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Strengthening E-commerce Customer Satisfaction through Delivery Service Transparency

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ABSTRACT

The purpose of this study is to investigate the impact of Real-Time Tracking Systems (RTTS) on customer satisfaction through Last Mile Delivery (LMD) Transparency in the context of E-commerce businesses. The research aims to explore how the integration of real-time tracking affects consumer satisfaction, particularly focusing on the transparency of the delivery process. The sample for this study comprised 112 respondents, all of whom were vocational students in Bandung with prior experience in e-commerce transactions and regular use of RTTS to monitor their product shipments. This study employs a quantitative approach, utilizing correlation and regression analysis to examine the relationships among variables. Data was collected using a structured questionnaire distributed via Google Forms, both directly and through social media platforms, targeting respondents who met the study's inclusion criteria. The findings indicate that the use of RTTS has a significant positive effect on customer satisfaction through enhancing LMD transparency in e-commerce, accounting for 55.6% of the variation in delivery transparency. The remaining 44.4% of the variance is attributed to other factors, suggesting that additional elements beyond RTTS also contribute to the transparency and efficiency of the last-mile delivery process. These results highlight the importance of real-time tracking in improving customer experience and operational transparency in the rapidly growing e-commerce sector.

Keywords: Real-Time Tracking System, Last Mile Delivery, Customer Satisfaction; E-commerce

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INTRODUCTION

In the era of increasingly rapid digital transformation, the e-commerce industry has become a major force in the world of global trade (Aprinato, 2021). The extraordinary growth of the e-commerce business has not only created more opportunities for consumers to access various products and services online, but also presents new challenges, especially at the critical stage of the last delivery known as Last Mile Delivery. This stage is one of the most complex aspects of logistics, because it involves direct interaction with end consumers and determines the overall level of customer satisfaction (Morganti et al., 2014; Efawati et al., 2021).

The Last Mile Delivery process often faces various obstacles, ranging from uncertainty in delivery times, unclear status of goods, to problems with inefficient delivery routes (Gevaers et al., 2011). For this reason, the need for transparency and real-time visibility is becoming increasingly urgent in improving the quality of customer experience. According to the Technology Acceptance Model theory (Davis, 1989), the adoption of technology in a service is greatly influenced by perceived usefulness and perceived ease of use, where the Real-Time Tracking System has the potential to fulfill both of these dimensions in the context of delivery services.

In this context, the Real-Time Tracking System is present as an important innovation. This technology allows consumers to monitor the movement of their goods in real time, thereby reducing uncertainty and increasing satisfaction in service providers (Lim et al., 2018). Research by Boysen et al. (2021) also shows that transparency in Last Mile Delivery through real-time tracking contributes significantly to increasing customer satisfaction and loyalty.

The use of the Real-Time Tracking System not only benefits E-commerce service providers by increasing operational efficiency but also has a direct positive impact on consumer experience. This system is able to fix historical problems in Last Mile Delivery, such as late delivery, unclear estimated arrival times, and difficulty in tracking the status of goods (Esper et al., 2003). Thus, the adoption of this tracking system is expected to improve the timeliness of delivery and provide better visibility to consumers regarding the status and location of the products they order.

This study will specifically explore the real impact of the implementation of the Real-Time Tracking System on the transparency and reliability of Last Mile Delivery, with a primary focus on the user experience of Vocational Students who actively use E-commerce services. Vocational students were chosen as the object of research because of the high level of adoption of digital technology and the use of E-commerce platforms among them (Nurain et al., 2024; Rachman et al., 2024). In addition, studies that specifically investigate the perceptions and satisfaction of educated consumers in the context of using real-time tracking are still very limited, so this study is expected to fill the gap in the existing literature.

Therefore, this study aims to analyze the extent to which the Real-Time Tracking System in E-commerce services affects the transparency of delivery and consumer satisfaction of vocational students. With a deeper understanding of the preferences and expectations of these young, educated users, the research results are expected to provide valuable contributions for E-commerce companies and logistics industry players to continuously improve service quality and build long-term relationships with their customers (Thariq & Efawati, 2024).

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LITERATURE REVIEW

Real Time Tracking System (RTTS)

According to Tredinnick (2023) A real-time tracking system is a system that allows you, as a user, to track by relying on GPS satellites at the same time as the vehicle is moving. Users can see and monitor movements in remote locations at the same time. This real-time tracking system can be done by connecting hardware that is installed on your e-commerce application (Tredinnick, 2017). While monitoring can be done by accessing advanced software online. This can make it easier for users to monitor. It informs customers and website owners about the status of the order from start to finish. In this way, customers can regularly check the status of their orders, when the order arrives, delays, etc. Therefore, it ensures smooth product delivery. Order tracking includes tracking shipping status, tracking number, estimated delivery date, etc. In addition, it saves time by automating the entire order tracking process.

This tracking system is very useful in the business industry, especially logistics, to meet customer demand that is more focused on strengthening market position. This is achieved through increasing customer satisfaction and implementing information technology. The system includes physical bots and a global transparency network, effective and efficient in a changing market. However, most of the existing tracking of shipments is designed for that purpose.

Last Mile Delivery (LMD)

According to Kiba et al. (2021) Last mile delivery, or the last stage of delivery in the supply chain, has a central role in meeting customer expectations in the e-commerce business. Basically, last mile delivery includes the activity of delivering goods from a distribution center or retailer directly to the hands of consumers, often via courier services or package delivery services. As the popularity of e-commerce increases, companies are competing to increase efficiency in this last stage.

Last mile delivery, or "last mile" delivery, refers to the last stage in the supply chain where products or goods are sent from a distribution center or retailer directly to their final destination (Mangiaracina, 2019), which is usually the customer's address. Although called the "last mile," the actual distance can vary greatly, depending on geographic location and shipping infrastructure.

Last mile delivery is very important because this stage often involves delivery to the area closest to the customer. This includes various delivery methods, such as the use of couriers, package delivery services, delivery cars, motorbikes, or even the use of drones in some cases.

According to Ranieri et al. (2018) last mile delivery is often a major focus point as it involves the delivery process to the closest area to the customer, and therefore, high time expectations are associated with delivery. This is where customers interact directly with the delivery service, and openness and transparency are key. The use of technology, such as real-time tracking systems, is an important strategy in increasing efficiency and transparency in last mile delivery, ensuring that customers can track their orders accurately, receive real-time notifications, and ensure goods arrive safely and on time.

E-Commerce

E-commerce, or electronic commerce, refers to the activity of buying and selling products or services online through digital platforms. This involves electronic transactions that can

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be done through websites, mobile applications, or other e-commerce platforms. E-commerce has become a major force in the modern business world, providing customers with easier and faster access to shopping, while for sellers, opening up wider market opportunities (Halena & Yovita, 2020; Mulyadi & Efawati, 2024).

E-commerce has changed the way consumers interact with products and services (Novyantri & Setiawardani, 2021; Efawati, 2024). Users can explore various products, compare prices, and read customer reviews before making a purchasing decision (Chaniago, 2020; Chaniago & Efawati, 2020). Technological developments have also driven innovation in terms of online shopping experiences, such as augmented reality to try products virtually or artificial intelligence-based recommendation systems (Rifathurrahman et al., 2024; Efawati et al., 2024). the process of buying and selling services or products between two parties via the internet or the exchange and distribution of information between two parties in one company using the internet.

Economists and business experts, such as Michael Porter, observe that e-commerce has changed the dynamics of competition in various industries. E-commerce enables easier market access for small and medium-sized businesses, while simultaneously increasing the intensity of competition. In addition, business and technology experts such as Amazon's Jeff Bezos emphasize the importance of customer focus and the use of technology to improve operational efficiency. In the global context, Amruddin et al. (2023) predicts the continued growth of e-commerce as a major driver of economic growth, especially with the increasingly widespread use of technologies such as the Internet of Things (IoT) and artificial intelligence to enhance the personalization of shopping experiences and supply chain efficiency. Although e-commerce has brought great benefits, challenges such as online transaction security, data privacy, and the environmental impact of product delivery remain a focus of attention and require innovative solutions (Chaniago & Efawati, 2024).

Real-Time Tracking System and E-commerce Consumer Satisfaction

Real-Time Tracking System is a technological innovation that provides consumers with full visibility into their goods delivery process. With real-time tracking, consumers can find out the current location of the ordered product, estimated time of arrival, and the status of the package's journey transparently (Lim et al., 2018). In the context of E-commerce, this system has great potential to increase consumer satisfaction. According to the Expectation Confirmation Theory by Oliver (1980), satisfaction occurs satisfaction when the service received meets or exceeds customer expectations. Real-Time Tracking System helps reduce customer uncertainty and anxiety about delivery, thereby directly improving user experience and driving their trust. Research by Esper et al. (2003) also confirms that transparency in logistics contributes significantly to the level of consumer satisfaction in online purchases.

Based on the assumptions above, the research hypothesis is as follows:

H1: There is an influence of the Real Time Tracking System on E-Commerce customer satisfaction.

The Role of Last Mile Delivery Mediation

Last Mile Delivery is the last stage in the delivery process that involves delivering products from the warehouse or distribution center to the hands of consumers. This stage is considered one of the most critical components in determining the success of the customer experience in E-commerce (Gevaers et al., 2011). Although the Real-Time

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Tracking System functions to increase visibility, the effectiveness and reliability of Last Mile Delivery are important factors that mediate the relationship. A tracking system without fast, timely, and accurate delivery will still result in a less than satisfactory experience. In other words, the Real-Time Tracking System increases transparency and consumer expectations, but the success of Last Mile Delivery is what truly meets or even exceeds these expectations, resulting in high satisfaction. Conversely, if real-time information shows delays or discrepancies in delivery, consumer trust and satisfaction can decrease. This model is in line with the idea of service delivery gap (Parasuraman et al., 1988), where there is a risk of mismatch between the service promise communicated to customers (via tracking systems) and the actual delivery realization (service performance).

Based on the assumptions above, the research hypothesis is as follows:

H2: There is an influence of Real Time Tracking System on E-Commerce customer satisfaction through Last Mile Delivery

Framework

Figure 1. Framework
Source: Own compilation

RESEARCH METHOD

This study uses a quantitative approach that aims to analyze the relationship between the use of Real-Time Tracking Systems (as independent variable) and Last Mile Delivery Reliability (as mediation variables) on E-commerce Consumer Satisfaction (as dependent variables). The subjects in this study were vocational students at Bandung who are active users of E-commerce services and have experience using real-time tracking systems in monitoring their delivery of goods. The number of samples in this study was 112 respondents selected using purposive sampling techniques, namely based on certain criteria, namely vocational students who have used E-commerce services and actively utilize real-time tracking features. Data were collected through a questionnaire created using Google Form. The distribution of questionnaires was carried out online via social media (WhatsApp, Instagram, Line) and directly through face-to-face meetings on campus. The research instrument was a questionnaire based on a 5-point Likert scale, ranging from "Strongly Disagree" (1) to "Strongly Agree" (5).

The data analysis techniques used include: Descriptive Analysis is used to determine the general description of the characteristics of respondents and their answers, while the Normality Test is used to test whether the data is normally distributed. Meanwhile, Correlation analysis is used to determine the level of relationship between variables. In addition, linear regression analysis is carried out to test the influence between variables. All data processing is carried out using statistical programs such as SPSS.

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Validity and Reliability Test Results

The validity test measures the instrument in the questionnaire, the validity test of each item is carried out by correlating the score of each item with the total score which is the sum of each item score. The trial to obtain validity was carried out on 30 respondents and correlating each respondent's answer item with the total respondent's answer. If the correlation result is >0.3 then the item is valid (Chaniago et al., 2023) Based on the results of the validity test, it was found that all variable instruments got correlation values between 0.5 and 0.8. So it can be concluded that all instruments are valid.

The reliability test of the measuring instrument is used to obtain the suitability of the data results obtained and sourced from the field, or to obtain a measuring instrument that is accurate and consistent in measuring what is to be measured. The results of the reliability test with $\alpha \geq 0.7$ are suitable for testing various purposes in research (Chaniago et al., 2023) both for questionnaires and for field data. Based on the results of the reliability test, it was found that the Cronbach's Alpha value of the questionnaire showed a value of ≥ 0.7, so it can be concluded that the measuring instrument is reliable.

RESEARCH RESULTS

Based on the questionnaires that have been distributed, the following results of the demographic analysis of respondents are presented in Table 1:

Table 1. Profile of respondents

Responden Demography	Profile	Frequency	Percentage
Age	17-19	12	10,71%
	20-24	100	89,29%
Gender	Male	34	30,36%
	Female	78	69,64%
Vocation School	Politeknik Negeri Bandung	82	73,21%
	Politeknik LP3I Bandung	30	26,79%
Type of E-Commerce	Shopee	90	80,36%
	Tokopedia	11	9,82%
	Lazada	5	4,46%
	Mix	6	5,36%
Time using in E-Commerce	1-3 years	77	68,75%
	4-5 years	35	31,25%

Source: Own compilation (2024)

Descriptive Analysis

Descriptive analysis using the average test obtained information such as Table 2.

Table 2. Descriptive Statistic of Real Time Tracking System Variable (X1)

	N	Minimum	Maximum	Mean	Std. Deviation
X1	112	1.00	5.00	4,4925	.70438
X2	112	3.00	5.00	4,4478	.63445
X3	112	1.00	5.00	4,194	.89169

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X4	112	1.00	5.00	3,8955	.81899
X5	112	3.00	5.00	4,3881	.60190
X6	112	1.00	5.00	4,2687	.78975
X7	112	3.00	5.00	4,2985	.73886
X8	112	3.00	5.00	4,2687	.75040
X9	112	2.00	5.00	4,3731	.64751
X10	112	2.00	5.00	4,1194	.76915
X11	112	2.00	5.00	4,3134	.74282
X12	112	2.00	5.00	3,8955	.92334
X13	112	1.00	5.00	4,1493	.87479
X14	112	1.00	5.00	4,0299	1,02942
X15	112	1.00	5.00	3,8955	.90678
X16	112	2.00	5.00	4,0448	.70567
Valid N (listwise)	112			4,19217	

Table 3. Descriptive Statistic of Last Mile Delivery Variable (X2)

	N	Minimum	Maximum	Mean	Std. Deviation
X17	112	2.00	5.00	3,4925	.7043
X18	112	3.00	5.00	4,4478	.6344
X19	112	1.00	5.00	3,194	.8916
X20	112	1.00	5.00	2,8955	.8189
X21	112	3.00	5.00	4,3881	.6019
X22	112	1.00	5.00	3,2687	.7897
X23	112	2.00	5.00	4,2985	.7388
X24	112	3.00	5.00	4,2687	.6504
X25	112	3.00	5.00	3,3731	.5475
X26	112	2.00	5.00	4,1194	.7691
X27	112	2.00	5.00	4,3134	.6428
X28	112	2.00	5.00	4,8955	7233
X29	112	1.00	5.00	4,1493	.8747
X30	112	2.00	5.00	4,0299	.9422
X31	112	2.00	5.00	3,8955	.8698
X32	112	2.00	5.00	4,0448	.8754
Valid N (listwise)	112			4,4215	

Based on the Table 2 and Table 3, it can be seen that the Real Time Tracking System and Last Mile Delivery variables have a minimum value of 1 and a maximum value of 5. The overall average value of 112 respondents is 4.19217 and 4.4215. The highest average value is 4.4925 and 4.8955 while the lowest average is 3.8955.

Tabel 4 Statistik Deskriptif Variabel Y

	N	Minimum	Maximum	Mean	Std. Deviation
Y1	112	1.00	5.00	3,9403	.88558

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Y2	112	2.00	5.00	3,9552	.82449
Y3	112	3.00	5.00	4,3731	.69273
Y4	112	2.00	5.00	4,0896	.84802
Y5	112	2.00	5.00	4,1791	.73702
Valid N (listwise)	112			4,10746	

Based on the Table 4, it can be seen that the Real Time Tracking System and Last Mile Delivery variables have a minimum value of 1 and a maximum value of 5. The overall average value of 112 respondents is 4.10746. The highest average value is 4.3731 while the lowest average is 3.9403.

Table 5. Correlations

Correlations

		TX	TY
TX	Pearson Correlation	1	.745**
	Sig. (2-tailed)		.000
	N	112	112
TY	Pearson Correlation	.745**	1
	Sig. (2-tailed)	.000	
	N	112	112

**. Correlation is significant at the 0.01 level (2-tailed).

From the results of the analysis above, a Pearson Correlation value of 0.745 was obtained with a total of 112 respondents. This figure shows that the Real Time Tracking System and Last Mile Delivery Transparency have a correlation of 74.5% and a significance of 0.00.

Normality Test

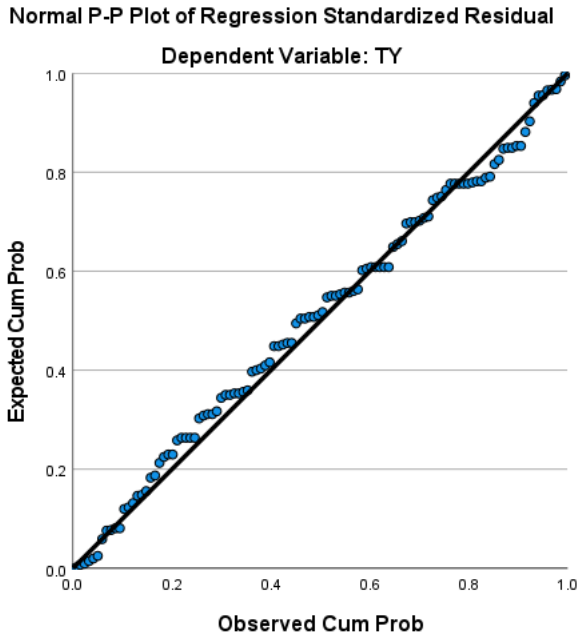

Figure 2 Normal Probability Plot Graph

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Source: Research results (2024)

Based on the Figure 2, it can be seen that the points are spread around the diagonal line. It can be concluded that the data is normally distributed.

Hypothesis Test

Table 6 Model Summary Simple Regression

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.745[a]	.556	.552	1.92519	.556	137.529	1	110	.000

a. Predictors: (Constant), TX
b. Dependent Variable: TY

Source: Research results (2024)

To measure how much influence the real-time tracking system (X1) and last mile delivery transparency (X2) have on E-Commerce consumer satisfaction (Y), a simple regression analysis is used. The value of R square 0.556 or 55.6% can be categorized as good (Chaniago et al., 2023) meaning that consumer satisfaction in using E-Commerce is influenced by the real-time tracking system and last mile delivery by 55.2% and the remaining 45.8% is influenced by other factors.

Based on the total regression analysis, the influence of the real-time tracking system and last mile delivery transparency on consumer satisfaction in E-Commerce is 55.6% significant at 0. This means that the H1 hypothesis which reads "There is an influence of the Real Time Tracking System on E-Commerce customer satisfaction". Likewise, H2 which reads "There is an influence of the Real Time Tracking System on E-Commerce customer satisfaction through Last Mile Delivery", can be accepted.

DISCUSSION

As stated by Soepriyadi (2021), in the context of e-commerce business, the phenomenon underlying the importance of real-time tracking systems and transparency in last mile delivery is very significant. This phenomenon is closely related to changes in consumer behavior, where consumers increasingly prefer to shop online, driving the demand for more efficient and transparent delivery services. Previous research has shown that the level of user satisfaction can be influenced by the extent to which consumers can track and understand the delivery process of the goods they buy.

Demographic data also plays an important role, especially in understanding how vocational students, as an active user group in e-commerce, respond to real-time tracking systems and last mile delivery transparency. Vocational students, representing a tech-savvy and digitally active generation, tend to look for services that are not only efficient but also provide added value to their online shopping experience, such as transparency, real-time updates, and personalized delivery options.

In the theoretical framework, the concepts of satisfaction and convenience emerge as key variables that explain the positive impact of real-time tracking systems and last mile delivery transparency on user satisfaction. These concepts align with research findings indicating that consumers prefer e-commerce services that offer clarity and transparency, particularly in the critical final stages of the supply chain when goods are en route to their destination. Satisfaction increases when consumers are well-informed about the status of

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their purchases, thereby reducing uncertainty and enhancing their overall shopping experience.

However, it is crucial to also consider other theoretical perspectives, such as the theory of information uncertainty. While real-time tracking aims to increase transparency, an overabundance of information especially when it includes negative updates such as delivery delays or route changes can paradoxically lead to consumer anxiety, dissatisfaction, or even distrust. Hence, there is a critical need to balance the quantity and quality of information provided: enough to foster trust and provide reassurance, but not so much that it overwhelms or confuses the user.

This study, conducted on 112 respondents, demonstrated a positive influence between the real-time tracking system and last mile delivery transparency in e-commerce businesses. The R-square value of 0.556 indicates that 55.6% of the variation in the decision to use e-commerce services among vocational students can be explained by these two variables, suggesting a strong influence. The significance value of 0.000 further confirms the statistical robustness of these findings, meeting the requirements for hypothesis testing.

Based on the regression analysis, the contribution of the Real-Time Tracking System and Last Mile Delivery Transparency accounts for 55.2% of the influence on consumer decisions in the e-commerce business, while the remaining 44.8% is attributed to other factors such as price, product variety, customer service, brand reputation, and promotional strategies.

In addition to these findings, this study also highlights that Last Mile Delivery acts as a mediating variable between the Real-Time Tracking System and e-commerce customer satisfaction. Specifically, the real-time tracking system indirectly affects customer satisfaction through improvements in the last mile delivery process. This means that even though real-time tracking directly enhances satisfaction by increasing transparency and reducing uncertainty, its full impact is realized when it simultaneously improves the perceived efficiency, reliability, and transparency of last mile delivery.

The mediating role of last mile delivery suggests that the quality of the delivery experience is a critical bridge between technological capabilities (tracking systems) and the emotional and cognitive responses of consumers (satisfaction). A real-time tracking system that is integrated well with a smooth, transparent, and timely last mile delivery process will significantly enhance customer satisfaction, while any disruption in the delivery process despite good tracking can negate the potential positive effects.

Thus, the results of this study underline the strategic importance of not only implementing a real-time tracking system but also ensuring that it is closely linked to a reliable last mile delivery system. Understanding consumer preferences related to delivery transparency and performance can provide companies with a competitive advantage, improve customer loyalty, and foster stronger, long-term relationships. Moreover, companies should carefully design their logistics operations to ensure that transparency is complemented by efficiency and problem-solving capabilities in last mile delivery.

In conclusion, the successful integration of real-time tracking and transparent last mile delivery processes not only enhances user satisfaction but also plays a pivotal role in shaping consumer trust and loyalty in the highly competitive e-commerce market. Future research could explore additional moderating factors such as emotional responses, brand familiarity, and cultural differences to gain deeper insights into the dynamic interplay between tracking transparency, last mile delivery performance, and consumer behavior.

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CONCLUSION

The implementation of the Real-Time Tracking System through Last Mile Delivery E-commerce as a system that increases the trust and satisfaction of e-commerce consumers opens a new window to a level of transparency that was previously difficult to achieve. The research findings show that this technology provides clarity and direct visibility to consumers regarding the status and position of goods delivery. Vocational students as active users of E-commerce consider this real-time information very valuable because it can minimize uncertainty and increase trust in the delivery process.

Based on the results of the hypothesis test, it was found that the Real-Time Tracking System has a positive and significant effect on Last Mile Delivery Transparency. Furthermore, Last Mile Delivery Transparency acts as a mediating variable that strengthens the influence of the Real-Time Tracking System on user satisfaction. The results of the analysis show an R Square value of 0.556, which means that 55.6% of the variability in user satisfaction can be explained by the existence of real-time tracking and delivery transparency. The significance value of 0.000 also confirms that the influence is very strong and statistically acceptable.

Thus, this study confirms that the existence of a Real-Time Tracking System through Last Mile Delivery is not only a technological innovation, but also a key factor in increasing consumer satisfaction in delivery services in the context of Vocational Students who are active in E-commerce. This system indirectly increases the level of user satisfaction through increased transparency of delivery.

Furthermore, this study shows that a smooth and reliable user experience in the final stage of delivery significantly contributes positively to consumer satisfaction to the E-commerce services used. Therefore, the implementation of a Real-Time Tracking System through Last Mile Delivery is a very important strategic step in building an E-commerce ecosystem that is responsive to user expectations and needs, and is able to create competitive advantages amidst increasingly tight digital market competition.

Further Research Suggestions

This study provides a strong picture of the role of Real-Time Tracking System and Last Mile Delivery transparency on E-commerce user satisfaction, especially Vocational Students. For further research, it is recommended to expand the scope of variables by including other factors such as delivery speed, customer service, and price perception. In addition, the study can be expanded to other consumer groups outside of Vocational Students and use a longitudinal method to see changes in perception over time. Further researchers are also advised to explore the negative effects of information overload in real-time tracking, and test additional mediating variables such as trust or perceived value to enrich the research model.

Managerial Implications

For E-commerce management, the results of this study emphasize the importance of integrating accurate and user-friendly real-time tracking technology, while strengthening the quality of last mile delivery services so that the user experience remains positive. Companies need to ensure proactive communication when delivery problems occur, and utilize tracking data to personalize services and build customer loyalty. In addition, companies must maintain a balance in providing information to consumers enough to increase trust, but not too much to cause confusion or anxiety. With the right strategy, real-time tracking and shipping transparency can be a major competitive advantage in the E-commerce ecosystem.

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