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Impact of Automated Parcel Stations on E-Commerce's Last-Mile Delivery

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Abstract
As technology develops and advances, last-mile delivery is deemed to be a crucial component of online trading. The use of Automated Parcel Stations (APS) sustenance sustainable last-mile delivery among SMEs and e-commerce users. Thus, ensuring APS can increase efficiency, reduce shipping and labor costs, and offer free, convenient delivery and return processes are essential. This study aims to understand the challenges of APS usage and propose a mitigation strategy for better use of APS in Malaysia towards enhancing last-mile delivery services among SMEs and e-commerce users.

Keywords: Automated parcel station, last-mile delivery, e-commerce, sustainable supply chain management

1.0 Introduction
E-commerce is the common practice of broadcasting information about products and services over computer and electronic networks, which has benefited the advancement of individual communication. E-commerce focuses on lowering costs while maintaining and improving the speed and quality of services to meet the needs of businesses, customers, and organizations (Choshin & Ghaffari, 2017). The concept of e-commerce has impacted traditional brick-and-mortar stores. E-commerce, on the other hand, has its own set of threats. Consumers are migrating to e-commerce services for various reasons, including convenience and cost savings (Savrul et al., 2014). However, over time, it has been established that customers frequently fail to receive their orders. Missed deliveries are more common, which hurts both the buyer's and the seller's interests.

The growing tendency to deliver parcels has impacted online delivery companies' whole supply chain distribution, especially during the post-COVID-19 pandemic. Alike the expansion of e-commerce has led to an increase in the use of last-mile delivery for package delivery in the metropolitan area. Online retailers aim to provide clients with very responsive last-mile delivery solutions to boost revenue and capture market share from competitors (Rajendran & Wahab, 2022). According to the previous study, challenges such as extended lead time and failure of door-to-door delivery are not the only issues with last-mile delivery in Malaysia (Ballare & Lin, 2020). Another challenge includes missing deliveries, delivery flexibility, real-time visibility, delivery options, specific delivery slot selection, and a few

others (Rajendran & Wahab, 2019). These challenges trigger hindrances in the express industry's development, growth, and expansion.

2.0 Literature Review

The growth of e-commerce, on the other hand, has boosted the use of last-mile delivery for package delivery in cities (Rajendran & Wahab, 2022). Moreover, last-mile delivery in metropolitan areas keeps rising with e-commerce retail sales growth. The high-quality last-mile delivery business currently aids the business-to-consumer (B2C) commerce sector. Because of the increase in demand from the B2C sector in Malaysia, last-mile delivery in business has experienced a substantial increase in volume. The express industry has seen tremendous expansion in recent years. Malaysia's e-commerce sector is approximately RM1.09 trillion in 2021; by 2025, it is predicted to increase to RM1.65 trillion (Gomes, 2022).

Moreover, online businesses are attempting to increase sales and take market share from their rivals by offering customers highly responsive last-mile delivery services (Allen et al., 2017). However, there have been several reported problems with this service, which have reduced delivery efficiency, which in turn causes customer unhappiness. Additionally, the peakiness of seasonal demand patterns, reduced lead times between customer orders and deliveries, complex sets of delivery time services, high delivery failure rates related to deliveries to residential addresses, the need to manage high levels of product return, and the lack of affordable urban logistics services are the most common operational pressures placed on last-mile logistics providers (Allen et al., 2017). Accordingly, these problems typically arise when distribution service arrangements are made between the transportation hub and the ultimate delivery to the customer's location.

Comparable, consumer problems such as delivery delay, not being at home, or being forced to stay home to pick up a parcel might result in first-time delivery failure. A customer's absence was a significant factor in product delivery failure (Visser et al., 2014). This occurred because most parcel delivery services delivered the items during business hours or the recipients weren't at home for various reasons. When deliveries are unsuccessful, customers will be contacted to schedule a new delivery window or pick up their orders from the closest post office. Customers may be unhappy because they have to pay extra fees that result from failed deliveries, either on their own or through shipping courier services. Thus, alternative distribution methods for e-commerce enterprises are required to mitigate such challenges. Thus, automated parcel stations (APS) are an enormous source of reliability and a better delivery mechanism in these scenarios. APS is now an important part, particularly for those who live in the city center (Xiao et al., 2018). APS provides customers with amenities such as parcel collection and delivery with additional freedom. Customers can choose from various postal addresses by using the APS delivery system, which is easily accessible at public locations and metro stations (de Oliveira et al., 2017). Fig. 1 demonstrates some of the APS providers available in Malaysia.

Fig. 1. List of available APS in Malaysia

APS also referred to as smart locker, parcel locker, smart/intelligent box, delivery box, and (shared) reception box, have been suggested as a long-term alternative to the above problems with home delivery. APS is an unattended or automated box attached to a wall outside the customer's home in a safe place and can be opened with a key or an electronic code. Consumers can be notified of the delivery by text message or email (Lemke et al., 2016). Most of the time, the APS is used to store packages, but it can also hold food if it can keep the temperature stable. APS can improve vehicle routing, lowers delivery costs for logistics operators, and reduce the stress on drivers who have to deal with wrong addresses and missed deliveries (Zenezini et al., 2018). Alike APS can lower consumer shipping costs and make delivery and return services more accessible and proactive. APS also enables cutting environmental emissions by up to two-thirds (Seghezzi et al., 2022).

APS has met the demands of e-commerce retailers and online customers for quick delivery (de Oliveira et al., 2017). However, APS may have various drawbacks, such as pricey services, high costs, and data loss due to functional or technological issues. Nevertheless, before APS was established to solve the last-mile delivery problem, no alternative fool-proof and cost-effective system had been introduced (Seghezzi et al., 2022). As more people shop online, notably during the COVID-19 pandemic, the quality of parcel delivery has become increasingly crucial (Rajendran & Wahab, 2022). Hence, the current study attempts to uncover the challenges that APS providers faced when it comes to last-mile delivery. Because of the massive increase in e-commerce transactions, there is a need for APS studies to improve and ensure the effectiveness of APS implementation.

3.0 Methodology

The issues that APS providers and users experience when it comes to last-mile delivery are investigated using a qualitative approach. This study, in particular, uses descriptive research methodologies to explain the APS scenario in Malaysia, particularly during the post-COVID-19 pandemic. In-depth semi-structured interviews were performed with representatives from seven APS providers in central Malaysia. However, due to confidentiality, the names and organizations of the respondents will not be revealed (Table 1). Furthermore, the authors are observing the current trend in APS and its challenges, proposing mitigation strategies through a field observation among the APS user, and performing a detailed content analysis. This is because authors can get more significant, detailed, and richer results through observational research (Talib & Wahab, 2021). Secondary data such as referred journal articles, books, newspapers, and online databases are also used to obtain information. Then, the data were analyzed qualitatively by looking for themes and patterns.

Table 1. List of experts

Company	Respondent's Designation	Working Experiences
MY1	Operations Team Leader	> 18 years
MY2	Senior Manager	> 12 years
MY3	Managing Director	> 11 years
MY4	Chief Operating Officer	> 15 years
MY5	Co-Founder & CEO	> 13 years
MY6	Digital Engineering Leader	> 15 years
MY7	Operations Manager	> 21 years

Note. Names of the experts and organisations are not revealed as per anonymity commitment.

4.0 Findings and Discussion

4.1. Challenges Faced from the Operator Perspective
4.1.1. Disagreement opinion among the APS providers
APS services can be shared among the delivery providers. However, the safety issue, space, and status of the parcel (prohibited) remain a concern among the APS providers. Additionally, the APS installation should get full cooperation from the local citizens, the premises owners, and local authorities (Zurel et al., 2018). This is an issue when the APS provider does not prefer the selected location. It will jeopardize the entire last-mile delivery, resulting in consumers opting for the home delivery mode (Lachapelle et al., 2018).

4.1.2. Location constraints
The effectiveness of the APS is heavily reliant on its location within the city. Hot spots with a high density of population, pedestrian areas, shopping centers, bus stations, and business centers are among the suitable location for installing APS (Lachapelle et al., 2018). However, it is difficult to find a suitable location and considerable effort must be expended by negotiating with public authorities, considering legal difficulties, and systematizing the leasing process.

4.1.3 High initial investment
A high cost is required for the initial investment, which includes the administration, locker maintenance, repair, and operating costs such as security, digital technology, and energy efficiency (Hübner et al., 2016). However, APS usage remains low and unpopular. This is because senders and receivers prefer to ship and receive directly from couriers and verify things before paying to ensure the legitimacy and quality of products (Wahab, 2021).

4.2. Challenges Faced from the From User Perspective
4.2.1. Lack of awareness
Lack of knowledge of APS benefits leads to its low usage. A proper guideline or manual to use the APS services is required, particularly for the elderly. This is due to the APS requiring digital knowledge for tracking systems for delivery/collection notification and payment methods (Wang et al., 2018). Similarly, a limited and unadvertised APS location is among the factors of its low usage (Huang et al., 2019). Moreover, the negative perspective about safety and technical difficulties is among the issues that hinder APS utilization.

4.2.2. Unattended delivery payment issue
Despite the rise of e-cash, e-checks, and e-wallets, COD is still the most popular payment method opt by e-commerce consumers (Halaweh, 2018). Since most e-commerce transactions employ COD payment, APS usage has become unpopular. Furthermore, the cost of using this service is among the issues of APS utilization. Customers are being charged an additional fee for using the APS service to defray the costs of the lockers (Tang et al., 2021). This could be a significant stumbling block for APS usage.

4.2.3 Parcel size constrain
Another problem that prevents the use of APS is the parcel's size, weight, and dimension. According to standard procedure, each locker can only hold one package at once (Schwerdfeger & Boysen, 2022). However, some lockers may contain packages left during earlier shifts that their intended recipients have not yet picked up. The transporter and the customers will have problems due to this situation. Fig. 2 summarizes the challenges faced by both operators and users.
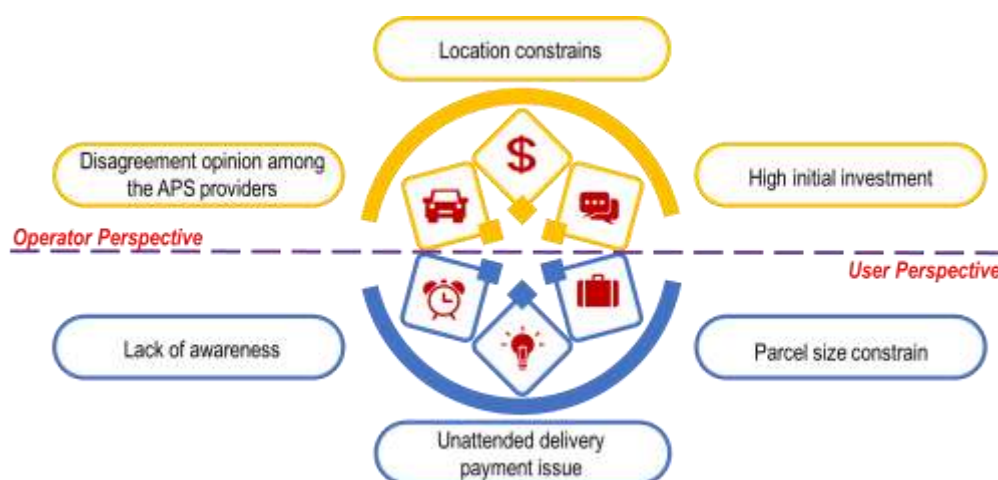
Fig. 2. Challenges faced by APS operators and users

4.3 Mitigative Measures
4.3.1. Disagreement among the APS providers
APS providers should create a standard operating procedure (SOP) or manual guide to ensure the space utilization, safety, and status of the parcel (prohibited) can be tracked efficiently. The use of blockchain technology in managing parcel and consumer data is one of the examples that can be utilized to enhance the effectiveness of APS management (Huang et al., 2019). The mutual agreement about the location selection decision should be documented appropriately.

4.3.2. Location constraints
APS helps enhances the last-mile delivery due to the location distance, delivery times, and location address being predetermined. A suitable APS location is necessary to ensure the effectiveness of APS usage, particularly within the city center (Hübner et al., 2016). Thus, stakeholders' feedback and government support in identifying an appropriate APS location is necessary to ensure its fullest utilization. Alike, the use of the Geographic Information System (GIS) will maximize the efficiency of location decision-making and planning (Guerlain et al., 2016).

4.3.3 High initial investment
Malaysia's government is very committed to creating a sustainable transport option. APS adoption is one of the ways that may support this agenda. Thus, subsidies and taxes reduction is applied to all APS providers. This will reduce the burden of high APS adoption initial costs (Seghezzi et al., 2022). APS providers should be more aware of the incentive given. Moreover, the formation of cohesive and sustainable APS apps may also reduce the long-term maintenance cost.

4.3.4. Lack of awareness
The use of the social media platform is one of the strategies to promote the benefit of APS usage. Technology will streamline and accelerate the APS services toward a more structured, reliable, effective, and smooth information flow (Tedjo et al., 2022). Additionally, the discounted price or points system may encourage the use of APS. This will create positive word-of-mouth, becoming a stepping stone for future APS usage (Lian et al., 2020).

4.3.5. Unattended delivery payment issue
Establishing APS apps is highly required to ensure the unattended delivery payment can be solved. For instance, using artificial intelligence such as a smartwatch to verify delivery status, send notifications to customers for collection, and proceed with payment will speed up the process (Halaweh, 2018). This initiative required strong stakeholder collaboration, including APS providers, bankers, I.T. developers, and the government.

4.3.6 Parcel size constrain
Early notification is necessary to ensure the packages did not stay in the locker for more than specific hours based on the APS provider agreement. The use of artificial intelligence such as the smartwatch is imperative to solve this issue. For instance, the user will be charged if the packages did not be collected within the stipulated time (Rajendran & Wahab, 2022). This is to ensure the next delivery can be done without any hassle. Moreover, a clear form of communication is required to ensure the information is always on a real-time basis. Table 2 summarises the challenges and mitigative measures for Malaysian APS usage that can be used as a guideline.

Table 2. Challenges and mitigation measures summary

Challenges		Mitigative Measures
Disagreement among the APS providers	▪	Create an SOP or manual guide
	▪	Blockchain technology adoption

	▪	Stakeholders' mutual agreement
Location constraints	▪	Stakeholder's feedback and government support
	▪	Geographic Information System (GIS) adoption
High initial investment	▪	Government subsidies and taxes reduction
	▪	Formation of cohesive and sustainable APS apps
Lack of awareness	▪	Use of the social media platform
	▪	Discounted price or points system
Unattended delivery payment issue	▪	Establishment of artificial intelligence (i.e., smartwatch)
	▪	Strong stakeholder collaboration (APS providers, bankers, IT developers and the government)
Parcel size constrain	▪	Early notification through smartwatch alarm
	▪	Real-time information on the parcel status

5.0 Impact of APS on Last-Mile Delivery

APS aids in addressing other crucial last-mile delivery issues like cost efficiency, same-day delivery, and round-the-clock real-time package tracking. Additionally, APS is able to meet a growing demand, which results in a decrease in vehicle use and makes it environmentally friendly. It is also in line with the UN Sustainable Development Goals (SDG) agenda, goal number 11; Sustainable Cities and Communities. Moreover, when compared to traditional delivery, which has a high rate of failed home deliveries, APS is more cost-effective. Since it is assumed that the first delivery would be successful 100% of the time, using APS avoids this problem and saves money by not having to redeliver and disperse the package (Gevaers et al., 2014). Alike, parcels can be combined and delivered to a single location, thereby saving time and money. Besides, because the parcels won't be personally delivered to each recipient's home, the delivery routes will be improved and able to reduce operational costs (Rajendran & Wahab, 2022).

Similarly, APS switched from a B2C to a B2B delivery strategy, and issues like missed deliveries owing to "not at home problems," long delivery executive transit times, and difficulty locating the address are now resolved. APS makes it easier for logistics companies to deliver packages to predetermined locations, which are typically well-known places. Because of the reduction in overall turnaround time for logistics companies, both e-commerce and logistics companies may more easily guarantee same-day delivery (Hübner et al., 2016). Similar to this, APS is adaptable to meet rising demand. This is partly due to the fact that APS are facilities that have high startup costs but minimal ongoing costs. As a result, the same facility may be used even if demand rises if it is underutilised (Zurel et al., 2018).

6.0 Conclusion and Research Directions

Due to the rise of e-commerce and urbanization, there is a huge increase in last-mile deliveries. World Economic Forum (2020) predicts that the demand for last-mile delivery will grow by 78% by 2030. This represents an additional 36% of vehicles on the road worldwide. The last-mile delivery system has shown APS as a sustainable and cost-effective solution. This study explores and identifies the challenges Malaysia's APS providers and users confront in responding to effective last-mile delivery. The observation and content analysis's findings showed that disagreement among the APS providers, location constraints, high initial investment, lack of awareness, unattended delivery payment issues, and parcel size constraints are the challenges of Malaysia's APS usage in Malaysia.

This study emphasizes that the challenges found could lead to a fresher understanding of the challenges and opportunities affecting Malaysia's APS usage. This study may establish the foundation for future scholarly investigation of Malaysia's APS usage. The outcome from this study also adds to the overall APS and last-mile business discipline, which may enhance knowledge of the APS and last-mile delivery as a whole. Furthermore, the study's findings will also help practitioners to understand the challenges facing Malaysia's logistics industry and possible mitigation strategies that might be useful to remain competitive. This paper's findings will help top management, whether in the public or private APS provider, to carry out or develop a strategic initiative.

This study's subjective results have a drawback because it is one of the first to examine the Malaysian APS challenges toward effective last-mile delivery. The author's observations of the industry provide the basis for the emphasized strategies. Future investigations should perform a quantitative study. An empirical analysis would demonstrate the importance and support of the arbitrary aspects addressed in this paper. Therefore, more organized and in-depth empirical studies should be the main emphasis of future studies.

Further research is required to identify and comprehend any additional pertinent or hidden challenges affecting Malaysia's APS towards effective last-mile delivery. Therefore, conducting focus groups or panel interviews as part of future empirical research to produce more insightful findings about the whole APS system in Malaysia should take place. Despite the paper's limitations and the paucity of APS research in Malaysia, the qualitative nature and methodology used in this study further support the suitability and relevance of the content analysis for exploratory research.

Acknowledgements

Paper Contribution to Related Field of Study

This study has several implications for both academics and practitioners. The research stream demonstrates a positive move in the APS

and last-mile delivery-related study which is in line with the SDG agenda. This study contributes simple access to information on various trends, themes, and research streams on APS and last-mile delivery for future researchers to use as a foundation. Nevertheless, future research should integrate the findings of this study by performing a mixed-method analysis to boost the total value of similar investigations. The authors hope that this study will assist academics in focusing their intellectual capital on future research that will have a substantial influence, particularly on APS and last-mile delivery and SDG.

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