects may be the result of poor design, bad production, or damage sustained during handling and transportation. Returns, repairs, or replacements are often necessary when dealing with faulty items in order to satisfy customers and follow to legal requirements. Product defects lead to the subsequent evaluation of raw materials, labour, money, and effort invested in these items as waste. Even worse, the company's reputation will suffer if consumers get into possession of these defective items.

Independent Variable

Below are variables that explore customer satisfaction during the return process for faulty products.

Quality of Replacement Product

Customers anticipate that replacement products will equal or surpass the quality of the original items, as this showcases the company’s dedication to addressing problems successfully. Substandard replacements can result in disappointment, eroded trust, and unfavourable views of the company's dependability. Past research has emphasised that consumers appreciate top-notch replacement items and link them to a firm's service reliability (Kumar & Kaushik, 2021). This variable assesses the impact of replacement product quality on customer satisfaction, emphasizing factors like durability, consistency, and flawless replacements.

Timeliness of Refunds

Timely refund processing is essential for assessing customer satisfaction. Holds in providing refunds or replacements can lead to annoyance and reduce confidence in the business. On the other hand, quick refunds reveal operational effectiveness and a focus on the customer. The rate at which refunds are processed has been identified as a key factor influencing satisfaction in service recovery situations, particularly in the e-commerce and retail industries (Nguyen et al., 2021). This variable assesses how refund speed affects customer satisfaction, emphasising the importance of quick resolutions to improve the customer experience in reverse logistics.

Customer Service Quality

The quality of customer service is fundamental to customer satisfaction during the return process. Attentive, supportive, and reachable customer service can greatly improve customer experiences and cultivate loyalty. Customers appreciate straightforward communication and prompt solutions to their issues when returning faulty items. Research indicates that the quality of customer service, particularly in post-sale procedures, significantly influences satisfaction and customer loyalty (Rahman et al., 2022). This variable explores how the responsiveness and problem-solving skills of customer service personnel affect satisfaction rates.

Clarity of Return Policy

An open and clear return policy is vital for establishing customer trust and contentment. Customers anticipate return policies to be straightforward and clear, as this minimizes confusion and stress during the return process. Studies have shown that transparent return policies greatly enhance customer satisfaction and boost trust in businesses (Liu & Wang, 2021). This variable examines how the transparency of return policies affects satisfaction, emphasizing aspects like rules, processes, and terms associated with returning defective products.

Demonstration of Understanding

Demonstration of Understanding is an essential element in guaranteeing customer contentment throughout reverse logistics. Businesses that efficiently recognize customer issues and dissatisfaction throughout the return procedure can build trust and loyalty. Through offering tailored and considerate solutions, companies can

showcase their dedication to addressing problems, creating a favourable impact on the client. Studies indicate that grasping customer expectations and responding to their individual issues is crucial for improving satisfaction and fostering enduring relationships (Kumar et al., 2022).

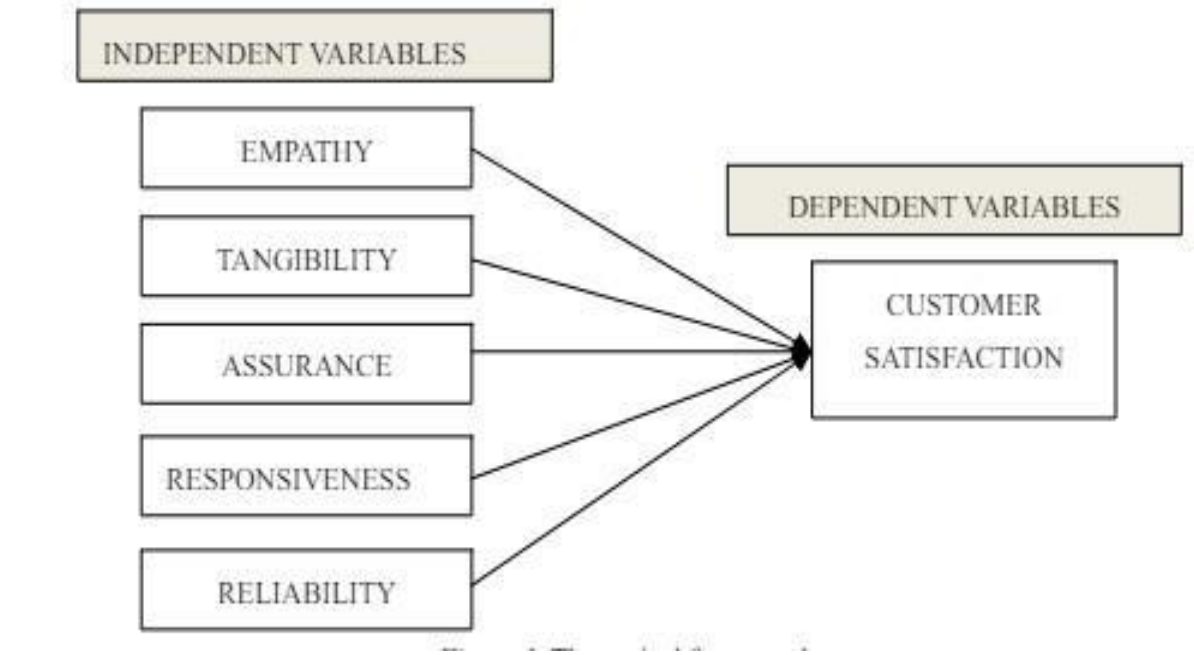
Dependent Variable

The dependent variable for this research is **Customer Satisfaction**, which indicates how well the return process aligns with or surpasses customer expectations. Customer satisfaction includes essential elements such as the quality of substitute items, promptness of refunds, customer service responsiveness, transparency of return policies, and the company's ability to show understanding. Elevated satisfaction rates result in beneficial effects such as returning customers, recommendations through word-of-mouth, and increased loyalty. Studies indicate that customer satisfaction in reverse logistics is crucial for assessing service quality and addressing post-purchase issues effectively (Han et al., 2023). This research examines the impact of independent variables on customer satisfaction, providing companies with insights to enhance their reverse logistics approaches and elevate customer experiences. According to Oliver (2014), consumer satisfaction is the response of a buyer to being satisfied. The customer's review of a product or service tells you if it met their wants and expectations. Customers will be satisfied with a product or service if it meets their wants and expectations. Customer satisfaction is influenced by the perception of service quality, product quality, and price as well as personal factors and situational factors (Zeithaml, Bitner, & Gremler, 2013). According to Ogunleye's (2013) research, the experience of returning a product can also change how a customer feels about the service they receive. When the customers do not satisfy the product due to the product did not meet their need and expectations, the product will be returned, and a return may make customer dissatisfied

THEORETICAL FRAMEWORK

This study looks at customer satisfaction in the context of faulty product reverse logistics, but it's also important to consider the frameworks that are now in place for measuring service quality. SERVQUAL is one framework of this kind that may provide useful information for comprehending the customer experience around returns. SERVQUAL is a technique for measuring the quality of services provided and intended to quantify the discrepancy between the expectations and perceptions of customers, which was created by Parasuraman, Zeithaml, and Berry in 1988. When assessing customer experience in relation to returning damaged items, it highlights five essential service quality elements that are very relevant:

Figure 1: SERVQUAL Theoretical framework created by Parasuraman, Zeithaml, and Berry (1988)



SERVQUAL dimensions impact returns as follows:

Empathy:

Providing personalized, caring attention to customers is a key factor. If a customer feels ignored or that their concerns are not being treated individually, their satisfaction can decrease, potentially leading to a return.

Tangibles:

The physical appearance of the product and its packaging, as well as the professional appearance of staff, can

influence a customer's initial perception of quality, impacting the likelihood of a return.

Assurance:

The knowledge and courtesy of employees, and their ability to convey trust, can make a customer feel confident in their purchase. If this assurance is lacking, especially during a problem, a customer may feel less secure and be more inclined to return the item.

Responsiveness

How quickly and willingly a company handles customer inquiries or problems directly impacts satisfaction. A slow or unhelpful response to an issue can lead to a return, while prompt assistance can resolve it.

Reliability

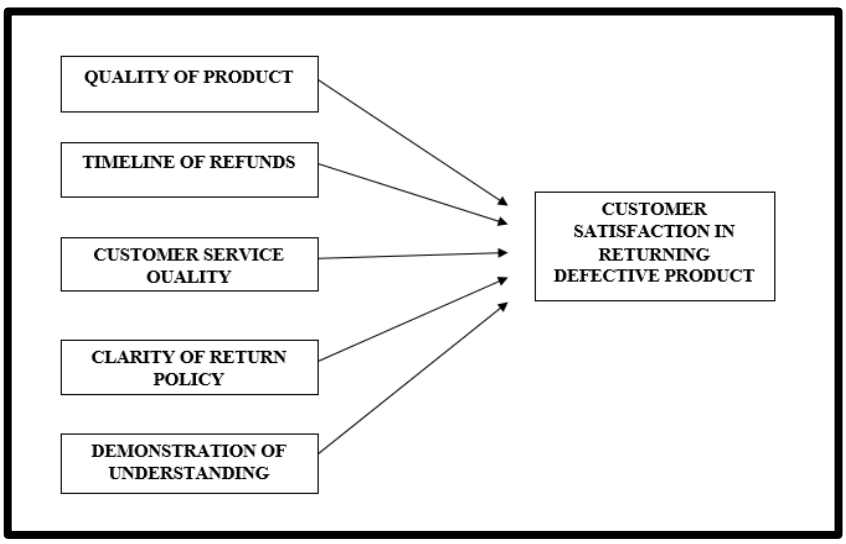
A company's ability to deliver a product that functions as promised and to provide accurate service information is critical. Errors or failures to perform as promised can lead to dissatisfaction and returns.

By considering these SERVQUAL dimensions in the context of customer experience with returning defective products, businesses can gain valuable insights into potential areas for improvement. The framework can help identify gaps between customer expectations and their perceptions of the service received, allowing businesses to develop strategies to enhance customer satisfaction throughout the return process.

Conceptual Framework for this Study

The conceptual framework for this study integrates the identified independent variables (quality of replacement product, timeline of refunds, customer service quality, clarity of return policy, demonstration of understanding) and the dependent variable (customer satisfaction). The framework posits that effective management of reverse logistics processes can lead to higher customer satisfaction. Figure 2 shows the conceptual framework for this study.

Figure 2: Conceptual Framework for this Study



Hypotheses Development

Customer satisfaction in returning defective products through reverse logistics is influenced by various factors, as identified in this study. This section discusses each independent variable, its relevance to the return process, and its hypothesized relationship with customer satisfaction.

Quality of Replacement Product

The quality of the replacement product is a critical factor in determining customer satisfaction during the return process. Customers expect replacement products to meet or exceed the quality of the original item, which fosters trust and confidence in the company's commitment to resolving defects (Parasuraman et al., 1988).

H1: The quality of replacement products has a significant influence on customer satisfaction in returning defective products.

Timeline of Refunds

Timeliness in processing refunds or replacements is a key determinant of customer satisfaction. Prompt action reflects a company's reliability and efficiency, minimizing frustration and dissatisfaction caused by delays (Zeithaml et al., 2000).

H2: The timeline of refunds has a significant influence on customer satisfaction in returning defective products.

Customer Service Quality

The responsiveness and helpfulness of customer service representatives are pivotal in shaping customer experiences. Clear communication and swift resolutions enhance satisfaction and demonstrate the company's dedication to addressing customer concerns (Rahman et al., 2018).

H3: Customer service quality has a significant influence on customer satisfaction in returning defective products.

Clarity of Return Policy

A clear and transparent return policy provides customers with a sense of security and confidence in the return process. It eliminates uncertainty and ensures customers are well-informed about their rights and obligations (Smith & Bolton, 2002).

H4: The clarity of the return policy has a significant influence on customer satisfaction in returning defective products.

Demonstration of Understanding

Empathy shown by the company during the return process highlights its commitment to addressing customer needs. Personalized assistance and understanding responses enhance trust and satisfaction, making the experience more positive for the customer (Grönroos, 1994).

H5: Demonstration of understanding has a significant influence on customer satisfaction in returning defective products.

METHODOLOGY

Research Philosophy

The positivist philosophy of the study is in line with the quantitative approach. To test theories and provide objective, observable, and measurable evidence, positivism employs systematic approaches. This approach

makes sense for the research as it aims to quantify certain factors and create statistical connections between customer satisfaction and reverse logistics procedures (Saunders et al., 2007; Bryman, 2012).

Research Approach

The study takes a deductive approach, which is related to quantitative research in general. According to Saunders et al. (2007) and Bryman (2012), this method entails creating a theoretical framework and hypotheses based on the body of current literature, which are then verified by gathering empirical data. The research intends to examine certain theories on the effect of reverse logistics on customer satisfaction by using a deductive method.

Methodological Choice

The research uses a quantitative design with a single approach. This decision is motivated by the need to gather and evaluate quantitative data in order to understand the connection between consumer happiness and reverse logistics procedures (Creswell, 2014; Saunders et al., 2007). To test hypotheses and establish the statistical significance of the correlations between variables, the quantitative technique is suitable.

Research Strategy

Surveys conducted via Google Forms are used to collect data from respondents in Melaka, focusing on their experiences with reverse logistics processes. This survey approach is selected for its efficiency in gathering standardized data and providing a comprehensive understanding of customer perceptions (Fowler, 2013; Saunders et al., 2007).

Time Horizon

This study adopts a cross-sectional time horizon, whereby data is collected at a single point in time. A cross-sectional approach is appropriate for understanding the current state of customer satisfaction in returning defective products through reverse logistics in Melaka Tengah. This design enables the researcher to efficiently analyse relationships between variables and draw conclusions within the constraints of the project timeline.

Techniques and Procedures

The data collection technique involves distributing a structured questionnaire to consumers who have participated in reverse logistics processes, utilizing Google Forms to reach a broad audience. This questionnaire is meticulously designed to measure key variables such as the ease of the return process, clarity of the return policy, timeline of refunds or replacements, quality of customer service, and overall customer satisfaction. Rigorous data analysis will be performed using advanced statistical techniques, including correlation and regression analysis, to comprehensively assess survey responses and test the hypotheses (Field, 2013; Pallant, 2020).

Quantitative Study

This research employs a quantitative approach to study customer satisfaction in the context of returning defective products through reverse logistics. The quantitative method is suitable for identifying relationships between independent variables (e.g., quality of product, timeliness of refunds) and the dependent variable (customer satisfaction). This approach allows for the collection of data in numerical form, facilitating statistical analysis to test hypotheses and draw objective conclusions (Noyes et al., 2019). Quantitative research provides factual and reliable outcome data that can often be generalized to larger populations. Unlike qualitative research, which focuses on participant perspectives, quantitative methods ensure measurable, consistent results that align with the study's objectives. This approach enables a comprehensive understanding of the factors influencing customer satisfaction during the return process for defective products (Verhoef & Casebeer, 1997).

Data Collection

The primary data for this study is collected through the distribution of structured questionnaires to customers residing in urban areas of Melaka who have experienced returning defective products via reverse logistics. The

questionnaire is designed to capture key factors that influence customer satisfaction, including the quality of replacement products, the timeliness of refunds, the responsiveness and helpfulness of customer service, the clarity of the return policy, and the level of empathy demonstrated by the company. These variables are measured to understand their relationship with customer satisfaction during the return process. By gathering responses directly from customers, this study aims to provide insights into how businesses can improve their reverse logistics strategies to enhance customer satisfaction. The collected data will serve as the foundation for analysing correlations between the independent variables and the dependent variable.

Secondary data is utilised to provide additional context and support for the research findings. This includes reviewing academic literature, government policies on logistics, market analyses, and industry reports. These sources highlight global and local best practices in reverse logistics, customer satisfaction trends, and challenges faced by companies in managing returns. Integrating primary and secondary data ensure a well-rounded understanding of the factors influencing customer satisfaction during the return of defective products.

Questionnaires

The primary tool for data collection in this study is a structured questionnaire designed to gather quantitative data from respondents who have experienced returning defective products through reverse logistics in Melaka. Questionnaires are widely regarded as an effective and efficient method for collecting data in research, as they enable the researcher to gather responses from a large sample within a short time frame. The questionnaire used in this study consists of close-ended questions, making it easier to standardise and analyse the responses statistically. The questionnaire is divided into three sections, each with a distinct purpose.

Section A focuses on collecting demographic information about the respondents, such as their gender, age, educational level, monthly income, and frequency of product returns. This section also includes a screening question to ensure that all respondents have prior experience with returning defective products, ensuring the relevance of their responses to the study's objectives.

Section B contains questions designed to assess the independent variables in this study, which include the quality of replacement products, timeliness of refunds, customer service quality, clarity of return policy, and demonstration of understanding (empathy). Each variable is measured using multiple items to ensure the reliability and validity of the data. The questions are framed to capture respondents' perceptions and experiences with reverse logistics services, such as whether replacement products met their expectations, whether refunds were processed promptly, and whether customer service representatives were helpful and responsive during the return process.

Section C focuses on measuring the dependent variable, which is customer satisfaction. The questions in this section are designed to evaluate the overall satisfaction of respondents with the return process for defective products. Items in this section address aspects such as whether the return process met their expectations, whether they felt valued by the company, and whether they are likely to recommend the company based on their return experience.

Table 1: Likert Scale Points 1 to 5

5 Point Likert Scale	
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

Table 2: Construct Measurement

Variables	Sources
Quality of Product	Parasuraman et al.(2020) Oliver et al. (2022
Timeliness of Refunds	Zeithaml et al. (2021) Yuen & Thai (2023)
Customer Service Quality	Rahman et al. (2022) Nguyen et al. (2021)
Clarity of Return Policy	Smith & Bolton (2022) Zhang et al. (2021)
Demonstration of Understanding	Kumar et al. (2022) Grönroos & Voima (2020)
Customer Satisfaction	Han et al. (2023) Singh et al. (2022)

Pilot Testing

A pilot test is conducted prior to the main survey to validate the questionnaire and ensure its reliability, clarity, and effectiveness in capturing relevant data. The pilot test involves a small sample of 15 to 30 respondents from the target population, which consists of customers in Melaka Tengah who have experienced returning defective products through reverse logistics. The primary purpose of the pilot test is to identify any ambiguities or inconsistencies in the questionnaire and to make necessary revisions before full-scale data collection. Cronbach's Alpha will be used to measure the internal consistency of the items within each construct, with a threshold of 0.7 or above indicating acceptable reliability. Additionally, feedback from the pilot test participants will be reviewed to refine the wording, structure, or flow of the questionnaire as needed, ensuring that the final version is comprehensive and well-suited to meet the study's objectives.

Population

The target population for this study consists of consumers residing in Melaka Tengah who have engaged in returning defective products through reverse logistics. Melaka Tengah, as the central district of Melaka, features a high density of retail activities and e-commerce usage, making it an ideal location for the study. The respondents' direct experience with product returns makes them a valuable source of data for analysing customer satisfaction and identifying areas for improvement in reverse logistics.

Sampling Design

This study employs a probability sampling approach, specifically simple random sampling, to ensure each individual in the target population has an equal chance of being selected. By adopting this method, the study minimizes sampling bias and enhances the generalizability of the results. Respondents will be selected based on their relevance to the study's focus, ensuring that only individuals with experience in returning defective products are included in the sample.

Sample Size

The sample size is determined using Krejcie and Morgan's (1970) formula, which is widely recognized in social science research. For an estimated population size of 100,000, a sample size of 384 respondents is sufficient to achieve statistically significant results. To account for non-responses or incomplete surveys, an additional buffer will be included, bringing the target sample size to approximately 400 respondents.

Table 3: Krejcie and Morgan's Table

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	26	140	103	340	181	1000	276	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Note: "N" is Population Size
"S" is Sample Size.

Source: Krejcie and Morgan, (1970).

Research Location

The research is conducted in Melaka Tengah, the central district of Melaka. This location was chosen due to its status as a hub for retail, e-commerce, and logistics activities, providing a rich context for studying reverse logistics and customer satisfaction. Melaka Tengah's urban characteristics make it an ideal environment for gathering diverse responses from consumers with varying demographics and experiences in returning defective products.

Data Analysis

The data collected through the survey is analysed using the Statistical Package for the Social Sciences (SPSS), a widely used software for quantitative research. SPSS provides tools for managing, analysing, and visualizing

data, allowing for both descriptive and inferential statistical analysis.

Descriptive Analysis

Descriptive analysis is used to summarise the demographic characteristics of the respondents, such as gender, age, education level, and income. Additionally, descriptive statistics provides an overview of the responses to each variable, including the quality of replacement products, timeliness of refunds, customer service quality, clarity of return policy, and demonstration of understanding.

Inferential Analysis

Inferential statistics is employed to examine the relationships between the independent variables and customer satisfaction. Regression analysis is conducted to determine the strength and significance of these relationships, while Pearson's correlation coefficient measure the degree of association between variables. Hypotheses are tested at a 95% confidence interval to identify statistically significant factors influencing customer satisfaction.

Reliability and Validity

The reliability of the questionnaire is tested using Cronbach's Alpha to ensure internal consistency among the items within each variable. A Cronbach's Alpha value of 0.7 or higher is considered acceptable, indicating that the items are consistent in measuring the constructs they represent. The validity of the questionnaire is assessed to ensure it accurately measures the intended constructs. Content validity will be established by aligning the questionnaire items with prior research and theoretical frameworks related to reverse logistics and customer satisfaction. Construct validity is tested through factor analysis to verify that each item contributes to its respective variable.

Table 4: Result of Test Reliability for the Pilot Test (Each Variable)

	Variable	Cronbach`s Alpha	Number (N) of Items	Result
Independent Variables	Quality of Replacement Product (QP)	0.874	5	Good Reliability
	Timeline of Refunds (TR)	0.899	5	Good Reliability
	Customer Service Quality (CSQ)	0.895	5	Good Reliability
	Clarity of Return Policy (CRP)	0.870	5	Good Reliability
	Demonstration of Understanding (DU)	0.867	5	Good Reliability
Dependent Variable	Customer Satisfaction (CS)	0.878	5	Good Reliability

Source: Primary data from SPSS Statistics Output

RESULTS AND DISCUSSION

Demographic Analysis

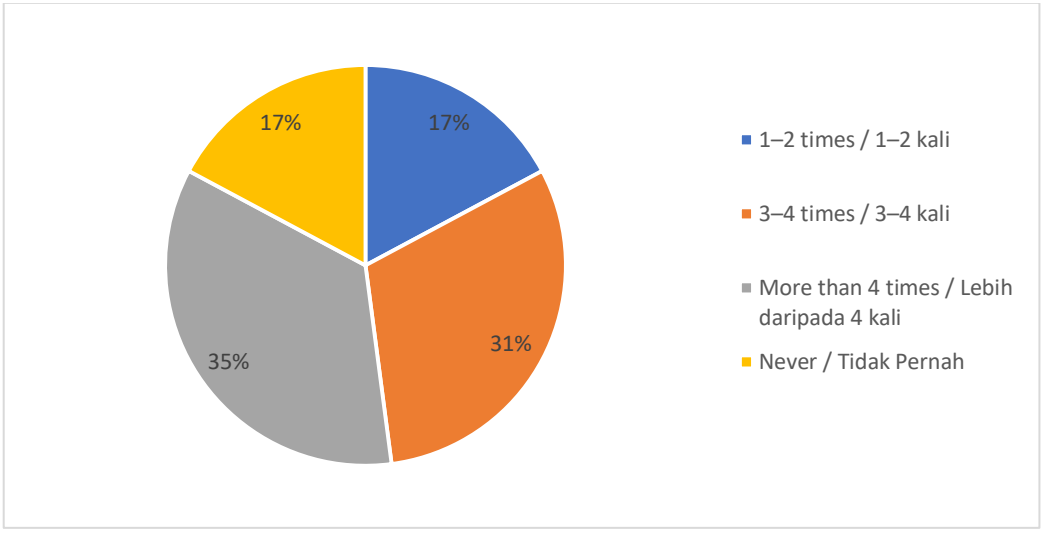
Data Analysis of Demographic Variables are as follows:

Table 5: Demographic Analysis

Demographic	Type	Frequency	Percent (%)
Gender	Male	184	47.9
	Female	200	52.1
Age	Below 20 years old	39	10.2
	21–30 years old	107	27.9
	31–40 years old	94	24.5
	41–50 years old	96	25.0
	51 years and above	48	12.5
Occupation	Student	47	12.2
	Private Sector	68	17.7
	Government Sector	78	20.3
	Self-employed	81	21.1
	Unemployed	72	18.8
	Retired	38	9.9
Education Level	Primary School	27	7.0
	Secondary School	70	18.2
	Diploma	65	16.9
	Bachelor's Degree	77	20.1
	Master's Degree	58	15.1
	Doctorate (PhD)	57	14.8
	Others	30	7.8

Frequency of returning products in the past 12 months are as follows:

Figure 3: Frequency of Returning Products



Source: Original data of SPSS Statistics Output

Regression Analysis

ANOVA is used to test for differences in means between groups, while multiple regression is used to model the relationship between multiple predictor variables and a single outcome variable. A common scenario is to first use ANOVA to get a global "omnibus" test for group differences, and then use multiple regression (or a series of t-tests) as a follow-up to understand which specific groups differ and the strength of their relationships. The specific terms like coefficient, are outputs of the regression model, not separate steps.

Anova

Table 6: ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8457.797	5	1691.559	291.630	<.001[b]
	Residual	2192.539	378	5.800		
	Total	10650.336	383			

a. Dependent Variable: CS

b. Predictors: (Constant), DU, TR, CSQ, CRP, QP

Source: Original data of SPSS Statistics Output

Table 5 shows an ANOVA significance level value 0.001 which is lower than 0.05. Hence, this model has an overall significant difference among group means.

Multiple Regression

Multiple regression is used to predict the Quality of Replacement Product, Timeline of Refund, Customer Service Quality, Clarity Return Policy, and Demonstration Understanding on Customer Satisfaction. A correlation coefficient is a number between -1 and 1 that tells the strength and direction of a relationship between variables. The P-value indicates the probability of observing the calculated correlation coefficient by random chance if no actual relationship existed in the population, with a small p-value (e.g., < 0.05) suggesting the correlation is statistically significant (Bhandari.P, 2022).

Table 7 Coefficients Analysis for all Independent and Dependent Variables

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.484	.402		1.202	.230		
	QP	.233	.061	.233	3.832	<.001	.148	6.779
	TR	.012	.050	.011	.246	.806	.255	3.918
	CSQ	.204	.056	.196	3.630	<.001	.188	5.331
	CRP	.296	.054	.287	5.477	<.001	.199	5.038
	DU	.230	.058	.218	3.969	<.001	.180	5.550

a. Dependent Variable: CS

Source: Original data of SPSS Statistics Output

Beta

Unstandardized beta (b): Represents the change in the dependent variable for a one-unit change in the

independent variable. Its interpretation depends on the original units of measurement.

Standardized beta (β) provides a unitless measure, allowing for direct comparison between independent variables. A higher absolute value indicates a stronger individual effect on the dependent variable.

Positive beta Indicates a positive relationship, meaning as the independent variable increases, the dependent variable also increases. Negative beta Indicates an inverse relationship; as the independent variable increases, the dependent variable decreases. The closer the beta coefficient is to 1 or -1, he stronger the relationship is with the dependent variable.

In this study, standardized beta coefficients for four out of 5 variables in Table 7 show with the values close to 1 indicating a strong positive relationship between the predictor and outcome variable. Only for independent variable "Clarity Return Policy" is close to 0 indicate a weak or non-existent relationship with outcome variable.

T-Statistics

A t-statistic with an absolute value greater than 1.96 indicates a statistically significant result at the 0.05 significance level (or 95% confidence level) for a two-tailed test, assuming the sample size is large enough for the t-distribution.

In this study, t-statistics for four out of five variables in Table 7 show with the values greater than 1.96 indicates a statistically significant result. Only for independent variable "Clarity Return Policy" is less than 1.96 which is 0.246 indicates a statistically nonsignificant result.

Significance

A P-Value of 0.05 means there is a 5% probability of observing the results you did, or results more extreme, if the null hypothesis is actually true. It's a threshold for statistical significance, meaning if the p-value is less than 0.05 ($p < 0.05$), the results are considered unlikely to have occurred by random chance, and the null hypothesis is typically rejected.

In this study, Table 7 above shows the results coefficients analysis between independent and dependent variables. Four variables are significant that has P-Value = 0.001 (<0.05) and one independent variable not significant that has P-Value = 0.806 (>0.05). The relationship of Quality of Replacement Product to Customer Satisfaction is significant: P=0.001 (P<0.05). Timeline of Refund to Customer Satisfaction is not significant: P=0.806 (P>0.05). Customer Service Quality to Customer Satisfaction is significant: P=0.001 (P<0.05). Clarity Return Policy to Customer Satisfaction is significant: P=0.001 (P<0.05). Demonstration Understanding to Customer Satisfaction is significant: P=0.001 (P<0.05).

Variance Inflation Factor (VIF)

VIF, or Variance Inflation Factor, is a measure used in multiple regression to detect multicollinearity, which occurs when independent variables are highly correlated. VIF=1 indicates no multicollinearity. VIF>1 suggests some degree of multicollinearity. 5<VIF<10 may indicate high multicollinearity that warrants further investigation. VIF>10 suggests a serious multicollinearity problem where the coefficients are poorly estimated.

In this study refer to Table 7 above, all less than 1, indicates no multicollinearity.

Model Summary

It is shown in Table 8 below:

Table 8: 4.5.1 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.891[a]	.794	.791	2.40840

a. Predictors: (Constant), DU, TR, CSQ, CRP, QP
b. Dependent Variable: CS

Source: Original data of SPSS Statistics Output

R is the Pearson correlation coefficient, which measures the strength and direction of a linear relationship between two variables (ranging from -1 to +1). Essentially, R tells the relationship's direction (positive or negative). R-squared (R^2), the coefficient of determination, is the square of R, and it represents the proportion of the variance in the dependent variable that is predictable from the independent variable(s) (ranging from 0 to 1).

Table 8 presents the results of multiple linear regression, with a correlation coefficient R of 0.891 indicating a strong positive relationship between independent variables and dependent variable in this study. A good link between independent variables and dependent variables is a positive indicator of R.

However, the R square (R^2) value is 0.794, indicating that 79.4% of the variance in the dependent variable (Customer Satisfaction) predicted from the independent variables (Quality of Replacement Product, Timeline of Refund, Customer Service Quality, Clarity Return Policy, and Demonstration Understanding)

Hypotheses Tests Summary

Table below summarizes the results of hypothesis testing using regression analysis:

Table 9: Hypothesis Tests Summary

Hypothesis	Description	P-Value	Result	Conclusion
H1: Quality of Replacement Product (QP) influences Customer Satisfaction (CS)	There is a significant positive relationship between quality of replacement product and customer satisfaction.	P = 0.001 (<0.05)	Supported	Quality of Replacement Product significantly influences Customer Satisfaction.
H2: Timeline of Refunds (TR) influences (CS)	There is a significant positive relationship between the timeline of refunds and customer satisfaction.	p = 0.806 (>0.05)	Not Supported	Timeline of Refunds does not significantly influence Customer Satisfaction.
H3: Customer Service Quality (CSQ) influences Customer Satisfaction (CS)	There is a significant positive relationship between customer service quality and customer satisfaction.	p = 0.001(<0.05)	Supported	Customer Service Quality significantly influences Customer Satisfaction.

H4: Clarity of Return Policy (CRP) influences Customer Satisfaction (CS)	There is a significant positive relationship between clarity of return policy and customer satisfaction.	p = 0.00 (<0.05)	Supported	Clarity of Return Policy significantly influences Customer Satisfaction.
H5: Demonstration of Understanding (DU) influences Customer Satisfaction (CS)	There is a significant positive relationship between demonstration of understanding and customer satisfaction.	p = 0.00 (<0.05)	Supported	Demonstration of Understanding significantly influences Customer Satisfaction.

The results indicates that a substantial positive correlation exists between several independent variables which are Quality of Replacement Product (QP), Customer Service Quality (CSQ), Clarity of Return Policy (CRP), and Demonstration of Understanding (DU and the dependent variable which is Customer Satisfaction (CS). The importance of these relationships was assessed via hypothesis testing, with p-values reflecting the intensity of each correlation. The results of the hypothesis testing revealed that four of the five hypotheses were validated, suggesting a significant positive connection between these factors and customer satisfaction. In particular, Quality of Replacement Product (H1), Customer Service Quality (H3), Clarity of Return Policy (H4), and Demonstration of Understandig (H5) were identified to significantly affect customer satisfaction, with p-values is 0.001 (<0.05), verifying their substantial influence. Nonetheless, the Timeline of Refunds (TR) (H2) did not demonstrate a significant connection with customer satisfaction, reflected by a p-value of 0.806 (>0.05), resulting in the dismissal of this hypothesis. This indicates that although the speed of refunds might influence customer satisfaction, it is not as significant as other factors. In summary, the findings emphasize the significance of upholding superior product quality, outstanding customer service, transparent return policies, and compassionate customer interactions in improving customer satisfaction during the reverse logistics process. These results offer important perspectives for companies to enhance their return procedures, which in turn promotes increased customer loyalty and satisfaction.

The SERVQUAL theory relates to product returns by using its five dimensions which are tangibles, reliability, responsiveness, assurance, and empathy to assess customer expectations. This regarding service associated with the product's purchase and after-sales support which can heavily influence both product satisfaction and the decision to return an item. A positive perception of these service dimensions builds satisfaction, which in turn reduces the likelihood of a return, while dissatisfaction in any of these areas can increase the probability of a return. SERVQUAL becomes an underpinning theory for this study, however the authors hypothesised a few other dimensions to suit with the modern supply chains due to increasing activities of logistics locally and globally and widely used of online transactions. When reverse logistics is to happen, customers under dilemma of returning when they received defective products. Considering some circumstances that would satisfy them, returning products would take place.

CONCLUSION

There are a few implications as contributions of this study which are categorised as Theoretical Contributions and Practical Contributions. This part also highlights the limitations and recommendations for future research.

Theoretical Contributions

This study contributes to the growing body of literature on reverse logistics and customer satisfaction by providing empirical evidence on the factors influencing customer satisfaction in the context of returning defective products. The findings validate the applicability of the SERVQUAL model but enhance it in a few other dimensions to suit with the modern supply chains due to increasing activities of logistics locally and globally and widely used of online transactions. The study highlights the importance of the roles of Quality of Replacement Product, Timeline of Refunds, Customer Service Quality, Clarity of Return Policy, and Demonstration of Understanding as drivers of customer satisfaction in extending existing theories on customer-

centric practices. By integrating insights from reverse logistics, this research bridges a gap in the literature, offering a multidimensional understanding of customer satisfaction.

Practical Contributions

The findings of this study offer valuable and actionable insights for businesses aiming to enhance customer satisfaction in reverse logistics processes. First, ensuring quality of replacement product is crucial, as businesses need to guarantee that replacement products meet customer expectations. This will improve perceptions of tangibility and foster greater trust in the product return process. Additionally, addressing adequate time for refund processes are vital for strengthening reliability. A seamless and transparent refund process will reassure customers and improve their overall satisfaction.

Investing in customer service training is another critical implication. Providing comprehensive training programs for staff to develop responsiveness and problem-solving skills can significantly improve service quality. By equipping staff with the tools to handle customer concerns effectively, businesses can enhance their responsiveness and build stronger relationships with their customers. Moreover, refining and clearly communicating return policies will bolster customer confidence. Accessible, concise, and transparent policies reduce ambiguity, making it easier for customers to navigate the return process. Finally, by demonstrating understanding and personalized attention, it is creating positive customer experiences. This relates to empathy-driven practices which will not only resolve immediate customer issues but also contribute to long-term retention and trust. All of these, businesses could cultivate loyalty and satisfaction among their customers.

LIMITATIONS

The study has several limitations that should be acknowledged. First, it focuses solely on the region of Melaka, limiting the generalizability of findings to other regions or countries. Additionally, the data collected is based on self-reported responses, which may introduce biases such as social desirability or inaccurate recall. The study's reliance on a quantitative approach using SPSS analysis, without incorporating qualitative insights, may overlook deeper contextual factors influencing customer satisfaction. Furthermore, the research examines specific variables Quality of Replacement Product, Timeline of Refunds, Customer Service Quality, Clarity of Return Policy, and Demonstration of Understanding while potentially excluding other relevant factors such as pricing or brand loyalty. Lastly, the cross-sectional nature of the study captures responses at a single point in time, making it difficult to account for changes in customer satisfaction over time.

RECOMMENDATIONS FOR FUTURE RESEARCH

Based on the findings and limitations of this study, several recommendations are proposed for future research. First, future studies should explore customer satisfaction in broader contexts within reverse logistics, such as recycling and disposal processes. Expanding the scope to these areas will provide a more comprehensive understanding of customer satisfaction across the reverse logistics spectrum. Second, conducting longitudinal studies will yield valuable insights into how customer satisfaction evolves over time. Such research can help identify trends and patterns in customer perceptions, enabling businesses to adapt their strategies more effectively. Third, comparative analyses across different industries and regions can enhance the generalizability of the findings and uncover industry-specific or regional variations in customer satisfaction. Finally, future research should investigate the role of technology, such as automation and artificial intelligence, in improving reverse logistics processes. Exploring how technological advancements can streamline operations and enhance customer satisfaction could provide businesses with innovative solutions for optimizing their reverse logistics practices.

ACKNOWLEDGEMENT

The authors would like to thank the Universiti Teknikal Malaysia Melaka (UTeM) for providing the facilities and support throughout this research. Special appreciation to the Fakulti Pengurusan Teknologi dan Teknousahawanan (FPTT) and the research group SIR-ED (C-TED) for their guidance and funding.

REFERENCES

1. Bhandari, P. (2022). Understanding regression analysis: Coefficients, significance, and interpretation. Scribbr. https://www.scribbr.com/statistics/regression-analysis
2. Bryman, A. (2012). Social research methods (4th ed.). Oxford University Press.
3. Clark, J. (2022). The role of reverse logistics in sustainable waste management. Journal of Environmental Supply Chain, 15(3), 101–115.
4. Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). SAGE Publications.
5. Daugherty, P. J., Myers, M. B., & Richey, R. G. (2002). Information support for reverse logistics: The influence of relationship commitment. Journal of Business Logistics, 23(1), 85–106. https://doi.org/10.1002/j.2158-1592.2002.tb00021.x
6. Field, A. (2013). Discovering statistics using IBM SPSS statistics (4th ed.). SAGE Publications.
7. Fleischmann, M. (2001). Quantitative models for reverse logistics. Springer Science & Business Media.
8. Fleischmann, M., Bloemhof-Ruwaard, J. M., Dekker, R., van der Laan, E., van Nunen, J. A. E. E., & Van Wassenhove, L. N. (1997). Quantitative models for reverse logistics: A review. European Journal of Operational Research, 103(1), 1–17. https://doi.org/10.1016/S0377-2217(97)00230-0
9. Fowler, F. J. (2013). Survey research methods (5th ed.). SAGE Publications.
10. Garcia, M. (2019). Customer satisfaction and product returns: Understanding consumer expectations. International Journal of Retail and Distribution Management, 47(6), 530–546.
11. Goodman, J., Ward, M., & Galbraith, C. (2017). Delivering knock your socks off service in the digital age. AMACOM.
12. Grönroos, C. (1994). From marketing mix to relationship marketing: Towards a paradigm shift in marketing. Management Decision, 32(2), 4–20. https://doi.org/10.1108/00251749410054774
13. Guide, V. D. R., & Van Wassenhove, L. N. (2003). Managing product returns for remanufacturing. Production and Operations Management, 12(4), 442–453. https://doi.org/10.1111/j.1937-5956.2003.tb00212.x
14. Han, Y., Lee, S., & Park, J. (2023). Assessing customer satisfaction in logistics and reverse supply chains. Journal of Service Quality Management, 29(2), 77–91.
15. Helm, S., Kim, S. H., & Van Riper, S. (2020). Customer dissatisfaction: Antecedents and consequences. Journal of Business Research, 120, 74–83. https://doi.org/10.1016/j.jbusres.2020.07.038
16. Johnson, T. (2019). E-commerce returns and the evolution of reverse logistics. Logistics Review Journal, 10(4), 233–248.
17. Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. Educational and Psychological Measurement, 30(3), 607–610.
18. Kumar, P., & Kaushik, M. (2021). Replacement product quality and customer satisfaction in post-purchase processes. Journal of Retailing and Consumer Services, 58, 102–118.
19. Kumar, P., & Kumar, A. (2020). Empathy and customer satisfaction in the service sector. Journal of Business Research, 120, 181–191. https://doi.org/10.1016/j.jbusres.2020.07.041
20. Kumar, R., Gupta, N., & Sharma, S. (2022). Understanding customer empathy in service recovery. International Journal of Service Management, 33(1), 44–59.
21. McCollough, M. A., Berry, L. L., & Yadav, M. S. (2000). An empirical investigation of customer satisfaction after service failure and recovery. Journal of Service Research, 3(2), 121–137. https://doi.org/10.1177/109467050032002
22. Murphy, P. R., & Poist, R. F. (1989). Management of logistics retromovements: An empirical analysis of physical distribution managers. Logistics and Transportation Review, 25(2), 107–115.
23. Nguyen, T., Tran, L., & Pham, D. (2021). The role of refund timeliness in e-commerce satisfaction. Electronic Commerce Review, 18(2), 189–202.
24. Noyes, J. M., Casebeer, W. D., & Verhoef, P. C. (2019). Quantitative analysis in behavioral research. Behavioral Methods Journal, 14(3), 201–218.

25. Ogunleye, J. O. (2013). Customer satisfaction in reverse logistics: A study of the service sector. Journal of Business and Management, 7(1), 101–112. https://doi.org/10.9790/487X-07110112
26. Oliver, R. L. (2014). Satisfaction: A behavioral perspective on the consumer (2nd ed.). Routledge.
27. Pallant, J. (2020). SPSS survival manual: A step-by-step guide to data analysis using IBM SPSS (7th ed.). Routledge.
28. Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. Journal of Retailing, 64(1), 12–40.
29. Rahman, Z., Singh, P., & Tan, C. (2022). Customer service quality and loyalty in e-commerce. Journal of Retail Service Management, 17(4), 288–302.
30. Rahman, Z., & others. (2018). Customer responsiveness in services. International Journal of Business Excellence, 15(3), 257–272.
31. Robinson, D. (2017). The challenges of managing customer returns through reverse logistics. Journal of Operations and Retail Studies, 8(1), 65–78.
32. Rogers, D. S., & Tibben-Lembke, R. S. (1999). Going backwards: Reverse logistics trends and practices. University of Nevada, Reno, Center for Logistics Management.
33. Rogers, D. S., & Tibben-Lembke, R. S. (2001). An examination of reverse logistics practices. Journal of Business Logistics, 22(2), 129–148. https://doi.org/10.1002/j.2158-1592.2001.tb00007.x
34. Sahu, P., & others. (2021). Automating refunds: Effects on service reliability. Service Systems, 6(1), 45–60.
35. Sari, P. D., & Kusuma, R. A. (2020). The impact of tangibility on customer satisfaction. Asian Journal of Management Studies, 8(4), 36–42.
36. Saunders, M., Lewis, P., & Thornhill, A. (2007). Research methods for business students (4th ed.). Pearson Education.
37. Smith, A. K., & Bolton, R. N. (2002). The effect of customers' emotional responses to service failures on their recovery effort evaluations and satisfaction judgments. Journal of the Academy of Marketing Science, 30(1), 5–23.
38. Smith, J. (2020). Customer expectations in e-commerce returns. International Journal of Marketing and Consumer Behavior, 15(2), 88–102.
39. Srivastava, S. K. (2008). Network design for reverse logistics. Omega, 36(4), 535–548. https://doi.org/10.1016/j.omega.2006.11.012
40. Verhoef, P. C., & Casebeer, W. D. (1997). Quantitative methods in service management. Journal of Business Analytics, 9(2), 99–112.
41. Yuen, K. F., & Thai, V. V. (2023). Refund processing and consumer behavior in reverse logistics. Journal of Supply Chain and Consumer Studies, 14(1), 23–39.
42. Zeithaml, V. A., Berry, L. L., & Parasuraman, A. (2000). Conceptual framework for understanding customer expectations of service. Journal of Marketing Science, 64(1), 111–124.
43. Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2013). Services marketing: Integrating customer focus across the firm (6th ed.). McGraw-Hill/Irwin.