The Effectiveness of Last Mile Logistics Real-Time Data Analytics in Enhancing Customer Satisfaction

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ABSTRACT

Customer satisfaction is a very important measure of success in the changing environment of last-mile delivery services. The proposed study will examine how real-time data analytics can influence customer satisfaction by referring to the Unified Theory of Acceptance and Use of Technology (UTAUT) framework. The quantitative research methodology is used, and the questionnaire surveys are used among the customer base of the last-mile delivery services within the Klang Valley area. The convenience sampling technique is used to select the participants, who are picked in consideration of their availability, accessibility, and willingness to respond. It is planned that the sample size will be 384 respondents, and the data will be analysed with the help of SPSS. The conclusion will focus on the importance of delivery speed and accuracy, real-time tracking, live customer service communication, electronic proof of delivery, and efficient reverse logistics in improving the utilisation of real-time data analytics and its impact on customer satisfaction.

Keywords: Last mile logistics: Real-time data analytics; Customer satisfaction

INTRODUCTION

It is important to note that the topic of last-mile logistics (LML) has gained increased popularity as a research question among researchers and business professionals over the past five years (Aljohani, 2024). The main factors driving rapid growth include increased urbanisation and population expansion, a greater emphasis on sustainability, and a rise in online purchasing (Olsson et al., 2019). LML is the final stage of a product's journey through the supply chain (Thanh et al., 2025). He added that last-mile delivery aims to deliver the exact goods, in the right quantity, to the right location, and at the right time for the customer or user. Meanwhile, customer satisfaction in a modern competitive logistics field is more than a measure of service quality, but a competitive advantage that can influence loyalty to brands and market shares. The use of technology is a critical requirement to address the flaws of the traditional logistics models that most often cannot support the efficiency and sustainability goals of the operations (Al-Khatib et al., 2020).

This research focuses on the efficiency of logistics service providers (LSPs) in performing last-mile delivery for business – to - consumer businesses, where LSPs manage and deliver products on behalf of their customers (Zainuddin et al., 2022). Among such novel technologies that LSPS will need to employ to meet these expanding customer satisfaction needs are real-time data analytics, which play a key role in enhancing the performance of LML processes (Hanbali and Khan, 2025). Real-time information enables making better routing decisions in uncertain networks and adaptation to the changing traffic environment (Chen et al., 2021). Such real-time data is enabled through several tools, including GPS, machine learning and Internet of Things, which would convert all this data to important insights toward future development of processes.

Despite advancements in logistics technology, persistent issues such as faulty or partial deliveries, a lack of real-time communication, restricted flexibility in delivery alternatives, and variable staff delivery experiences continue to have an influence on overall customer satisfaction. Thus, the logistics industry in Malaysia has not yet fully benefited from real-time data, and its effectiveness in enhancing customer satisfaction has not yet been fully realised, despite the availability of these technologies and their promise (Mohamad & Novia Zahrah, 2024). Additionally, little is known about the present uses of real-time data, the precise advantages it offers in terms of delivering results and customer satisfaction, and the challenges that prevent its wider use, which will risk Malaysian logistics companies to satisfy customer requests.

This study targets customers in the Klang Valley, which, according to Man & Abd Majid (2024), is one of the most critical regions of Malaysia because it has become a hub of economic activity, trade, and urban sprawl. The LML is usually dubbed as the most costly, inefficient, and polluting component of the supply chain. Olsson et al. (2019) state that the last mile may lead to 13-75% of all costs involved in the entire supply chain, depending on many different criteria. This study explores the possible ways through which real-time data can be used to enhance the performance of Malaysian logistics firms.

LITERATURE REVIEW

Last- Mile logistics

According to Onro (2025), in logistics, the delivery process is generally divided into three main stages: the first mile, the middle mile, and the LML. The LML, which refers to the final stage, entails delivering the goods directly to the customer's door or chosen pickup location (Laseinde et al., 2017). Although the LML phase may cover a shorter distance and take less time than the upstream stages of logistics, it is often regarded as the most challenging part of the logistics process. Commonly referred to as the "last-mile problem," this phase is fraught with unpredictable factors such as traffic conditions, failed delivery attempts, and route inefficiencies (Chu et al., 2021). Devari et al. (2017) have indicated that last-mile delivery is vital in terms of delivering goods at the right time and place or location, thus increasing customer satisfactionThis stage is frequently associated with complex logistical activities, such as route optimisation, inventory control, and communication with numerous stakeholders, including couriers, drivers, and clients (Gielens et al., 2020). Even though the LML concept is not new to commerce and goods exchange environments, it has gained considerable value over the past few years, especially with the rise of e-commerce (Restuputri et al., 2022).

Logistics Service Provider

According to Abbasi et al. (2024), LSPs are third-party agencies that handle, transport, and manage storage, distribution, shipping, and customs clearing on behalf of their clients. DHL, POS Malaysia, J&T Express, Nippon Express, and Lalamove are just a handful of the LSPs operating in Malaysia, with many others offering logistics services to a variety of industries. Customers of such providers are often split into two categories, business-to-business (B2B) and business-to-consumer (B2C) (Kenton, 2022). According to Zainuddin et al. (2022), LSP performance in the B2C arena is especially important, and LML efficiency has a major impact on customer satisfaction. Furthermore, LSPs that use new technologies, such as real-time data technologies, will be more efficient in offering a customer-centric and stable service (Banoo, 2021). However, regardless of how good the products are, the customer experience is likely to suffer as a result of inefficiencies such as delayed delivery, damaged goods, inability to communicate proactively, and similar factors (Zainuddin et al., 2022).

Real-time data analytics

Real-time analytics is a type of big data analytics in which data items are evaluated and managed in real time (Milosevic et al., 2016). Because the value of information tends to deteriorate over time, obtaining high-quality and relevant data in the shortest amount of time is both challenging and criticalTechnologies such as GPS, machine learning, artificial intelligence, and the Internet of Things (IoT) enable real-time data distribution in the supply chain, enhancing businesses' processes and providing greater insight (Alonge et al., 2021). It is this real-time data that allows businesses to track the conditions and performance, and enables a quick response to any problems in the operation. (Smith, 2024). Major leaders in the logistics industry prove that integrating data in real-time is very practical. As an example of such innovations, coupled with IoT technologies, DHL (2025) now has real- time tracking that allows tracking parcels and vehicles in real time, in addition to real-time monitoring of temperature- sensitive shipments.

Customer Satisfaction

The Cambridge dictionary defines customer satisfaction as how happy a customer is when doing business with a company. Oliver (2014) defined customer satisfaction as the consumer's satisfaction reaction. He adds that it refers to a customer's evaluation of a product or service in order to determine whether or not the product or service meets the customer's wants and expectations. When a customer's wants and expectations are met by a product or service, it is presumed that satisfaction is also with the service or product (Oliver, 2014). Prompt deliveries and the overall speed of the delivery processes have also been identified as major factors of customer satisfaction (Fisher et al., 2017). On the customer experience level, delivery delays can cause cognitive dissonance, which negatively affects a consumer's view of the whole online purchase experience (Vakulenko et al., 2019). It should also be highlighted that customers are likely to rate their overall experience with LML without mentioning any phases of the process or participants (Tax et al. 2013). This is especially essential in today's market, as demand for faster, more flexible delivery options is increasing.

Delivery Speed and Accuracy

The time it takes to transfer products from the transportation hub to the final destination is referred to as delivery speed (Wang et al., 2021). Last-mile accuracy refers to how exact and accurate last-mile delivery is in guaranteeing that the correct goods reach their intended destination (Boysen et al., 2020). Real-time data handling involves processing large amounts of data in real time and converting that data into actionable information (Iyer, 2021). Thus, LSPs may now access real-time information about critical items like road traffic, weather, and vehicle performance (Prapinit et al., 2024). This allows for real-time modification of delivery routes, saving drivers time negotiating congested locations (Al-Khatib et al., 2020). Such systems are especially helpful in cities, where roadways are structured in complex patterns. When real-time data is utilised with AI, delivery vehicles may determine the most efficient routes, avoid hazards, and locate prime loading and parking zones at destinations (Iyer, 2021). As a result, delivery speed will rise while accuracy is ensured.

Real-Time Tracking Facilities

Real-time tracking allows clients to check the location and progress of their packages during the LML (Puri, 2025). This provides customers with access to a variety of information about the delivery, including live ETA visibility, the person carrying out the task in the LML, and even the ability to leave special instructions, such as leaving at the door, not ringing the bell, and calling the customer (Puri, 2025). Order information is provided by email notifications, text messages, internet portals, and mobile applications (Vijoleta Vrhovac et al., 2024). Furthermore, utilising prior traffic history, weather predictions, road closure information, and current traffic data, LSPs may identify places in cities where congestion is expected to occur (Jazemi et al., 2023). LSPs who are prepared can move items ahead of time, organise deliveries effectively, distribute resources more sensibly, and maintain high delivery reliability. As a result, they may respond more quickly and efficiently, resulting in higher-quality transport and customer service (Shuaibu et al., 2025).

Electric Proof of Delivery

The electronic proof of delivery (ePOD) is a digital document that serves as a record of delivery service completion (Miashkova, 2023). In addition to collecting digital signatures, barcodes, QR codes, and other kinds of verification, electronic proof of delivery systems can record the time and geographic position of each job in a single transaction (Pham, 2024).It provides real-time data since the data is immediately available online via mobile technology or cloud connections, allowing all parties involved to easily receive current delivery instructions (Peer & Mishra, 2023). When the validation of information is complete, the system quickly prepares an official ePOD document, including facts such as the delivery location, time, recipient confirmation, and any images or remarks (Bettermile, 2024).

As demonstrated by Prapinit et al (2024), ePOD improve logistics procedures, reduces processing times, and boosts supply chain visibility. The use of digital technologies in business reduces needless paperwork, lowers the chance of document loss, and speeds up everything from billing to stock management and customer communication (Peer and Mishra, 2023). ePOD demonstrates how digital advancements, such as real-time data connectivity and mobile access, are revolutionising LML. As a result, LSPs may respond to issues faster, provide greater value to clients, and retain their loyalty over time (Disc, 2023).

Live Customer Service Communication

Real-time customer service refers to direct interactions between companies and their clients (Akther, 2024). It is concerned with providing immediate help and resolving issues on the spot. The most often utilised channels for providing real-time customer assistance include live chat, phone chats, video calls, and social media. Vrhovac et al. (2024) found that the quality of real-time interactions has a substantial impact on consumer impressions. According to the findings, customers are more likely to think that the service they are receiving has exceeded their expectations if delivery persons or customer support representatives demonstrate professionalism, empathy, and a willingness to quickly resolve the matter. This is especially crucial since customers expect more care and confidence when handling sensitive or high-value products (Vrhovac et al., 2024). The capacity to provide consistent customer service through real-time, data-driven communication has the impact of increasing trust among customers while also guaranteeing that brand loyalty to the organisation may be steadily developed. Last but not least, the employment of real-time data and communication technology in last-mile logistics is expected to be a strategic necessity for LSPs to match current consumer demands and provide high-quality service.

Efficient reverse logistics

Rogers and Tibben-Lembke (2001) describe efficient reverse logistics as the effective, efficient, and costeffective approach to processing items that are returned, recycled, replaced, or reimbursed. They added that a well-designed reverse logistics system can provide benefits such as customer convenience, enhanced loyalty, and decreased corporate losses. When a consumer wishes to return a product, he or she initiates the process by sending a return request (Maday, 2023). Using real-time data technology in reverse logistics operations may significantly boost productivity and profitability. Real-time data analytics provide continuous quality monitoring and control throughout the return process to ensure that everything runs as intended (Adewale, 2025). Furthermore, real-time data enables customer support staff to proactively resolve issues such as delays, incorrect returns, or product damage, leading to faster replies and enhanced consumer trust (Adewale, 2025). Aside from increasing consumer satisfaction, proper return management may improve a company's financial success and foster tighter relationships with key customers (Adebayo, 2022).

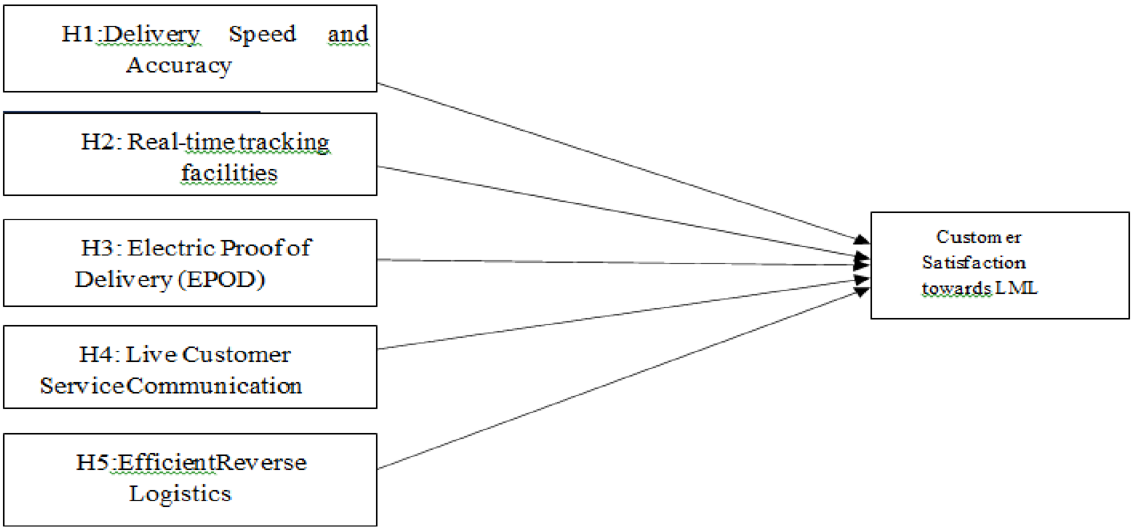
Utaut

The Unified Theory of Acceptance and Usage of Technology (UTAUT), which provides a framework for understanding technology adoption and usage behaviour, is the foundation of this study. Performance expectancy, effort expectancy, social influence, and enabling factors are the four main constructs that UTAUT identifies by combining eight earlier models. (Venkatesh et al., 2012; Lescevica et al., 2013). In last-mile logistics, performance expectancy indicates consumers' view that real-time data technologies, such as real-time tracking, improve delivery speed and accuracy (Ain & Siddiqui, 2020; Zibarzani et al., 2024).

Effort expectancy relates to the ease of using these technologies, such as electronic proof of delivery, which improves customer satisfaction (Peer & Mishra, 2023). Social influence refers to the impact of peers and social media on customers' perceptions of technology use, whereas facilitating conditions refer to the availability of organisational and technical support, such as live customer service and efficient reverse logistics (Lescevica et al., 2013; Thánh et al., 2025; Vrhovac et al., 2024). Together, these structures explain why customers adopt real-time data technologies in LML and how they improve service quality and customer satisfaction.

Theoretical Framework

The diagram reflects the structure of this study, demonstrating the relationships among five independent variables, namely delivery speed and accuracy, real-time tracking facility electronic proof of delivery, live customer service communication, and efficient reverse logistics, and the dependent variable, namely customer satisfaction.



RESEARCH METHODOLOGY

In this study, the research method is quantitative, where a structured questionnaire will be administered through Google Forms, with the respondents filling out the questionnaire themselves. The questionnaire will be divided into four parts. Section A will entail demographic details of the respondents such as age, gender and salary. Section B addresses the independent variables of the study related to LML real-time data analytics, namely delivery accuracy and speed, real-time tracking, electronic proof of delivery, live customer service communication, and effective reverse logistics. This section contains four items for each construct to examine their influence on the performance of LML real-time data analytics. Section C examines the dependent variable, customer satisfaction, which reflects respondents' overall evaluation of LML services. Everything is measured with the help of a five-point Likert scale. The target population of this study comprises individuals who use last-mile logistics services in the Klang Valley. The Krejcie and Morgan (1970) table was used to determine the sample size, which came up with a required sample of 384 respondents. The participants were selected using the convenience sampling method. SPSS was used to analyse the data collected through the questionnaires that were completed. A pilot test was done before the actual data collection so that the questionnaire items could be refined to make them clear and reliable. To determine the internal consistency of the measurement scales, Cronbach's alpha was used. Thereafter, Pearson correlation was performed to establish the strength and direction of the relationships between the study variables, which are delivery accuracy and speed, real-time electronic proof of delivery, tracking live customer service communication, and effective reverse logistics. Lastly, multiple regression analysis was performed to determine the effects of the independent variables on the dependent variable.

RESULTS AND DISCUSSION

Reliability Analysis

Table 1: Reliability Analysis

Variables	Constructs	No. of Items	Cronbach's Alpha	Reliability Level
DV	Customer Satisfaction	10	0.925	Excellent
IV 1	Delivery Speed and Accuracy	5	0.790	Acceptable
IV 2	Real Time Tracking Facilities	5	0.823	Good

IV 3	Electric Proof of Delivery (ePOD)	5	0.855	Good
IV 4	Live Customer Service Communication	5	0.805	Good
IV 5	Efficient Reverse Logistics	5	0.795	Acceptable

N = 388

A total of 35 questions are measured using a Likert scale ranging from 1 to 5, with 1 indicating strongly disagree, 2 indicating disagree, 3 indicating neutral, 4 indicating agreement, and 5 indicating strongly agree. The reliability analysis shows that all constructs utilised in this study have high internal consistency. The dependent variable, Customer Satisfaction, had a Cronbach's Alpha of 0.925, indicating outstanding reliability. Among the independent variables, Electronic Proof of Delivery (ePOD) and Real-Time Tracking showed good reliability, with Cronbach's Alpha values greater than 0.80, indicating that delivery visibility is a well-defined and stable construct in the study. Delivery Speed and Reverse Logistics recorded Cronbach’s Alpha values of over 0.790, which fall within the acceptable reliability range.Thus, the results for all 35 items being evaluated demonstrate that no items are being deleted because their values are all greater than 0.4 and contribute to the variable construct. Overall, the findings indicate that the measurement instruments utilised in this study are reliable and appropriate for future inferential analyses such as Pearson correlation and multiple regression.

Descriptive analysis

Table 2: Collected Respondents demographic

Demographic	**Frequency**	**Percentage (%)**
Gender Male	162	41.8
Female	226	58.2
Age Group	.	
Under 20	45	11.6
21 – 30	179	46.1
31 – 40	80	20.6
41 – 50	55	14.2
51 and above	29	7.5
How often do you use last-mile delivery services? Every week	63	16.2
Once every couple of weeks	135	34.8
Once a month	98	25.3
Once every couple of months	68	17.5
Once every 6 months	24	6.2

Which last-mile logistics service do you find the most reliable? DHL	59	15.2
J&T	201	51.8
POS Malaysia	77	19.8
Ninjavan	49	12.6
Shopee express	1	0.3
Tiktok express	1	0.3

N=388

There are a total of 388 respondents, and among the respondents, male respondents consist of 162 people, which are 41.8% meanwhile female respondents are 226 people, which is 58.2%. The demographic analysis shows that the respondents were predominantly young adults aged 21–30 (46.1%), followed by those aged 31– 40 (20.6%). Next are respondents aged from 41-50 (14.2%), followed by under 20 (11.6%), and lastly those who are 51 and above (7.5%). This indicates that last-mile logistics services are heavily utilised by economically active and digitally engaged consumers.

In terms of income, the highest is under RM1,700(34%). Next income is between RM3,701 - RM5,700 (22.4%) and followed closely with RM1,701 - RM3,700 (21.6%). Besides, the income of RM5,701 - RM7,000 (14.4%) and lastly is income over RM7,000 (7.5%). the majority earned below RM3,700, reflecting strong adoption of last-mile delivery services among middle- and lower-income groups. Notably, 100% of respondents had used last-mile logistics services, confirming the relevance of the sample to the research objectives.

Usage frequency results show that most respondents use these services once every couple of weeks (34.8%) Followed by once a month (25.3%). Next is one every couple of months (17.5 %), followed closely by every week (16.2 %), and lastly once every 6 months (6.2%). It suggests that last-mile delivery has become a routine service rather than an occasional convenience. In terms of perceived reliability, J&T Express was identified as the most reliable provider (51.8%), followed by POS Malaysia (19.8%) and DHL (15.2%). This highlights the competitive dominance of private logistics firms in Malaysia's last-mile delivery market.

Pearson's Correlation Analysis

Table 3: Pearson's Correlation of Independent Variables and Dependent Variable

	Customer Satisfaction	**Delivery Speed and Accuracy**	**Real Time Tracking Facilities**	**Electric Proof of Delivery (ePOD)**	**Live Customer Service Communication**	**Efficient Reverse Logistics**
Customer Satisfaction	1					
Delivery Speed and Accuracy	0.773 **	1				
Real Time Tracking Facilities	0.812 **	0.751 **	1			

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Electric Proof of Delivery (ePOD)	0.771 **	0.742 **	0.769 **	1		
Live Customer Service Communication	0.760 **	0.680 **	0.735 **	0.720 **	1	
Efficient Reverse Logistics	0.775 **	0.698 **	0.723 **	0.740 **	0.791 **	1

**. Correlation is significant at the 0.01 level (2-tailed). *Source: (Developed from Research)*

Pearson's correlation analysis was conducted to examine the strength and direction of the relationships between the study variables. The results indicate that all independent variables are positively and significantly correlated with customer satisfaction at the 0.01 significance level, suggesting that the likelihood of these relationships occurring by chance is less than 1%. Among the independent variables, Real-Time Tracking Facilities demonstrate the strongest positive relationship with customer satisfaction (r = 0.812), indicating that increased delivery visibility significantly enhances customer satisfaction. This finding highlights real-time tracking as a key driver of customer perceptions in last-mile logistics services. Other variables also exhibit strong positive correlations with customer satisfaction. Efficient Reverse Logistics (r = 0.775) and Delivery Speed and Accuracy (r = 0.773) demonstrate nearly equal levels of importance, indicating that both timely deliveries and effective return processes are crucial to customer satisfaction. In addition, Electronic Proof of Delivery (ePOD) (r = 0.771) and Live Customer Service (r = 0.760) display strong positive linear relationships with the dependent variable, further confirming the importance of technology-enabled service quality. Furthermore, a high inter-variable correlation is observed between Real-Time Tracking Facilities and ePOD (r = 0.769), indicating that these technology-driven features are often perceived as complementary by users. Overall, the findings confirm strong associations between real-time data-enabled logistics services and customer satisfaction, supporting their inclusion in subsequent regression analysis.

Multiple Regression Analysis

Table 4: Multiple Regression Independent Variable and Dependent Variables

	Beta(β) (Standardised Coefficient)	**t**	**Sig.**
(Constant)		1.179	.239
Delivery Speed and Accuracy	.213	5.185	.000
Real Time Tracking Facilities	.304	6.821	.000
Electric Proof of Delivery (ePOD)	.132	2.992	.003
Live Customer Service Communication	.141	3.206	.001
Efficient Reverse Logistics	.197	4.404	.000
R Square	.773		
Adjusted R-Square	.770		
F Value	260.588		
Sig. F Change	.000		

The goodness of fit of the model is indicated by the R-squared value of 0.773. This value indicates that the independent factors (delivery speed and accuracy, real-time tracking facilities, electronic evidence of delivery, live customer service communication, and efficient reverse logistics) can explain almost 77.3% of the variability in the dependent variable, which is customer satisfaction. Moreover, the F-value of 260.588 at p-value 0.000 indicates the F-value to be significant between the independent variables and the dependent variable. The analysis also indicates how all the variables are important in determining customer satisfaction.

It is worth noting that Real-Time Tracking Facilities ($b=0.304$, $p<0.05$) turns out to be the most significant factor in this study. Then Delivery speed and accuracy ($b = 0.213$, $p<0.05$). The next one is efficient reverse logistics ($b = 0.197$, $p < 0.05$), Live Customer Service Communication ($b = 0.141$, $p < 0.05$), and electric proof of delivery (ePOD) ($b = 0.132$, $p < 0.05$), which give a positive result. As a result, the findings validated the hypotheses H1, H2, H3, H4, and H5 and addressed the research questions and research objectives.

Hypothesis Testing

Table 5: Summary of Hypothesis Results

Hypotheses	**Statement of Hypotheses**	**P Value (p<0.05)**	**Results**
H1	There is a significant relationship between delivery speed and accuracy, and customer satisfaction in last-mile logistics.	.000	**Accepted**
H2	There is a significant relationship between real-time tracking facilities and customer satisfaction in last-mile logistics.	.000	**Accepted**
H3	There is a significant relationship between electric proof of delivery (EPOD) and customer satisfaction in last-mile logistics.	.003	**Accepted**
H4	There is a significant relationship between live customer service communication and customer satisfaction in last-mile logistics	.001	**Accepted**
H5	There is a significant relationship between efficient reverse logistics and customer satisfaction in last-mile logistics.	.000	**Accepted**

The conclusion on the hypothesis results was presented in Table 5. All the hypotheses based on the analysis made justify the fact that the speed and accuracy of real-time data delivery, the availability of real-time tracking facilities, the provision of electronic proof of delivery, the availability of live customer service, and efficient reverse logistics have a significant impact on customer satisfaction in the case of last-mile delivery. H1 to H5 are accepted since the value less than 0.05 is significant.

Delivery speed and accuracy positively influence customer satisfaction, as stated in H1. These claims are supported by correlation analysis and multiple regression analysis, where $r = 0.773$ and $p<0.05$. This supports the theory by Vrhovac et al. (2024), people now prefer fast and dependable deliveries when buying online since they believe it's more convenient than shopping in person. On-time and accurate deliveries increase trust, lead customers to stay loyal for the future, and help the business thrive. It is consistently shown that customers expect their orders to arrive quickly, and delays, incorrect shipments, or missed parcels are not tolerated.

The second hypothesis, H2, stated that there is a significant relationship between real-time tracking facilities and customer satisfaction in last-mile logistics. These claims are supported by correlation analysis and multiple regression analysis, where $r = 0.812$, $p<0.05$. According to Vrhovac et al. (2024), being able to track orders plays the most important role in boosting customer satisfaction**.** Now, people expect to see when their orders reach each step, starting from the moment they order until they get the product. Providing information smoothly determines how satisfied customers are with their online purchases. Giving customers timely and correct updates about products, when their items will arrive, where they are being delivered and when to pick them up matters a lot.

According to Peer et al. (2023), the use of ePOD systems enhances transparency, reliability, and communication in the delivery process, leading to improved customer satisfaction levels. ePOD systems give clients and logistics providers instant and verified delivery confirmations. This builds confidence and reliability, telling customers that their things were handled with care and accuracy. As a consequence, ePOD not only increases logistics businesses' operational efficiency but it also boosts consumer trust and loyalty by providing a transparent and smooth LML experience. This supports H3, where there is a significant relationship between electric proof of delivery (EPOD) and customer satisfaction in last-mile logistics. These claims are supported by correlation analysis and multiple regression analysis, where $r = 0.771$, $p<0.05$.

Based on a study by Vrhovac et al. (2024), providing an easy and customised way for customers to solve their problems can lead to improved customer satisfaction, higher chances of repeat purchasing and continued loyalty to the brand. In the last stage of delivery, when goods are passed directly to the customer, these abilities are very important because the customer's experience there can determine how the service is rated. This supports H4, where there is a significant relationship between live customer service communication and customer satisfaction in last-mile logistics. These claims are supported by correlation analysis and multiple regression analysis, where $r = 0.760$, $p<0.05$.

According to Ain and Siddiqui (2020), the availability and simplicity of product returns have a major influence on how online buyers perceive the delivery service and the merchant. Businesses should make the process of returning products simpler and quicker, given that customers can easily return products through shipping personnel if they encounter an issue with the product received (Thánh et al., 2025). These studies support H5, which states that there is a significant relationship between efficient reverse logistics and customer satisfaction in last-mile logistics. These claims are supported by correlation analysis and multiple regression analysis, with $r = 0.775$ and $p < 0.05$.

CONCLUSION

The research objective is to gain more insight into the efficacy of last-mile logistic real-time information as a means to improve customer satisfaction. The researcher, in this case, will be able to fulfill the research objectives by studying the literature, analyzing the correlation coefficient of Pearson and Multiple Linear Regression analysis and testing the hypothesis as to whether or not the relationships between the independent variables (delivery speed and accuracy of real-time data, real-time tracking facilities, electronic proof of delivery, live communication with customers, and efficient reverse logistics) have any significant effect on customer satisfaction in LML services.

The findings show that delivery speed and accuracy of real-time data, real-time tracking facilities, electronic proof of delivery, live customer service communication, and efficient reverse logistics are all significantly and positively related to customer satisfaction. Therefore, this research successfully met its objective by showing that all independent variables are vital in customer satisfaction. These results are consistent with previous studies and reinforce the importance of adopting advanced logistics technologies and service strategies to remain competitive in the e-commerce and logistics industry.

Thus, businesses should focus on improving last-mile logistics by ensuring fast and accurate deliveries, providing reliable real-time tracking, and adopting electronic proof of delivery systems to increase transparency and trust. They should strengthen live customer service communication to resolve issues quickly and efficiently, especially during the final delivery stage. In addition, companies must simplify and speed up reverse logistics processes to make product returns easy and convenient for customers

The limitation is that the research adopted a cross-sectional design, meaning data were collected at a single point in time. As customer expectations and logistics technologies evolve rapidly, the results may not fully capture changes in customer perceptions over time. For future research, longitudinal studies could be conducted to examine changes in customer satisfaction over time, particularly as new technologies such as AI-driven routing, autonomous delivery, and advanced analytics are increasingly adopted in last-mile logistics.

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