

Perceived Ease of Use, Usefulness and Trust towards Consumer's Intention to Adopt Automated Parcel Locker as Last Mile Delivery

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Abstract

The escalating demand for home delivery as the last-mile solution has led to inefficiencies, and environmental concerns within the supply chain. A combination of Technology Acceptance Model (TAM) and other external variables formed the conceptual model for this research. This study aims to explore the relationship between the attributes of automated parcel lockers (APL) and consumers' intentions to adopt them as the last mile solution. The study also seeks to identify the most significant attributes influencing consumer intention to adopt APL for last-mile delivery. To achieve these objectives, a quantitative explanatory research approach will be employed, utilizing a questionnaire distributed to 385 online shoppers residing in Malacca city. The study found that perceived usefulness, ease of use and trust have positive relationship on consumer intention to adopt APL as last mile which trust have significant impact to intention to use APL. This study offers valuable theoretical and practical implications. The study's significance lies in its potential to unveil critical insights into the factors that drive Malacca consumer acceptance of APL as an efficient last-mile delivery option. The findings may offer valuable implications for logistics and courier service providers and contribute to the optimization of last mile operations.

Keywords: Perceived Ease of Use, Perceived Usefulness, Trust, Last Mile Delivery, Automated Parcel Locker

Introduction

In recent years, Malaysia has an increased growth in parcel volumes due to emergence of e-commerce nationwide. Due to the increasing growth of e-commerce, the amount of parcel delivery services has increased (Tsai & Tiwasing, 2021). According to research conducted by Statista Research Department (2022), from the year 2020 to 2021 the number of parcel volumes delivered by courier service providers in Malaysia has increased by 59.53 percent due to the rapid growth of e-commerce. Despite the growth of parcels volume and e-commerce, logistics and courier service companies are constantly being faced with traffic congestion making it difficult to meet their delivery schedules resulting in inefficiency and excessive cost

of last-mile delivery services (Tsai & Tiwasing 2021). Existing courier services do not meet the objective of traditional delivery on time, it will create dissatisfaction among customers who use internet for shopping. Most of the courier service providers perform regular tasks in collecting and distributing a large volume of parcels, experiencing daily stress to carry heavy consignments down stairs, telephone customers or ask for signatures (Chen et al., 2020).

In order to reduce the time taken for delivery, logistics and courier service providers generally schedule deliveries with customers in advance, so that customers are able to pick up their packages at their preferred time schedule (Chen et al., 2020). According to Mangiaracina et al (2019), novel alternative last-mile delivery solutions such as automated parcel lockers, smart locker, self-pickup parcel station are one of the most widely discussed options for customers to pick up their parcels at their preferred time and place. Quantitative research about consumer intentions in regard to automated parcel locker is limited to a research journals with narrow geographic scopes only.

The construction of the self-pickup technology service such as automated parcel locker reduces labor costs of logistics service providers, the reasons being the delivery personnel only need to deliver the parcels to one stop collection point and not need to deliver parcels from door to door (Boysen et al., 2020). In 2020, the demand towards logistic service increase gradually and it had stimulated the evolution of logistic. According to Kaur (2021), Tasco Berhad, a logistic solution company reported their annual profit in year 2021 had hit all new time which is RM41.27mil during pandemic of COVID-19. This is because efficient logistic service to fulfil order become one of the competitive advantages in e-commerce activity during COVID-19 outbreak as people forced to stay home. Due to increase of consumer demand, the importance of information flows in supply chain become significant. However, every country had forced to lockdown during COVID-19 outbreak peak period to prevent the infection of the virus so this action had brought huge impact to logistic industry. The number of shipments to a certain country had limited and many restrictions are set by inbound and outbound country government. The activities of logistic become less and its significant affect the production of manufacturing industry. The interconnecting of logistic system had proven its significant as customers or any parties within the supply chain can check the availability of goods or service through a tracking system. Today, logistic plays a significant role in most of the industry. It is significant to a business or manufacturer as it can optimize the production and profitability. According to Fugate et. al. (2010) better logistic performance can also offer lower costs, higher customer satisfaction, better supplier relationship, and greater industry reputation.

One of the issues with home delivery in Malaysia is home delivery failure, which when the customer does not show up to pick up. Like the high first-time delivery failure rate, this is caused by consumers who are absent when deliveries are made. According to An et al (2022), in the past six months, more than 50% of online buyers reported not receiving the packages they had ordered due to delivery error. Therefore, customers who lost their packages must wait until the vendor redelivers them; this results in an increase in the cost of transportation and the distance travelled by carriers (Lin et al., 2022). According to research done by Yuen et al (2019), utilization of automated parcel locker saves the company the cost to redeliver. Once the carrier places the package inside automated parcel locker, the customer is alerted via mobile application and at any time (Chen et al., 2020).

In research carried out by Song et al (2019), China has implemented automated parcel hub and self-delivery box to improve the efficiency of home delivery and solve the problem of failed delivery. Consumer willingness to adopt alternative solution such as automated parcel locker as last mile delivery is required to obtain societal benefits. Despite many benefits automated parcel lockers offers, various studies suggest that customers are not willing to adopt the service because of issues such as inconvenience use and exploitation (Wang et al., 2019).

The study aims at evaluating the factors that influence customers intention regarding automated parcel locker as last mile delivery. Most of the published articles discussed theories to identify attributes or factors that influence the user's intention, since automated parcel locker adoption is an alternate solution for the last mile in several Asian nations (Chen et al., 2020). Still, these papers only focused on countries that had long adopted the service. In this study, researcher analyze Malaysian consumer intention to use automated parcel lockers for last-mile delivery to close the knowledge gap and offer a basic grasp of what will be required to create this new parcel service for the institution. The relevant ideas about purpose and acceptability models were deduced in the context of last-mile delivery.

Cultural Influences on Psychological Well-being

The perception and experience of happiness and autonomy in different countries are greatly influenced by cultural aspects, particularly collectivism and individualism. Collectivist cultures prioritize group objectives and social cohesion, typically regarding individual autonomy as secondary to the group's needs and values. This can impact an individual's manifestation of happiness and overall state of being in ways that are significantly distinct from societies that prioritize individualism, where personal accomplishments and independence are usually praised. Triandis (1995) emphasizes that in collectivist contexts, the level of well-being is more strongly linked to the caliber of one's interpersonal connections and collective concordance rather than individual autonomy. Research conducted by Hofstede (2001) has demonstrated that in communities characterized by individualism, personal contentment and freedom contribute to pleasure and overall well-being, indicating a clear association between autonomy and psychological wellness.

Malaysia is an interesting subject for study since it has a combination of traditional collectivist beliefs and a growing emphasis on individualism, especially among urban and younger people. The amalgamation of cultural paradigms has a significant impact on the perception and

significance of psychological concepts such as happiness and autonomy among the younger generation in Malaysia. Malaysian society has a long-standing emphasis on family unity, deference to authority, and the welfare of the community, all of which are typical of collectivist cultures. Nevertheless, the youth have been increasingly exposed to global education and media, economic development, and urbanization, which have introduced and made more common individualistic ideas. As a result, there is a complex interaction between various cultural elements that influences the personal and psychological results of young people.

The intermingling of cultures has a profound and intricate influence on the mental health of young people in Malaysia. Collectivist cultures possess strong social relationships and support

structures that can mitigate psychological stress and improve overall well-being. Conversely, the increasing importance attributed to independence and personal success among the younger generation in Malaysia might result in clashes between personal aspirations and societal norms, potentially having a detrimental effect on mental well-being. Research conducted by Juan et al (2016), indicates that Malaysian young individuals who are faced with the challenge of meeting conflicting expectations may encounter increased psychological conflict, while simultaneously demonstrating enhanced adaptation and resilience. The challenge for psychology research and interventions in Malaysia is to effectively address the distinctive cultural blend, by developing ways that promote well-being in a way that is culturally appropriate. This involves honoring both the collectivist traditions and the individualistic goals of the Malaysian population.

Literature Review

The examination of the past research literature provides an understanding of the factors influencing customer intention to utilize automated parcel lockers as last mile delivery, focusing on the perceived usefulness, perceived ease of use, and trust. Hence, the factors affecting the adoption of smart logistics in logistics company has been discussed.

Automated Parcel Locker

Automated parcel lockers are also called parcel locker boxes, self-service delivery lockers, smart lockers or parcel locker service (Vakulenko et al., 2017). Automated parcel locker can be defined as unattended automated box and can be accessed by a key or code and can notify the final consumer of the delivery via email or a mobile phone (Lemke et al., 2016). Automated parcel lockers have compartments that will only open after customer authentication which is more secured compared to regular locker parcels. Automated parcel lockers are also a secure way to keep valuables and help prevent the issue of lost keys (Luís et al., 2022).

In general, automated parcel locker is a type of alternative solution to last mile delivery that allows consumers to receive items on their preferred time schedule (Iwan et al., 2016). According to An et al (2022), because they are not required to give their home address while using parcel lockers, customers can lessen the likelihood of failed delivery and losses. According to Yuen et al (2019), the use of smart lockers saves the cost of firms which occurs due to re-delivery. Such innovative solution help reduce failed delivery and reducing the impact of environmental issues (Liu et al., 2019). For automated parcel lockers to be selected as an alternative to last mile for consumers, the consumers must come to view them as useful, easy to use and trustworthy.

Technology Acceptance Model

Technology Acceptance Model (TAM) was a research theory developed by Davis in 1989. This theory is widely used to illustrate the relationship between user's acceptance and adoption of a technology (Taufik & Hanafiah, 2019). Technology acceptance model is significant for research topic related to technology acceptance (Chuttur, 2009). In addition, TAM was widely employed in research articles to gauge how well-liked novel technologies were based on perceived usefulness and ease of use (Davis, 1989). Next, according to research done by Lai (2017), stated that perceived usefulness and ease of use affect the consumer intention to adopt a certain technology. In short, TAM is a hypothesis that may be used to create a research framework for the study of technology acceptance. TAM can be used to investigate the adoption of technology, such as an automated parcel locker, in relation to customer adoption intentions.

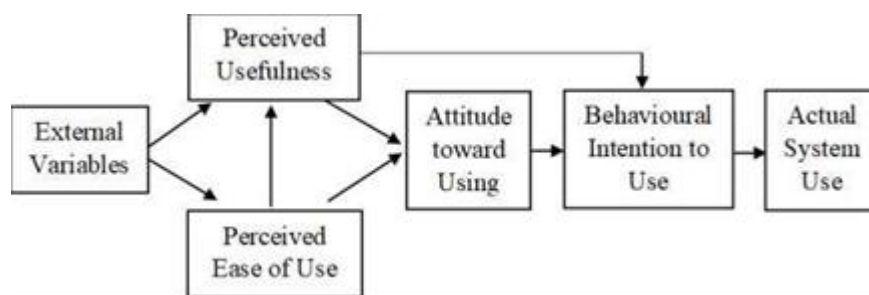


Figure 1: Technology Acceptance Model (TAM)

Source: Davis (1989)

Perceived Ease of Use

Davis (1989) highlighted that the degree to which a person thinks using a specific service can enable one to work with less effort is referred to as perceived ease-of-use. Researchers from China stated ease of use is what makes parcel lockers operate smoothly and shortens the time it takes for customers to pick up their packages (Yuen et al., 2019). Besides that, Wasan (2018) research paper mentioned consumers high value ease of use and positively influenced their purchase intentions and satisfaction. Yan et al. (2019) show that perceived ease of use positively influences consumers product usage intention. In addition, Yuen et al. (2019) discovered a link between perceived ease of use and consumer intent to adopt, concluding that the easier a technology is to use, the more probable it is that a customer will be willing to adopt.

H1: There is a significant relationship between perceived ease of use and the intention to adopt the automated parcel locker as last mile delivery.

Perceived Usefulness

According to Davis (1989), the users perceived usefulness refers to the ability of users of a certain technology to improve their work output. In his research, Davis discovered that perceived usefulness had a significant impact on how users accepted and intended to embrace a particular technology. Mohd Suki et al (2008), in their studies has stated perceived usefulness is one of the significant factors in TAM theory that impact consumer behaviour intention to adopt certain technology.

H2: There is a significant relationship between perceived usefulness and the intention to adopt the automated parcel locker as last mile delivery.

Trust

Individual perception influences whether a favorable or negative outcome is achieved and is the foundation of trust (Arora & Sahney, 2018). A study by Cheng et al. (2019) claims that knowledge of the trust factor is necessary to interpret a technology user's conduct. The technology acceptance model (TAM) states that trust is essential for consumers to be willing to use new technological services. The ease of use and protection of users' privacy of technology-based services, as shown by a study conducted in the United States by An et al. in (2022), increases the possibility that consumers will adopt the technology.

H3: There is a significant relationship between trust and the intention to adopt the automated parcel locker as last mile delivery.

Last Mile

Last mile can be thought of as the organization and management of the items' transportation and storage from the last dispatch location to the delivery point (Ha et al., 2022). Similar to last mile delivery, supply chain activities that connect products from storage facilities or distribution centres to the final consumer include transportation. (Miko and Abbas, 2024). One of the most difficult and expensive components of logistics is last-mile delivery. (Mangano & Zenezini, 2019).

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Consumer Intention to Adopt

Many studies are being conducted to determine using resource matching theory in China to study consumer intention (Chen et al, 2020). The recent development of automated parcel locker service by many commercial operators like online retailers and logistics service providers is critical in motivating customers to adopt this innovation service (Yuen et. al., 2019).

Customers' readiness to engage in certain behavior and likelihood of doing so after placing an order on an e-commerce site are referred to as their intention to use parcel locker service (Wang et al., 2019). It is crucial to comprehend what influences customers' decisions to use parcel locker services as the demand for shipments from e-commerce continues to rise (Tai & Tiwasing, 2021). Customers' reluctance to use parcel locker service is especially apparent in nations like Singapore, where the industry is still in its infancy (Yuen et al., 2019).

Only about 5% of packages are delivered to self-pickup locations such as automated parcel station allowing clients to pick up their packages, according to Ninja Van, a last-mile logistics service company in Singapore (Yuen et al., 2019). Consumers tend to the deciding rights whether or not to try a new service such as automated parcel locker as their last mile delivery service, and the traditional method such as home delivery remains their primary choice (Rout et al., 2022). According to Moroz & Polkowski (2016), home delivery is pricey, so logistics service providers are developing cutting-edge technologies like APL as a substitute for home delivery to address the issues and challenges. The TAM theory attributes in this study, such as perceived ease of use, usefulness, and trust directly influence the customers' intention in the study which could be prioritized by logistic service providers.

Method

This research uses quantitative research design specifically exploratory research. Questionnaires are distributed to respondents who frequently shopping online that residing in the Southern part of West Malaysia, specifically in Melaka. The research closely examined the intention of online shoppers in adopting the APL services.

Results and Discussion*Descriptive Analysis*

Data were collected from 385 respondents. Age, gender, marital status, employment status, monthly income, housing types and parcel delivery usage per month are all personal information considered in this study. The age range of the responders is between 18 and 40 years old. 37% of the respondents are in the range of age 18-24 years old, while the respondents in their 40 years and above constitute only the 10.9% of the respondents. As for gender, majority of the respondents are male, which is at 54.3%. Most of respondents are living in the high rise building with the percentage of 71.9% as compared to 28.1% respondents living in landed housing area. Most respondents, which at 40% that used the parcel locker as last mile delivery service only used it 1 to 3 times per month while only 26.5% of respondents used parcel locker more than 6 times.

Correlation Analysis

The Pearson Correlation test examined the relationship between independent variables (perceived usefulness, perceived ease of use and trust) and dependent variable (the intention

to adopt the APL services as last-mile delivery). The outcome of the correlations is summarised in Table 1. As shown in Table 1, all variables are significantly linked to the intention to adopt APL as last-mile delivery. As a result, it indicated that, trust has the highest correlation value with 0.859 which is significant at 0.00 level (2 tailed). Perceived usefulness, on the other hand, has the lowest correlation value of 0.822, which is significant at the 0.00 level.

Table 1
Pearson Correlations

| | | Perceived Usefulness | Perceived Ease of Use | Trust | Intention to Adopt APL |
|------------------------|---------------------|----------------------|-----------------------|--------|------------------------|
| Perceived Usefulness | Pearson Correlation | 1 | .852** | .815** | .822** |
| | Sig. (2-tailed) | | .000 | .000 | .000 |
| Perceived Ease of Use | Pearson Correlation | .852** | 1 | .849** | .830** |
| | Sig. (2-tailed) | .000 | | .000 | .000 |
| Trust | Pearson Correlation | .815** | .849** | 1 | .859** |
| | Sig. (2-tailed) | .000 | .000 | | .000 |
| Intention to Adopt APL | Pearson Correlation | .822** | .830** | .859** | 1 |
| | Sig. (2-tailed) | .000 | .000 | .000 | |

Multiple Regression Analysis

Multiple regression analysis was utilized in this study to investigate at the impacts of independent variables (perceived usefulness, perceived ease of use and trust) on dependent variable (intention to adopt APL as last mile delivery). The results of multiple regression analysis for intention to adopt APL as last mile delivery are summarised in Table 2.

Table 2
Model Summary

| Model | R | R ² | Adjusted R ² | Std. Error of the Estimate |
|-------|-------------------|----------------|-------------------------|----------------------------|
| 1 | .889 ^a | .791 | .789 | .32897 |

The R-square value was .791, indicating that the three independent variables can explain 79.1 percent of the variance in the intention to adopt APL. Other variables not examined in the study influenced the remaining 20.9 percent.

Empirical Results

Table 3 has shown that all proposed determinants are significantly associated with the intention to adopt APL as last mile delivery with coefficient estimation of trust (Beta=0.515;

Table 3
Coefficients

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|-------|-----------------------|-----------------------------|------------|---------------------------|--------|------|
| | | B | Std. Error | Beta | | |
| 1 | Constant | -.099 | .097 | | -1.028 | .305 |
| | Perceived Usefulness | .284 | .051 | .264 | 5.573 | .000 |
| | Perceived Ease of Use | .226 | .052 | .208 | 3.990 | .000 |
| | Trust | .515 | .052 | .467 | 9.945 | .000 |

p<0.001), perceived usefulness (Beta=0.284; p<0.001) and perceived ease of use (Beta=0.226; p<0.001). The sign of the regression standardized estimate (Beta) represents the positive or negative impact of the predictors on the dependent variable. Therefore, it can be stated that all determinants (trust, perceived usefulness and perceived ease of use) have positive effect on the adoption of APL as last mile delivery. With reference to Table 3, the regression equation is as follows:

$$\text{Adoption of APL as Last Mile Delivery} = 0.099 + 0.515 (\text{Trust}) + 0.284 (\text{Perceived Usefulness}) + 0.226 (\text{Perceived Ease of Use})$$

$$\text{Adoption of APL as Last Mile Delivery} = 0.099 + 0.515 (\text{Trust}) + 0.284 (\text{Perceived Usefulness}) + 0.226 (\text{Perceived Ease of Use})$$

Discussion and Research Implications

This study had interpreted and contextualized the model to identify and suggest a few factors, including perceived usefulness, convenience of use, and trust, that influence customers' intention to use automated parcel locker service. The final noteworthy theoretical contribution explains and defines the relationship between the attributes and how they affect consumers' intention to utilize automated parcel locker service as last mile. The findings are congruent with the study done in Thailand by Thongkam et al (2021), his research also aids academic scholars and practitioners by conceptualizing and validating consumer adoption of automated parcel locker service as last mile.

The overall findings provide important information that helps consumers to utilize automated parcel locker services as a last mile as an alternative to home delivery. Besides, the overall findings provide key information helps logistics courier service providers and automated parcel locker service provider in Malacca to supply a better automated parcel locker service as alternative last mile delivery based on consumer's demand, since customers always take

service characteristics like perceived usefulness, perceived ease of use, and trust into consideration before utilizing new technology services. In this study, trust is the most significant influence towards the intention to adopt automated parcel locker as last mile. The trustworthiness of a technology service is one of the primary factors that lead consumers to use automated parcel locker as last mile (Soodan & Rana, 2020). Therefore, logistics and courier provider need to ensure consumer trust by securing their personally privacy and need to ensure that their smart lockers offer service accurately and must ensure the consumer personal data will be kept confidential. Tsai and Tiwasing (2021), confirmed that trust attribute has significant effect on consumer's intention to adopt automated parcel locker service in Thailand.

From the perspective of perceived usefulness factor, the findings revealed that the utility of automated parcel lockers as a last-mile solution positively influences a consumer's inclination to use them, aligning with findings from various studies on the intention to adopt automated parcel lockers (Thongkam et. al., 2021; Chen, 2020; Yuen et al., 2019). Thus, this study contributes to previous research by confirming that perceived usefulness of automated parcel lockers significantly enhances consumers' intention to utilize them for last-mile delivery. A pivotal aspect of perceived usefulness entails customers' belief that employing automated parcel lockers for last-mile delivery eliminates the need to wait at home for deliveries or rely on others for assistance (Thongkam et. al., 2021). For example, enhancing the usefulness of automated parcel lockers for users could involve strategic placement near locations such as MRT stations, universities, and shopping malls to cater to users' needs throughout the day.

The results show a strong positive correlation between consumer intention to utilize automated parcel lockers as final mile and perceived ease of usage. This outcome is consistent with the findings of Xu et al (2019), who discovered that consumer behavior when using technology-based services is positively influenced by simplicity of use. In response to customer demands for user-friendliness, logistics and courier service providers might offer features like chatbots for seamless onboarding, artificial intelligence assistants, and FAQs to help with common queries. As conclusion, research help logistics and courier service providers to improve the existing last mile service and consumer have an alternative way to collect parcel other than conventional home delivery services.

The technology for last-mile deliveries is actively evolving, in which over the years, the rapid advancement of innovative technology in last mile delivery is getting cheaper and better. For example, automated drone delivery as last mile was widely use in densely populated cities to deliver small to medium-sized parcels. Thus, future research can explore on intention to adopt drone technology as a last mile.

Conclusion

This research adds to the expanding collection of study on logistical issues focusing on the downstream of supply chain efficiencies through the adoption of automated parcel locker as last mile delivery approach. The results indicate that trust is the most attribute factor in adoption new innovation such as the automated parcel locker, whereas perceived usefulness is the least factor that attribute to the new approach. It enhances the comprehension of alternative solutions for home delivery drawbacks.

The research extends existing technology adoption models, such as the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT), by introducing trust as a crucial determinant in consumer adoption. While these models typically emphasize perceived usefulness and ease of use, this study positions trust as the dominant factor, suggesting a shift in the understanding of how consumers adopt emerging technologies in logistics. This finding challenges and refines traditional technology adoption theories. By highlighting trust as the most significant factor in the adoption of automated parcel lockers, the research contributes to the theoretical understanding of the role of trust in the context of logistics innovation.

This study provides a theoretical foundation for future research to explore trust-building mechanisms in logistics technologies. Most last-mile delivery research focuses on operational efficiency, cost reduction, and consumer convenience. This research broadens the theoretical scope by integrating consumer behavioral aspects (like trust and perception of usefulness) into the study of last-mile logistics. It contributes to a more holistic view of how technology adoption impacts not only operations but also consumer engagement. Furthermore, the study also contributes to the theoretical discourse on sustainable logistics, adding parcel lockers as a solution that could reduce the environmental impact of deliveries by decreasing delivery failures and minimizing vehicle emissions. This reinforces the theoretical argument for sustainable innovations in logistics and their role in addressing global environmental challenges. Apart from that, the research is highly relevant in the context of the growing e-commerce industry, where fast, efficient, and reliable delivery is crucial. The findings encourage businesses to focus on building trust with consumers to foster the adoption of these lockers, a critical step in scaling these technologies.

The research situates itself in the context of shifting consumer preferences towards more flexible and convenient delivery options. As e-commerce continues to grow, consumers increasingly value convenience and flexibility in delivery services. By analyzing consumer behavior in relation to parcel lockers, this research highlights the importance of designing delivery services that align with modern consumer expectations. Last-mile delivery is one of the most expensive and logistically challenging segments of the supply chain. This study also offers a context-specific solution that addresses common last-mile delivery issues such as missed deliveries and long wait times, since it provides insights into how alternative delivery methods can alleviate these challenges, especially in urban environments.

These contributions position the research as a valuable asset for both academics and industry practitioners working in the rapidly evolving fields of supply chain management, logistics, and e-commerce.

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