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Parcel Locker as a Solution for Sustainable Operations and a Contactless Self-Service Solution for Last-Mile Delivery

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ABSTRACT

In recent years, technical diffusion, globalization, and the internet revolution have accelerated the growth of e-commerce and transformed business operation systems. Due to the phenomenon, the logistical procedure, including the last-mile deliveries, has become more burdensome. Furthermore, a new requirement for a sustainable contactless alternative in last-mile delivery has emerged due to the COVID-19 outbreak. Although self-service parcel lockers could be a solution in this context, none of the literature provides a comprehensive overview. Thus, this paper aims to determine the factors affecting consumers' perspectives of parcel locker adoption, sustainability considerations as well as the effect of COVID-19 outbreaks on the adoption process throughout published literature. The paper's objectives were accomplished via a systematic literature review method using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach, and 28 peer-reviewed journal articles were chosen. The overall review has found that customers' attitudes towards parcel locker adoption are changing for the better over time, indicating that the service has great potential to become a sustainable contact-free solution last-mile delivery alternative. The paper's additional value stems from its holistic approach to parcel lockers, which not only considers consumers' perceptions, sustainability considerations, and the impact of COVID-19 but also highlights issues that must be addressed to make it a sustainable last-mile delivery option.

Keywords: *covid-19, e-commerce, last-mile delivery, parcel lockers, systematic literature review.*

1. INTRODUCTION

In recent years, technical diffusion, globalization, and the internet revolution have accelerated the phenomenal growth of e-commerce and transformed business operation systems (Dobroselskyi *et al.*, 2021; Vakulenko *et al*., 2018, 2019). Particularly, the emergence of the COVID-19 pandemic and the adoption of measures such as lock-down, working from home, and eLearning has enhanced the growth of e-commerce to multiple folds (above 100% in certain areas) (Settey *et al*., 2021). In 2020, global retail e-commerce revenues constituted $4.28 trillion and are projected to reach $6.38 trillion by 2024 (Chevalier, 2021). While this rapid growth of e-commerce results in a substantial increase in package volumes, it has also augmented its burden on the logistical process, especially on last-mile delivery (LMD) (Boysen *et al.*, 2021). LMD refers to the last stage of the delivery process from the transportation hub toward the consumer's chosen point of destination (Lim *et al*., 2018). Considering the scale of targeted service standards, low shipment density, and wide endpoint dispersion, companies perceive last-mile delivery to be the least effective and most costly phase of the delivery process (Macioszek, 2017).

Therefore, multiple pieces of research have been conducted on last-mile delivery, and several approaches have

been proposed, such as cargo cycles (Melo & Baptista, 2017), various open fleets such as cargo bikes (Palanca *et al*., 2021), transport to the trunk by car (Lombard *et al*., 2018), reception box (Xuping Wang *et al*., 2014), crowdsourced services (Castillo *et al*., 2018), electric vehicles (Schnieder *et al*., 2020), autonomous delivery robots (Dalla Chiara *et al*., 2019), and drones (Yoo & Chankov, 2018), etc., to reduce the burden on last-mile delivery, maximize its service capability, and drive down the expenses (Mangiaracina *et al*., 2019). However, each of these options has several drawbacks (Srinivas & Marathe, 2021). Furthermore, the economic, environmental, and social consequences of last-mile delivery influence E-commerce consumers to pick a more sustainable alternative (Ignat & Chankov, 2020). In response to the COVID-19 pandemic, on the other hand, social distancing has evolved customers' behaviour to utilize contactless methods for purchasing and deliveries. As a result, the demand for a contactless and sustainable delivery approach as a last-mile delivery alternative has become an emerging concern (Koch *et al*., 2020; Xueqin Wang *et al*., 2021).

Parcel locker, on the other hand, is another well-recognized self-service tool (SST) used for picking up and returning items bought online from the perspective of last-mile delivery (Vakulenko *et al*., 2018; Wahab, 2021). These lockers are comprised of electronic locks with changing access codes that enable different clients to utilize them at their convenience (Deutsch & Golany, 2018). Therefore, a self-service quality parcel locker could be a choice for a sustainable and contact-free approach to last-mile delivery.

Since the factors influencing customers' perception play a significant role in the adoption process (Rajendran & Wahab, 2022; Tsai & Tiwasing, 2021), this research aims to review the factors influencing consumers' perception towards parcel locker adoption intentions as the last mile delivery solution. Thus, the purpose of this paper is to identify the factors influencing consumers' perspectives towards parcel lockers, sustainability considerations, and the impact of the COVID-19 outbreaks on parcel locker adoption as a last-mile delivery option. In achieving the purpose of this review paper, the following research questions have been developed accordingly:

1. What factors influence consumers' perspectives toward parcel locker adoption?
2. Does the parcel locker offer sustainability considerations to the consumers?
3. What was the impact of the COVID-19 outbreaks on parcel locker adoption as a last-mile delivery option?

The succeeding sections of this paper are structured as follows: a review of the literature pertaining to sustainable operations and a contactless self-service solution for last-mile delivery is reviewed, followed by the methodology employed in this study. The next section deliberates on the results and discussions, followed by the conclusion and future research agenda.

2. LITERATURE REVIEW

2.1 Parcel Lockers in Last-Mile Delivery

The surge in e-commerce has intensified the demand for efficient last-mile delivery (LMD) solutions. Parcel lockers have emerged as a favourable alternative, offering consumers flexibility and reducing delivery failures. Recent studies highlight that parcel lockers can decrease operational costs and mitigate negative externalities, such as traffic congestion and emissions, by consolidating deliveries to centralized locations (Caspersen & Navrud, 2021; Prasertwit *et al*., 2024). Furthermore, the strategic placement of parcel lockers in urban areas can optimize delivery routes and reduce vehicle miles traveled (Pourmohammadreza *et al*., 2025). A study by González-Romero *et al.* (2024) emphasizes that parcel lockers significantly reduce the carbon footprint of urban logistics by enabling bulk deliveries and reducing failed delivery attempts. Additionally, consumer adoption of parcel lockers is influenced by their perceived convenience and accessibility. Ma *et al*. (2024) argue that the placement of lockers in key urban and suburban locations is crucial in maximizing adoption and efficiency. While parcel lockers present a viable LMD solution, challenges such as security concerns, locker availability, and interoperability among multiple logistics providers need to be addressed (Ewedairo *et al*., 2024; Yuen *et al*., 2019). The adoption of parcel lockers continues to grow as technological advancements enhance their accessibility and usability, making them an integral part of future urban logistics solutions.

2.2 Sustainability Operations in Last-Mile Delivery

Sustainability in LMD is a growing concern due to its environmental impact. Implementing parcel lockers contributes to sustainable urban logistics by consolidating deliveries, thereby reducing the number of individual trips and associated emissions (González-Romero *et al*., 2024). A systematic literature review emphasizes that sustainable last-mile delivery solutions, including parcel lockers, play a crucial role in minimizing environmental footprints (Rhouzali *et al*., 2024). Parcel lockers help reduce the carbon footprint by decreasing the number of vehicle trips required for individual deliveries (Pourmohammadreza *et al*., 2025). Furthermore, they can be integrated with green transport modes, such as bicycles and electric vehicles, to enhance their environmental benefits (Yuen *et al*., 2019). The consolidation of parcels at central locations prevents unnecessary emissions, especially in high-density urban areas where traffic congestion and pollution are major concerns (Ma *et al*., 2024). However, despite these advantages, challenges remain in ensuring the widespread adoption of parcel lockers for sustainability purposes. Issues such as infrastructure investment, operational efficiency, and user acceptance must be addressed to maximize their sustainable impact (Caspersen & Navrud, 2021). Future research should focus on the lifecycle assessment of parcel lockers and their role in broader sustainable supply chain initiatives.

2.3 Consumer Adoption and Behavioural Considerations

Consumer acceptance of parcel lockers is influenced by factors such as convenience, accessibility, and perceived ease of use. A recent study indicates that consumers prioritize parcel traceability and are willing to accept slower deliveries in exchange for less polluting methods (Caspersen & Navrud, 2021). However, challenges such as security concerns and the need for user-friendly interfaces persist. Addressing these issues is essential to enhance consumer

trust and encourage widespread adoption (Ma *et al*., 2024). Research by Pourmohammadreza *et al*. (2025) suggests that demographic factors, such as age, digital literacy, and prior experiences with self-service technologies, influence consumers' willingness to use parcel lockers. Moreover, trust in logistics providers plays a crucial role, as concerns regarding package safety and locker availability can deter potential users (Yuen *et al*., 2019). Additionally, the integration of parcel lockers with mobile applications and real-time notifications enhances their usability and boosts consumer confidence in the system (González-Romero *et al*., 2024). Incentives, such as discounts for using lockers or loyalty programs, may also increase adoption rates (Rhouzali *et al*., 2024). While parcel lockers present an efficient and sustainable last-mile delivery solution, efforts must be made to educate consumers on their benefits and improve the overall user experience.

2.4 The Impact of COVID-19 on Last-Mile Delivery and Parcel Lockers

~~Consumer~~ The COVID-19 pandemic has accelerated the adoption of contactless delivery solutions, with parcel lockers gaining prominence as a safe and convenient alternative. Research suggests that the pandemic-induced shift towards contactless transactions has had a lasting impact on consumer behavior, with many individuals now favoring self-service options to minimize physical interactions (Pourmohammadreza *et al*., 2025). During the peak of the pandemic, parcel lockers provided a critical service by reducing face-to-face contact and ensuring uninterrupted last-mile deliveries (Ma *et al*., 2024). A study by Caspersen and Navrud (2021) found that consumers who initially adopted parcel lockers during the pandemic have continued using them post-pandemic, indicating a long-term behavioral shift towards automated delivery solutions. Furthermore, logistics providers have responded by expanding parcel locker networks, reinforcing their role in resilient and adaptable last-mile delivery systems (González-Romero *et al*., 2024). However, challenges such as locker saturation, high operational costs, and integration with existing supply chain models remain (Yuen *et al*., 2019). As contactless deliveries become the norm, further research should explore how technological advancements, such as AI-driven locker management and predictive analytics, can optimize the efficiency and scalability of parcel locker networks (Arevalo-Ascanio *et al*., 2024).

2.5 Research Gaps

While the literature emphasizes the potential of parcel lockers to enhance efficiency, sustainability, and consumer convenience in last-mile delivery, several research gaps remain. Notably, there is a need for more studies examining the perspectives of supply chain and logistics providers, particularly in optimizing locker networks and operational efficiency. Additionally, the long-term sustainability impacts of parcel lockers, including lifecycle assessments and urban mobility implications, warrant further exploration (Rhouzali *et al*., 2024). As consumer behavior continues to evolve post-pandemic, future research should investigate the persistence of contactless delivery preferences and their implications for logistics strategies (Caspersen & Navrud, 2021). Moreover, the role of regulatory frameworks in supporting the expansion of parcel locker infrastructure remains largely unexplored (Ma *et al*., 2024). By addressing these gaps, future studies can contribute to a more comprehensive understanding of parcel lockers' role in sustainable last-mile delivery operations.

3. METHODOLOGY

This systematic literature review paper was guided by Preferred Reporting Items for Systematic Reviews and Meta-Analyse (PRISMA) (Moher *et al*., 2009). PRISMA has been adapted and adopted for this paper due to its acceptable publication standard for various disciplines and highlighted important items that should be reported in this kind of systematic review paper.

3.1 Information Sources

Sources involved in identifying the related literature were (1) Google Scholar, (2) Scopus, (3) Science Direct, (4) Springer Nature, (5) IEEE Xplore, (6) MDPI & (7) Emerald Insight. This is due to all of these prominent databases providing access to a large amount of literature scope, which is highly related to the scope of the study. Moreover, the authors believe that the information gained from multiple sources is able to provide more comprehensive and rigorous action from the scope of a specific field. It can also avoid bias issues if focusing only on certain databases (Shaffril *et al*., 2021).

3.2 Identification, Screening, and Eligibility

Besides information source selection, the search strategy is also considered crucial in the identification process parts. As summarized in **Table 1,** the literature considered in the review was based on several criteria, such as types of publication, the language used, and the publication timeline.

Table 1 The selection criteria

Criteria	*Inclusion*
Document type	Peer-Reviewed Journal Articles
Language	English
Timeline	Between 2015-2022

The search was limited to Peer-Reviewed Journal Articles published in English to ensure the quality of the article published is more controlled in terms of scholarly qualities and high publication standards (Moher *et al*., 2015). The timeline of publication was considered to be between 2015-2022. This is because the use of parcel lockers for LMDs became popular, particularly during the COVID-19 outbreak, and it was established in 2016. It is also an acceptable and standard range of years applied by previous literature review papers covering recent publications. The search keywords were suggested and discussed among authors while going through familiar terms used in previously published literature. Variables utilized in the final search

1. Last-Mile Delivery Logistics* Challenges*
2. "Sustainability in E-Commerce"
3. Consumer Behaviour* or Self-service technology adoption*
4. Parcel Locker* or Self-service technology*

5. "Innovative Solution"
6. "Parcel Locker" in COVID-19 paragraph

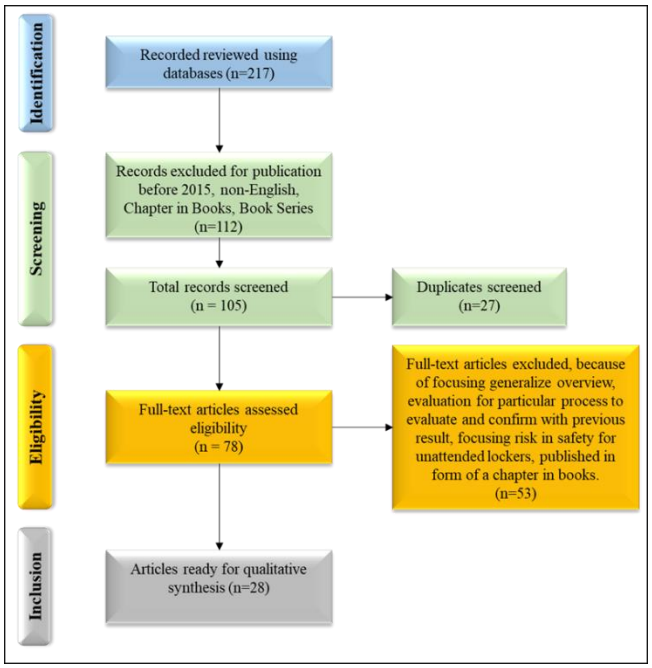

Figure 1 Flow diagram for search strategy
(Source: Adopted from Moher *et al*., 2009)

The screening process was done by several steps as in **Figure 1**, namely, including and excluding literature from different databases (according to selection criteria), and removal of duplicate literature (similar articles found in different databases). Each author did the search individually. Next, the result of the search was combined to confirm of articles to be screened. The first screening step resulted in a number of 105 included literature and 112 literature excluded based on the selection criteria that have not been met. Meanwhile, 27 pieces of duplicated literature have been removed in the second screening step. Throughout the screening process, a total of 78 articles were identified for the next process which is the eligibility process. The eligibility process was conducted by excluding literature (53 titles) that was a generalized overview, evaluation of the particular process to evaluate and confirm with previous results, focusing risks on safety for unattended lockers, published in the form of a chapter of books, the final synthesis included 28 articles as shown in **Figure 1.**

4. RESULTS AND DISCUSSIONS

4.1 Articles Reported by the Country of Study

Figure 2 illustrates the publishing results by country of study. China had the greatest proportion of publications (21%) followed by Poland (12%), Germany (12%), Sweden, Singapore, Austria, France, Belgium (10%), and other countries. The findings from the highest percentage may aid as the main reference for the future study.

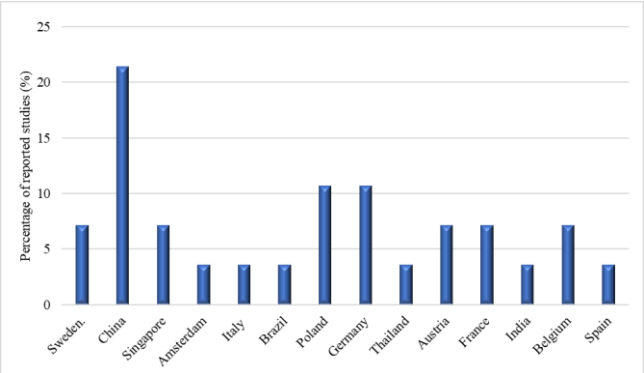

Figure 2 Articles reported by the country of study

Three major themes emerged from the review, with 29 subthemes identified under each of these themes. Consumer Perspectives (21 sub-themes), Sustainability (3 sub-topics), and COVID-19 Impact are the three major themes (five sub-themes) exhibited in **Table 2.**

Table 2 The selection criteria

Source	Consumers' Perspective																					Sustainability			COVID-19				
	Lo	Ti	Ac	Rq	Ss	Eu	Se	Ae	Al	Ce	Sq	Fd	Ra	Sd	Cm	Si	Tr	Pr	Lf	Hm	Cs	Ec	Er	Cp	Cc	TrT	Ca	SuR	Li
(Vakulenko *et al.*, 2018)	/	/	/	/	/	/	/	/	/	/	/																		
(Tang *et al.*, 2021)	/	/			/	/	/	/			/	/						/											
(Yuen *et al.*, 2018)										/			/		/		/		/										
(Vakulenko *et al.*, 2019)	/	/	/		/				/	/	/	/						/			/								
(Zhou *et al.*, 2020)		/			/	/	/			/				/	/	/	/	/											
(van Duin *et al.*, 2020)	/							/		/		/																	
(Mitrea *et al.*, 2020)	/	/							/					/				/	/				/	/					
(Nogueira *et al.*, 2021)					/					/				/									/						

Table 2 The selection criteria (Cont'd)

Source	Consumers' Perspective																					Sustainability			COVID-19				
	Lo	Ti	Ac	Rq	Ss	Eu	Se	Ae	Al	Ce	Sq	Fd	Ra	Sd	Cm	Si	Tr	Pr	Lf	Hm	Cs	Ec	Er	Cp	Cc	TrT	Ca	SuR	Li
(Iwan *et al.*, 2016)	/	/					/			/											/		/	/					
(Schwerdfeger & Boysen, 2020)	/																												
(Tsai & Tiwasing, 2021)		/					/			/			/		/			/			/			/					
(Tsai & Tiwasing, 2021)		/								/												/	/	/					
(Yuen *et al.*, 2019)	/	/				/	/			/		/						/											
(Prandtstetter *et al.*, 2021)	/																						/						
(Kapser & Abdelrahman, 2020)		/					/			/	/					/				/									
(Hofer *et al.*, 2020)	/																						/						
(Wang *et al.*, 2020)	/							/		/					/														
(Djelassi *et al.*, 2018)					/	/					/																		
(Roy *et al.*, 2018)		/									/				/														
(Rai *et al.*, 2020)	/	/										/							/										
(Akeb *et al.*, 2018)		/								/		/											/						
(Xueqin Wang *et al.*, 2018)						/							/		/		/												
(Lemke *et al.*, 2016)	/	/	/		/	/				/	/											/							
(Villa & Monzón, 2021)	/	/								/													/	/					
(Rai *et al.*, 2018)	/	/										/																	
(Kapser *et al.*, 2021)	/	/				/	/			/				/		/				/						/		/	/
(Liu *et al.*, 2020)					/																							/	
(Xueqin Wang *et al.*, 2021)																									/	/		/	/

Note: Location: Lo; Time access (24/7 Service): Ti; Access to service Ac; Reduction or elimination of queues: Rq; Service speed: Ss; Ease of use: Eu; Security: Se; Availability of lockers: Al; Avoidance of human interaction: Av; Cost Expectancy: Ce; Service quality & fairness: Sq; Faulty handling or failed delivery: Fd; Relative advantage: Ra; Sd: Sociodemographic variable; Compatibility: Cm; Social influence: Si; Trust on Trialability and performance: Tr; Privacy: Pr; Lifestyle: Lf; Hedonic motivation: Hm; Control over service: Cs; Environmental concern: Ec; Emission Reduction: Er; Congestion, accident and Sound Pollution: Cp; Channel compatibility: Cc; Trust in technology: TrT; Contactless approach: Ca Susceptibility to risk: SuR; Logistics Issue: Li.

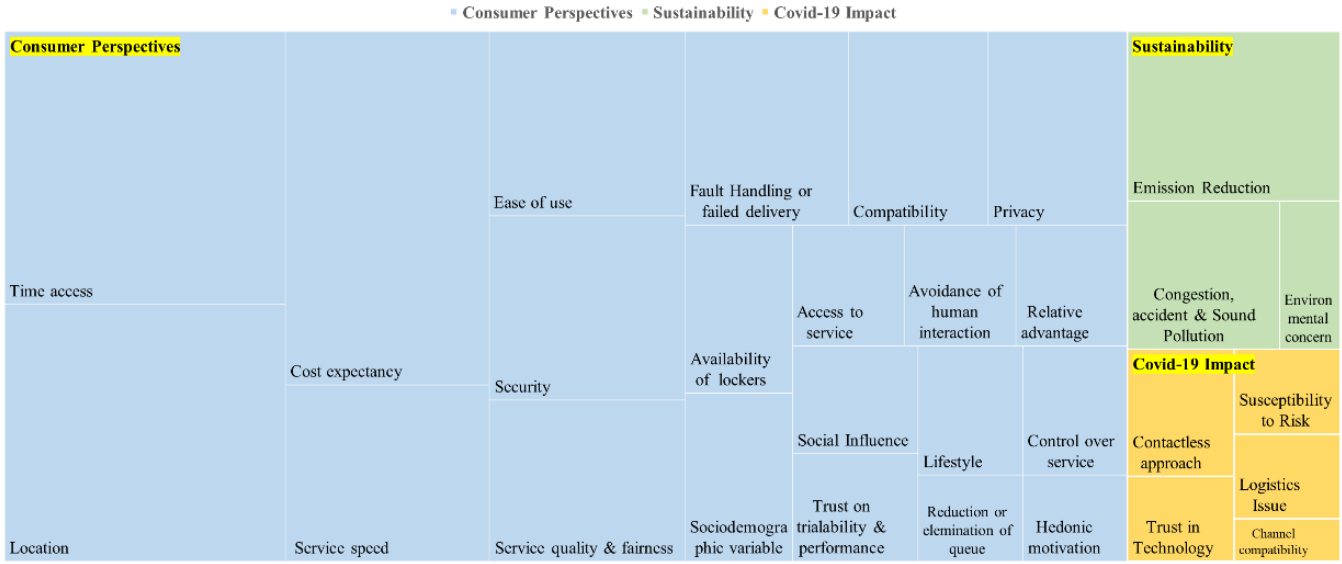

Figure 3 Distribution of the analysed theme

Table 3 Summarization of sub-themes under 3 major themes on parcel locker adoption

Main Theme	Sub-theme	Influence	Reference
Consumers' Perspectives	Location	Customers prefer parcel pick-up points to be near their residences, workplaces, metro stations, and gas stations, or on their way to errands.	(Hofer *et al*., 2020; Iwan *et al*., 2016; Kapser *et al*., 2021; Lemke *et al*., 2016; Liu *et al*., 2020; Mitrea *et al*., 2020; Prandtstetter *et al*., 2021; Rai *et al*., 2020; Schwerdfeger & Boysen, 2020; Tang *et al*., 2021; Vakulenko *et al*., 2018, 2019; van Duin *et al*., 2020; Villa & Monzón, 2021; Y. Wang *et al*., 2020; Yuen *et al*., 2019)
	Time Access	Consumers expect convenience, i.e., around-the-clock services or accessibility at their convenience time. Parcel locker provides this advantage.	(Akeb *et al*., 2018; Iwan *et al*., 2016; Kapser *et al*., 2021; Kapser & Abdelrahman, 2020; Lemke *et al*., 2016; Mitrea *et al*., 2020; Rai *et al*., 2018, 2020; Roy *et al*., 2018; Tang *et al*., 2021; Tsai & Tiwasing, 2021; Vakulenko *et al*., 2018, 2019; Villa & Monzón, 2021; Yuen *et al*., 2019; Zhou *et al*., 2020)
	Access to Service	The option to use both parcel lockers or traditional Service is desirable to some extent. Furthermore, some e-commerce retailers do not provide a parcel locker service, which poses a deterrent to adoption.	(Vakulenko *et al*., 2018, 2019; Xueqin Wang *et al*., 2018)
	Reduction or elimination of queues	Parcel locker's advantage over the traditional delivery system in avoiding a physical store's long line is found appealing to consumers.	(Mitrea *et al*., 2020; Vakulenko *et al*., 2018, 2019)
	Service speed	Prompt service through parcel lockers is desirable by all customers but offering free delivery motivates them to take tardy delivery.	(Djelassi *et al*., 2018; Lemke *et al*., 2016; Liu *et al*., 2020; Nogueira *et al*., 2021; Tang *et al*., 2021; Vakulenko *et al*., 2018, 2019; Zhou *et al*., 2020)
	Ease of use	Consumers like easy-to-use innovative technology that includes simplified guidelines. It has a favourable impact on their decision-making process of adoption.	(Djelassi *et al*., 2018; Kapser *et al*., 2021; Lemke *et al*., 2016; Tang *et al*., 2021; Vakulenko *et al*., 2018; Xueqin Wang *et al*., 2018; Yuen *et al*., 2019; Zhou *et al*., 2020)
	Security	Consumers often express concerns about parcels not being delivered, being stolen, or being delivered imperfectly.	(Hofer *et al*., 2020; Iwan *et al*., 2016; Prandtstetter *et al*., 2021; Tang *et al*., 2021; Tsai & Tiwasing, 2021; Vakulenko *et al*., 2018; Yuen *et al*., 2019; Zhou *et al*., 2020)
	Availability of lockers	The lack of or limitation of various sizes and empty lockers for receiving and returning packages has a negative influence on consumers' attitudes toward dissatisfaction.	(Tang *et al*., 2021; Vakulenko *et al*., 2018; van Duin *et al*., 2020; Y. Wang *et al*., 2020)
	Avoidance of human interaction	Mixed feelings were found from prior COVID-19 consumers.	(Vakulenko *et al*., 2018, 2019; Xueqin Wang *et al*., 2018)
	Cost expectancy	Consumers are often sensitive about service costs and expect them to be lower than conventional delivery. It has a significant impact, and customers often express an interest in using parcel lockers and self-service processes provided the store waives or charges a minimal delivery fee.	(Akeb *et al*., 2018; Iwan *et al*., 2016; Kapser *et al*., 2021; Kapser & Abdelrahman, 2020; Lemke *et al*., 2016; Nogueira *et al*., 2021; Tsai & Tiwasing, 2021; Vakulenko *et al*., 2018, 2019; van Duin *et al*., 2020; Villa & Monzón, 2021; Y. Wang *et al*., 2020; Yuen *et al*., 2018, 2019; Zhou *et al*., 2020)

Table 3 Summarization of sub-themes under 3 major themes on parcel locker adoption (Cont'd)

Main Theme	Sub-theme	Influence	Reference
Consumers' Perspectives	Service quality & fairness	Service quality and fairness positively influence consumers' choice of parcel locker. The initial phases and touchpoints of the e-customer experience and pre-delivery customers' decisions significantly impacted the return trip.	(Djelassi *et al*., 2018; Kapser *et al*., 2021; Lemke *et al*., 2016; Roy *et al*., 2018; Tang *et al*., 2021; Vakulenko *et al*., 2018, 2019)
	Fault Handling or Failed Delivery Capability	In case of malfunction, the rapid response from logistics/sellers aids users in making their choice. They anticipate a seamless package tracking procedure and a smooth return journey.	(Akeb *et al*., 2018; Rai *et al*., 2018, 2020; Tang *et al*., 2021; Vakulenko *et al*., 2019; van Duin *et al*., 2020; Yuen *et al*., 2018)
	Relative Advantage	Consumers anticipate that the parcel locker's innovative technology will offer an upper hand over the conventional delivery method.	(Tsai & Tiwasing, 2021; Xueqin Wang *et al*., 2018; Yuen *et al*., 2019)
	Sociodemographic variables	Age and gender have a major impact on the adoption process. Females are more interested in adoption because of their eco-friendly attitude, while older individuals over the age of 66 are less enthusiastic about the sale collecting procedure.	(Kapser & Abdelrahman, 2020; Mitrea *et al*., 2020; Nogueira *et al*., 2021; Zhou *et al*., 2020)
	Compatibility	The system must be compatible with existing systems and lifestyles. This strategy appeals to singles and working people in particular.	(Roy *et al*., 2018; Tsai & Tiwasing, 2021; Xueqin Wang *et al*., 2018; Y. Wang *et al*., 2020; Yuen *et al*., 2018; Zhou *et al*., 2020)
	Social Influence	Peers' preferences influence individuals' choice as well to use parcel locker	(Kapser *et al*., 2021; Kapser & Abdelrahman, 2020; Zhou *et al*., 2020)
	Trust in trialability and performance	Trust in the Parcel Locker system influences its adoption to a greater extent.	(Xueqin Wang *et al*., 2018; Yuen *et al*., 2019; Zhou *et al*., 2020)
	Privacy	Parcel locker provides customers privacy with what they buy through contactless delivery and thus is preferred by many.	(Mitrea *et al*., 2020; Tang *et al*., 2021; Tsai & Tiwasing, 2021; Vakulenko *et al*., 2019; Yuen *et al*., 2019; Zhou *et al*., 2020)
	Hedonic motivation	Not only utilitarian service but also hedonic or pleasant service systems motivate consumers to adopt this parcel locker approach.	(Kapser *et al*., 2021; Kapser & Abdelrahman, 2020)
	Control over Service	Customers' active participation makes the process end easily. As a result, waiting time for self-scanning users at a checkout counter may be less stressful and unpleasant.	(Iwan *et al*., 2016; Tsai & Tiwasing, 2021; Vakulenko *et al*., 2019)
Sustainability	Environmental concern	Environmental concern positively influences the adoption process. Although cost-efficiency often triumphs among Generation Y. However, when it comes to cost vs. ecology, the Y-generation is willing to spend even more.	(Lemke *et al*., 2016; Tsai & Tiwasing, 2021)
	Emission Reduction	Optimized routing and location of parcel lockers help reduce the use of a private car and more eco-friendly modes of transport.	(Akeb *et al*., 2018; Hofer *et al*., 2020; Iwan *et al*., 2016; Mitrea *et al*., 2020; Nogueira *et al*., 2021; Prandtstetter *et al*., 2021; Tsai & Tiwasing, 2021; Villa & Monzón, 2021)
	Congestion, accidents and Sound Pollution	Delivery service requires modes of transport, mostly by road. This results in the emission of pollutants, excessive noise, increased accidents, and congestion. Self-collection can reduce these issues.	(Iwan *et al*., 2016; Mitrea *et al*., 2020; Tsai & Tiwasing, 2021; Villa & Monzón, 2021)
COVID-19 Impact	Channel compatibility	When choosing a delivery channel, consumers often seek information about the characteristics and compatibility of the channel itself.	(Kapser *et al*., 2021)
	Trust on technology	Trust in the performance and innovative technology positively influence consumers' decision-making process.	(Kapser *et al*., 2021; Xueqin Wang *et al*., 2021)
	Contactless approach	The contactless approach has become a new norm influenced by trust, compatibility, and susceptibility to risk.	(Kapser *et al*., 2021; Liu *et al*., 2020; Xueqin Wang *et al*., 2021)
	Susceptibility to risk	While some researchers believe that it increases channel interoperability, it also lowers consumer trust in the contactless approach. Others suggested that sensitivity to exposure has a positive impact on selecting self-collection services.	(Kapser *et al*., 2021; Xueqin Wang *et al*., 2021)
	Logistics issue	COVID-19 has wreaked havoc on the global supply chain, causing a lack of logistical assistance and transforming the whole process, including last-mile deliveries.	(Kapser & Abdelrahman, 2020; Liu *et al*., 2020)

The findings were compiled into a comprehensive analysis of consumers' perspectives on parcel lockers, and factors that influence or dissuade them from adopting them as the best alternative for last-mile delivery. The consideration of sustainability among them, and the overall impact of the COVID-19 outbreak on consumers as well as last-mile delivery. The distribution of analysed themes is exhibited in **Figure 3** and summarized in **Table 3.**

Multiple facets of consumer psychology, service features and operation process, environmental sustainability

and the zenith of the COVID-19 pandemic shape the decision-making process and adoption. Although multiple influencing factors were identified, customers' chief concerns about last-mile delivery options are location, time access, and cost. Almost every customer is interested in using a parcel locker because of its handy pickup point location, 24/7 operation hours, and low cost. These features have made it the most lucrative, convenient, and flexible last-mile delivery alternative. On the other hand, people are increasingly concerned about the consequences of carbon emissions, congestion, accidents, and noise pollution, leading to a preference for environmentally friendly alternatives. As economic and socio-environmental sustainability are intertwined, parcel lockers have emerged as a more appealing option owing to their low cost and environmental benefits.

Furthermore, an examination of COVID-19's impact reveals its considerable impact on last-mile deliveries as well as its positive influence on consumers' decisions to choose a trustworthy, compatible, and contact-free approach. Overall, this comprehensive analysis reveals that customers are opting for a low-cost, eco-friendly, and contactless last-mile delivery alternative, leading to a positive shift in the intention to adopt parcel lockers. Thus, the Parcel Locker approach can be considered a contact-free, sustainable option for last-mile delivery.

5. CONCLUSION AND FUTURE RESEARCH AGENDA

In conclusion, 29 factors were extracted from prior literature exhibiting an overall effect on customers' attitudes, decision-making processes, and intention to embrace an alternative as a sustainable solution for last-mile delivery, with a focus on parcel lockers. location, time access, access to service, reduction or elimination of queue, service speed, ease of use, security, availability of lockers, avoiding human interaction, cost expectancy, service quality & fairness, fault handling or failed delivery, relative advantage, sociodemographic variable, compatibility, social influence, trust on trialability & performance, privacy, lifestyle, hedonic motivation, control over service are the factors that have influenced consumers' perspectives. Nevertheless, environmental concerns, emission reduction, congestion, accidents, and noise pollution are significant issues affecting last-mile delivery options' sustainability. Concerning COVID-19's effect, customers' self-collection service as the last mile option has been driven primarily by channel compatibility, trust in technology, contactless approach, susceptibility to risk, and logistics issues. While most research is consumer-centric, a few papers have focused on environmental and COVID-19 related factors. Moreover, the research excludes the retailer's perspective, which is a critical element to the service's success. Thus, future research should focus on these variables in-depth to assess their effect on customer adoption intentions.

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