

**JOURNAL OF INFORMATION
SYSTEM AND TECHNOLOGY
MANAGEMENT (JISTM)**www.jistm.com**EVALUATION ON PERCEIVED SERVICE QUALITY ON
PARCEL LOCKER DELIVERY SERVICE**Siti Azfanizam Ahmad^{1*}, Nadia Zhafira², Nurul Izzah Abd Rahman³¹ Department of Mechanical and Manufacturing Engineering, Universiti Putra Malaysia, Malaysia

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Article Info:**Article history:**

Received date: 18.09.2023

Revised date: 15.10.2023

Accepted date: 30.10.2023

Published date: 07.12.2023

To cite this document:

Ahmad, S. A., Zhafira, N., & Abd Rahman, N. I. (2023). Evaluation On Perceived Service Quality On Parcel Locker Delivery Service. *Journal of Information System and Technology Management*, 8 (33), 102-116.

DOI: 10.35631/JISTM.833009**This work is licensed under** [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)**Abstract:**

The rise in the number of e-commerce transactions in Indonesia has increased the number of goods to be delivered, which mostly using parcel delivery service. The most favorable parcel delivery alternatives in Indonesia are direct delivery services. Recently, delivery service providers innovated parcel locker service as one of the self-service technologies (SSTs) to self-collect the parcel to increase parcel delivery efficiency. However, this SST service has not been used optimally in Indonesia. To intensify customers' intention to use the service, service quality evaluation plays an important role to help retain customers and create inflow of new customers. The objectives of this study are to identify, evaluate, and prioritize the perceived service quality of parcel locker delivery from a customer perspective using the Bayesian Best-worst method (BWM), which calculates the weight and aggregates the final weights of criteria from all decision-makers (DMs) and Pareto principle. The prioritized service quality are evaluated further to come up with the proposed alternative solutions using the Delphi study. There are in total of four SST quality attributes with three corresponding sub-attributes each, which gives a total of twelve sub-attributes identified. The Bayesian BWM results show that Privacy Security is perceived as the most important service quality in a parcel locker based on customer perspective with the highest optimal weight (0.3562), followed by Convenience (0.2776), Functionality (0.2465), and Enjoyment (0.1198), respectively. Furthermore, there are seven prioritized sub-attributes to be focused on, and initially, eighteen parcel locker specifications were proposed as the alternative solutions in response to those sub-attributes. Based on the results obtained from nine expert users using the Delphi study show that there are a total of fourteen specifications were endorsed. This study evaluates the customer perceived service quality and produces recommendations in the form of alternative solutions for the prioritized service quality.

Keywords:

Customer Perceived Service Quality, Self-service Technologies, Parcel Locker Delivery, Best-worst Method

Introduction

The rapid increase of online shopping behavior worldwide affected the immense growth of internet economy activity in Southeast Asia, which grows gradually with no signs of slowing down (Davis et al., 2019). Indonesia, along with Vietnam, is two pacesetters in the Southeast Asia region with a growth rate of over 40% a year, projected at \$40 billion in 2019, according to the e-Conomy SEA study (Clement, 2020). This fast-growing e-commerce activity has had an impact on accelerating customer freight volume growth, which causes significant pressure on city logistics for the last mile (Guo et al., 2019). According to the Indonesia Central Bureau of Statistics (BPS, 2019), physical goods dominated e-commerce selling, with foods and beverages (27.85%) and apparels (22.11%) are the two most sold products in Indonesia e-commerce. This indicates that the e-commerce market in Indonesia really relies on parcel delivery services.

Currently, in Indonesia, the most preferred delivery option is direct delivery, where the parcel is directly sent by the couriers to the consignee's destination. However, the huge amount of parcels to be delivered each day resulted in courier workload and strain, as they need to climb stairs, knock on the doors, and request signature as the parcel has been delivered (Chen et al., 2018). Moreover, (Pratama, 2019) evaluate the on-time delivery rate at one of the largest delivery service providers in Indonesia, and the result shows that there is a significant difference between an average of accomplished on-time delivery percentage in Jakarta and Bogor as part of the Jakarta metropolitan area with 52% and 67% respectively compared with on-time delivery percentage in Yogyakarta and Semarang region with 75% and 80% respectively. Besides due to high street density in Jakarta metropolitan area, the unachieved on-time delivery target was also caused by misdirected and delayed parcels as well as customer error, including no recipient, unclear address, unknown recipient, and the recipient has changed the address (Pratama, 2019). The effect is a distribution failure that causes high costs for manufacturers and retailers of logistics services, inconveniences for customers, and an increased environmental burden. This shipment failure has a negative impact on all stakeholders, i.e., logistics service providers, retailers, customers, and society as a whole, that are part of the last-mile delivery process (Buldeo et al., 2019).

In an attempt to overcome the problems mentioned above, e-retailers and logistics service providers are pursuing new service solutions, often driven by innovations in technology (Vakulenko et al., 2019), through self-service technologies (SST). Parcel locker delivery is one of SSTs technologies to self-collect the parcel, where the lockers are located in the strategic area; office, apartment, train station, and shopping center, and the parcel could be retrieved by the customers at their convenience. This delivery method becomes one of the innovative solutions to avoid traffic congestion, shipping failure, and environmental pollution since it has fewer delivery trips (Chen et al., 2018; Ranieri et al., 2018; Yuen et al., 2019).

Unfortunately, this service is not yet become very popular and has not been used optimally in Indonesia (Refaningati et al., 2020). One of the solutions to optimize the service and intensify customers' intention to use the service is by service quality improvement, which helps in

retaining customers and creating inflow of new customers (Kuo et al., 2009; Rezaie et al., 2018). Kuo et al. (2009) also analyzed that service quality has a positive effect on perceived value and customer satisfaction, as well as on the intent of post-purchase.

In evaluating service quality, customer involvement is essential. Besides it aims to gain insights into customers' latent needs and expectations, customers in SSTs also take part as the contributor to the process of service delivery, which becomes an important source in service production. By allowing them to take part in the development, deep insights and new ideas have an opportunity to emerge. There are numerous dimensions of technological-based service quality in evaluating parcel locker delivery services. Service providers are often being uncertain in determining the right mix of service quality dimensions, and due to resources and time limitations, they need to prioritize the most important ones to allocate the resources in order to adapt the service quality to meet the customers' needs and expectations (Chowdhary & Prakash, 2007; Yadollahi et al., 2018). This study aims to identify, evaluate, and prioritize the perceived service quality of parcel locker delivery from a customer perspective and proposed alternative solutions.

Literature Review

The number of parcel lockers in the future is promising to rise steadily. Undoubtedly, in terms of being close to end-users, smart lockers have benefits. In addition, when picking up their products, consumers are flexible and do not need to wait at home for a delivery to arrive. In central cities, however, the density of installed smart lockers is higher than in suburban areas, as they typically have empty space to install smart lockers (Xiao et al., 2017).

Parcel lockers must be placed in locations that are accessible and convenient for customers and monitored via video cameras in order to avoid the risk of vandalism and theft in terms of location (Zenezini et al., 2018). The courier dropped the parcel inside the locker according to its dimensions. When it is stored, the customer is informed asked to pick up their parcel using an individual access code. For the service provider, this approach has several benefits. Vehicles deliver a greater quantity of parcels to the smart lockers instead go directly to the location by location of the end customer, which is often time-consuming and sometimes unpredictable (Ulmer & Streng, 2019). Consequently, the service provider needs to pay attention to ensure the quality is served in the best way possible to the customers.

Parasuraman et al. (1985) defined service quality as the difference between customer expectations and their perceived service performance, also defined as the extent to which customer needs are met by the service (Lewis, 1989), based on customer evaluation. Perceived service quality is a type of attitude, connected but not equal to satisfaction, resulting from a comparison of expectations with perceptions of service efficiency (Zeithaml et al., 1990). It is found that service quality positively influences perceived value and customer satisfaction, as well as indirectly impacted on post-purchase intention through customer satisfaction or perceived value (Kuo et al., 2009).

There are various conceptual models to measure service quality. One of the most widely used is SERVQUAL model (Parasuraman et al., 1991). This service quality model is a more generic model that offers a measurement framework where a large number of studies have been conducted for the perceived service quality of customer-employee interaction. Service sectors have, however, expanded as technology has risen enormously. Service firms have been offering various SSTs in recent years that seek to increase customer participation. (Dabholkar, 1996)

proposed alternative service quality models to increase the intent of consumers to use the service, including the expected ease of use, expected efficiency, and expected enjoyment. (Yen, 2005) developed an attribute-based quality satisfaction model for self-service internet technology, which found that ease of use and efficiency contribute positively to the satisfaction of users. (Ding et al., 2011) proposed a framework to examine the quality of online self-services and highlight that one of the service qualities which leads to users' satisfaction is service convenience. Another SST service quality scale was also assessed by (Lin & Hsieh, 2011). It was found that functionality, enjoyment, security, and convenience are some dimensions that developed based on psychometric scale development approaches.

Some studies have assessed the customers' insights in order to increase the quality of parcel locker delivery. (Vakulenko et al., 2018) was exploring the attributes which affect the value creation in using parcel locker delivery service. (Yuen et al., 2019) and (Chen et al., 2018) developed the model of customers' intention to use parcel locker delivery and discovered that those attributes positively influence the quality of service, which leads to post-purchase intention. However, the abovementioned studies referred only to provide insights into customers' value creation and factors affecting their determination to use parcel locker delivery. Further, a study conducted in Indonesia by (Zahra, 2019), evaluated the attributes which affecting the technology acceptance of one parcel locker delivery service in Indonesia, where the service quality has not been assessed in this study or other related studies specifically in Indonesia so far. Lastly, in terms of the application of the Best Worst Method (BWM), this method has been widely used in a number of application areas, one of which is to evaluate the service quality (Rezaie et al., 2018; Gupta, 2018).

This study focuses on evaluating the attributes in service quality and prioritize them using a novel and reliable methodology. Secondly, this study is one of the few studies conducted in the Indonesian context and will help service providers to improve their service quality based on the reference of the users specifically in Indonesia.

Methodology

Perceived Service Quality Attributes Identification

In this study, the mixed-mode method was used for data collection. After identifying the problem formulation which comes up from the existing issues, this study started with identifying the SST-related service quality dimensions and its attributes related to parcel locker delivery service. The data was obtained from an in-depth literature review and verified using semi-structured interviews with three experienced users of the parcel locker service.

Questionnaire for Pairwise Comparison Valuation

The next step in this study was to collect data from customers as the decision-makers (DMs) to assess perceived service quality through an online survey by distributing the link of the questionnaire publicly. The research participants were selected through a demographic questionnaire who fulfilled the eligibility as experienced users of online shopping who currently live in the Jakarta Metropolitan Area (Pratama, 2019), represent the biggest percentage of online shopping frequency and considered as a frequent online shopper with one to two times doing online shopping within a month (Suyanto et al., 2019) and using parcel delivery service as the means to deliver the order. Further, the participants were asked to evaluate the service quality attributes through pairwise comparison.

Bayesian Best Worst Method for Obtaining Optimal Weight

After the pairwise comparison data were obtained, the attributes were computed by calculating the weight of each of them using the Bayesian Best-Worst Method (BWM), and those attributes could be ranked and interpreted. The steps of the BWM to compute the attribute weights are described as follows (Rezaei, 2015):

Step 1. Determine a set of conditions for a decision, labeled $\{c_1, c_2, \dots, c_n\}$. It is also possible to categorize them into certain sub-criteria if the case has multiple decision criteria.

Step 2. Determine the best (e.g., most important, most desirable) and the worst (e.g., least important, least desirable) criteria by the DMs.

Step 3. Using a scale between 1 to 9, the DMs express the preference of the best criterion over all the other criteria to determine Best-to-Other vectors, which will be denoted by:

$$A_B = (a_{B1}, a_{B2}, \dots, a_{Bn}) \quad (1)$$

where a_{Bj} indicates the preference of the best criterion B over criterion j. For the same criterion pairwise comparison (a_{BB}), it is clear that the value is 1.

Step 4. Using a scale between 1 to 9, the DMs express the preference of other criteria over the worst criterion to determine Other-to-Worst vectors, which will be denoted by:

$$A_W = (a_{1W}, a_{2W}, \dots, a_{nW})^T \quad (2)$$

where a_{jW} indicates the preference of criterion j over the worst criterion W. For the same criterion pairwise comparison (a_{WW}), it is clear that the value is 1.

Step 5. Find the optimal weights ($w^*_1, w^*_2, \dots, w^*_n$).

The optimization problem in Step 5 of the initial BWM is replaced by a probabilistic model using the Bayesian BWM instead of a multinomial distribution model, using two steps; constructing the probability distribution and calculating the optimal group weight. Assume that the k^{th} DM, $k = 1, 2, \dots, K$, evaluates the criteria $c_1, c_2, \dots, c_n$ by providing the vectors A_B^k and A_W^k . The set of all vectors of K DMs showed by $A_B^{1:K}$ and $A_W^{1:K}$. The superscript $1:K$ would indicate the total of all vectors in the base and the overall optimal weight showed by w^{agg} .

w^{agg} estimation requires the use of many auxiliary variables. In particular, w^{agg} is determined on the basis of the optimum weights of K DMs shown by w^k , $k = 1, 2, \dots, K$. Bayesian BWM will then calculate w^{agg} and $w^{1:K}$ simultaneously.

Delphi Study for Alternative Solutions Evaluation

The alternative solutions in response to the perceived service quality were proposed using internet research and survey with a panel of experts using Delphi methodology to achieve convergence.

After the prioritized perceived service quality has been determined from the Pareto Principle rule, the Delphi questionnaire is being conducted in 3 phases, proposing nine experienced parcel locker users as the study participants. As for the requirement to select the panelists are knowledgeable with the study area, able to participate and communicate effectively, and available during the study duration. The first phase identifies the alternative solutions based on selected perceived value. The second phase and third phase are seeking consensus by reviewing and rating the alternative solutions.

Phase I

The initial alternative solutions towards selected customer perceived value are adopted from an in-depth literature review, and the first questionnaire draft was constructed.

Phase II

The expert panels were contacted to receive an invitation letter and drafted questionnaire. Using a 5-point Likert scale of importance, they were asked to review and rate the products. The panels would also have the chance, when deemed necessary, to incorporate, change or withdraw alternative solutions. The mean and percentage of agreement for scale 4 (important) and 5 (very important) were calculated with the consensus determination of 75% or higher for the percentage of agreement (Diamond et al., 2014; Nor, 2019).

Phase III

The previous responses that have been aggregated were presented back to the participants and rate them using the same scale. The second round oftentimes reaches the consensus (Diamond et al., 2014), and there might be a tendency for another panel to have more input from previous questionnaire results.

Results**Attributes Identification**

The emergence of SST in delivery services using parcel locker is getting increased attention. Thus, relevant information regarding parcel locker service quality attributes can be found in numerous credible works of literature. An in-depth literature study was conducted to identify a list of possible service quality towards parcel locker delivery. The literature search was designed to find the search terms in the literature's title, abstract, and keywords, resulting in a total of 4 main attributes derived from the dimensions of service quality of SST, namely Convenience, Privacy/Security, Enjoyment, and Functionality, as well as 12 sub- attributes, as defined in Table 1.

Table 1. Attributes Identification

Service Quality Dimensions		Sub-Attributes		Adapted Source
1	Convenience	1.1	Location convenience	(Chen et al., 2018; Yuen et al., 2019; Yen, 2005; Ding et al., 2011; Lin & Hsieh, 2011; Vakulenko et al., 2018; Zhou et al., 2020)
		1.2	Time flexibility	
		1.3	Reliable service	
2	Privacy/ Security	2.1	Personal information privacy	(Yuen et al., 2019; Lin & Hsieh, 2011; Zhou et al., 2020)
		2.2	Parcel content privacy	
		2.3	Locker security	
3	Enjoyment	3.1	Interesting and fun	(Dabholkar, 1996; Lin & Hsieh, 2011;
		3.2	Satisfaction	

3.3 Sense of security

Vakulenko et al., 2018)

4	Functionality	4.1	Ease of Use	(Yuen et al., 2019;
		4.2	User-friendliness	Dabholkar, 1996;
		4.3	Error-free	Yen, 2005;
				Lin & Hsieh, 2011;
				Vakulenko et al., 2018;
				Zhou et al., 2020)

Based on the examined literature, the detailed sub-attributes of each item were proposed. In the convenience dimension, there are three sub-attributes. Location convenience is related to the physical proximity of the smart locker to the customer's residence, offices, or public places. Time flexibility refers to the flexibility of the users to pick up goods inside the locker at their convenience. Lastly, the reliability of service relates to delivery accuracy and on-time factors.

In the privacy and security dimension, personal information privacy attributes refer to customer's personal data, including their full name, mobile number, and full address. Package content privacy refers to the details of the goods in the package, and locker security relates to the security level of items stored inside the smart locker.

In the enjoyment dimension, or emotional factor, there are three sub-attributes. Interesting and fun attributes relate to the feelings of interest and pleasure when using smart locker services. Satisfaction refers to the feeling of satisfaction after the user successfully completes the task using smart locker service, and a sense of security relates to when the customers are feeling safe when they put their goods inside the locker and retrieve the parcel in good condition.

Lastly, there are three sub-attributes in the functionality dimension. Ease of use attributes refers to the easiness of instructions given in the operation of the smart locker to retrieve or return the goods. User-friendliness is related to the user-friendly appearance in the display of the smart locker and the application in the mobile phone, and error-free refer to errors generated when operating the service for the first time.

Attributes Evaluation

There are 209 respondents who participated in the questionnaire, with a gender proportion of 37.3% male and 62.7% female. The consistency of the respondents was checked before calculating the optimal weights, and those with an acceptable consistency ratio (CR) were considered (Liang et al., 2020). Using the input-based CR and threshold, the different sample size was used per set of attributes. A threshold of 0.2681 was set for the service quality main attribute, which has four criteria and nine importance scales. This resulted in a sample size of 68 respondents (n=68). Furthermore, a CR threshold of 0.1359 was applied to the rest of the sub- attribute, which considering three criteria and nine importance scale. A sample size of 53 participants was used for a set of sub-criteria convenience (n=53), a sample size of 61 participants was used for a set of sub-criteria privacy/ security (n=61), a sample size of 64 participants was used for a group of sub-criteria enjoyment (n=64), and a sample size of 65 participants was used for a set of sub-criteria functionality (n=65) in order to obtain more reliable results.

In underlying Table 2, the optimal group weights of the service quality dimension as main-attribute are presented, which the data were collected from the pairwise comparison survey and computed using Bayesian BWM.

Table 2. Main Attributes Weights

Service quality dimensions (Main-attribute)	Weight
Convenience	0.2776
Privacy Security	0.3562
Enjoyment	0.1198
Functionality	0.2465

According to Table 2, 'Privacy Security' is the most important parcel locker service quality perceived by customers, with a weight of 0.3562. This implies that customers valued their privacy and security most when using parcel locker. The second most important dimension is 'Convenience', slightly followed by 'Functionality', and 'Enjoyment' is the least important attribute.

Table 3 presents the optimal weight of each sub-attribute, which the data were collected from the pairwise comparison survey and computed using Bayesian BWM. The attributes of service quality are presented in column 1, followed in column 2 by a list of sub-attributes from each dimension. Lastly, the calculated optimal local weight of each sub-attribute is shown in column 3.

A multiplication of each local weight of the sub-attribute by the weight of its corresponding main attribute was carried out in order to obtain the global weight, and the results are shown in column 5. These global weights can compare all sub-attribute in terms of their importance, regardless of their main attribute, as shown in column 6.

Table 3. Sub-Attributes Weights

Main attribute	Sub-attribute	Local weight per sub-attribute	Ranking within category	Global weight per sub-attribute	Overall ranking of sub-criteria
A1 Convenience	A1.1 Location Convenience	0.4253	1	0.1181	3
	A1.2 Time Flexibility	0.2874	2	0.0798	7
	A1.3 Service Reliability	0.2873	3	0.0798	8
A2 Privacy Security	A2.1 Personal Information Privacy	0.3714	1	0.1323	1
	A2.2 Parcel Content Privacy	0.2678	3	0.0954	5
	A2.3 Locker Security	0.3608	2	0.1285	2
A3 Enjoyment	A3.1 Interesting and Pleasant Feelings	0.17	3	0.0204	12
	A3.2 Satisfaction	0.2783	2	0.0333	11
	A3.3 Safe Feelings	0.5517	1	0.0661	9
A4 Functionality	A4.1 Usability	0.4094	1	0.1009	4

A4.2	User-friendliness	0.2339	3	0.0577	10
A4.3	Error-free	0.3567	2	0.0879	6

Aligned with the rank of the main attribute on which the customers perceived 'Privacy Security', 'Convenience', 'Functionality', and 'Enjoyment' as the most to least preferred attribute in the parcel locker service quality, respectively, the global rank of sub-criteria shows the similar arrangement as well. According to the data from Table 3, from 'Privacy Security' main attribute, the sub-attribute 'Personal Information Privacy' is perceived as the most important attribute for the customers in using parcel locker delivery, followed slightly with 'Locker Security'. Specifically, the customers valued privacy since it improves their trust. The third rank goes to 'Location Convenience', which under the 'Convenience' main attribute, followed by 'Usability' under 'Functionality' main attribute. Meanwhile, the first rank in 'Enjoyment' main attribute, 'Safe Feelings', fall into the ninth rank in the global rank.

Due to resources and time limitations, it is important to prioritize the most important ones to allocate the resources in order to adapt the service quality to meet the customers' needs and expectations (Vakulenko et al., 2018; Zahra, 2019), using the Pareto principle. The Pareto principle suggests that 80% of the impact comes from only 20% of potential causes, in this case is 80% of customers' perceived service quality of parcel locker delivery comes from 20% of the sub-attribute. Using the input of the global weight of the sub-attributes, the "vital few" from the "trivial many" can be distinguished. Those prioritized sub-attributes are 'Personal information privacy', 'Locker security', 'Location convenience', 'Usability', 'Parcel content privacy', 'Error-free', and 'Time flexibility'. This also implies that targeting the abovementioned sub-attributes automatically take care of approximately 80% of customers' perceived service quality towards parcel locker delivery.

Identification of Parcel Locker Specifications as Alternative Solutions

After the parcel locker service quality was identified and prioritized as explained in the above subsections, it is observed that there are sub-attributes in parcel locker delivery service quality that should be focusing on. Based upon these sub-attributes, the locker specifications in response to the corresponding sub-attributes were identified through an extensive review of credible literature. Initially, a total of eighteen alternative solutions were derived from the literature study results from credible sources, as presented in Table 4. These items were later examined by the panel of experienced parcel locker users to obtain the alternative solutions' consensus.

Table 4. Initial Proposed Alternative Solutions

Attribute	Sub-attribute	Initial Alternative Solution	References
1 Convenience	Location 1.1 convenience	1.1.1 Close to residence	(Yuen et al., 2019; Lemke et al., 2016; Liu et al., 2019)
		1.1.2 Close to working area (office, parking area)	(Yuen et al., 2019; Lemke et al., 2016)

		Close to public places (gas station, convenience store, shopping mall) (Yuen et al., 2019; Lemke et al., 2016) Close to transportation hub (MRT station, bus stop, train station) (Yuen et al., 2019; Lemke et al., 2016)	
	1.2 Time flexibility	1.2.1 Accessible for 24-hours a day, 7 days a week (Yuen et al., 2019; Vakulenko et al., 2018; Akeb et al., 2018) 1.2.2 Locker point distributed widely, resulted in a smaller queue (Vakulenko et al., 2018)	
2 Privacy security	2.1 Personal information privacy	2.1.1 Consignee personal information will not be enclosed on the smart locker screen during parcel retrieval (Weltevreden, 2008) 2.1.2 Use the locker point as the delivery address (Pos Malaysia, 2020)	
	2.2 Parcel content privacy	2.2.1 Parcel content information will not be enclosed on the smart locker screen during parcel retrieval (Zhou et al., 2020; Weltevreden, 2008; Wang et al., 2018) 2.2.2 One locker only accommodates one parcel (parcel locker cannot accommodate multiple packages from different resources in one locker) (Post, 2018)	
	2.3 Locker security	2.3.1 Recipient identification authentication needed during parcel retrieval (Vakulenko et al., 2018; Wang & Lin, 2016) 2.3.2 Recipient signature needed during parcel retrieval (Vakulenko et al., 2018; DHL, 2020) 2.3.3 Key in PIN needed as the password to retrieve the parcel (Vakulenko et al., 2018; DHL, 2020)	

4 Functionality	4.1 Usability	4.1.1 Sending, tracking, and parcel retrieval are integrated with mobile apps	(Yuen et al., 2019; Turkle, 2012)
		4.1.2 Provide real-time tracking	(Pos Malaysia, 2020; Post, 2018; DHL, 2020)
	4.3 Error-free	4.3.1 Provide help desk (call center) to assist technical issues	(Vakulenko et al., 2018)
		4.3.2 Provide 24-hour live chat to assist technical issues	(Vakulenko et al., 2018)
		4.3.3 Provide easily-accessed FAQs	(Pos Malaysia, 2020; Post, 2018; DHL, 2020)

Evaluation of Parcel Locker Specifications as Alternative Solutions

The objective of this subsection is to assemble and evaluate data related to the parcel locker specification so that alternative solutions can be proposed. To acquire the performance score of each alternative solution to evaluate each of them, expert surveys were held. Since the distribution of parcel locker delivery in Indonesia is not yet spreading widely, the customers who already experienced using parcel locker delivery at least once, were categorized as the expert user in this study. Moreover, since this study focuses on examining customers' preferences in using parcel locker delivery, it was essential to gather the information from the perspective of customers.

A total of 9 expert users participated in the two rounds of the Delphi study. The gender ratio of the participants is roughly equal, although the majority of the participants are male (55.6%), while the remaining 44.4% are female. In terms of their experience in using parcel locker, the ratio is certainly equal, with 33.3% of each category (1-2 times, 3-4 times, and more than 5 times using parcel locker).

The data collection process was carried out after a draft questionnaire was created, which consisted of eighteen parcel locker specifications as listed in Table 4. Participants were asked to provide an objective evaluation by analysis in the first round of the questionnaire and to rate the list of parcel locker requirements using a 5-point Likert scale of importance. They also were asked to add any specifications as deemed appropriate.

By using the percentage of agreement, the significance rating gathered from the survey was calculated. To assess the consensus, the rate of the agreement was designated to be 75%, scoring more than 4 (4 and 5) on the 5-point Likert scale (Diamond et al., 2014; Nor, 2019). According to the result of the first round of questionnaires, it can be inferred that there are thirteen out of eighteen specifications that have the percentage of agreement above 75%, and five specifications which considered not essential. Thus, the specifications which fall under the designated percentage of the agreement were eliminated and not considered as the items to be examined in the second round of Delphi questionnaire. Those eliminated items are the

consideration of parcel locker to be located close to public places, for instance in the gas station, convenience store, and shopping mall (1.1.3), the consideration of parcel locker to be located close to the transportation hub, for instance in the MRT station, bus stop, and train station (1.1.4), the feature to exclusively accommodate one locker for one parcel (2.2.2), recipient identification authentication during parcel retrieval (2.3.1), and recipient signature during parcel retrieval (2.3.2). Furthermore, three items as the alternative solutions from two service quality attributes are proposed in this round. Those items are to key in recipient name and ID number before retrieving the parcel and provide a clear flow chart to explain the parcel locker procedure to retrieve the parcel. In total, there are sixteen items to be assessed to the second round of Delphi questionnaire.

In the second round, the expert users were asked to review the specifications of the parcel locker and rate them using the same scale again (5-Likert importance scale). The data analysis applies the same for this round of the survey, and discovered that out of sixteen items, 88% or fourteen items were above 75% of agreement, and all of the items selected from round 1 of the questionnaire still considered important, which inferred that the participants were consistent with rating each item. However, there were two items eliminated since they were considered not essential, and those two were derived from the proposed items in the round 1 questionnaire, which are key in recipient name and ID before retrieving the parcel. According to this Delphi study, there are fourteen parcel locker specifications as the proposed alternative solution.

Conclusion

The overall completion of this study has met the objectives as targeted. This study evaluates the customer perceived service quality in a hierarchical set through a multi-method approach and produces recommendations in the form of alternative solutions for the prioritized service quality, as described as follows.

Starting from the initial service quality of parcel locker which are convenience, privacy security, enjoyment, and functionality were listed and broken down into four main attributes and twelve sub-attributes, which satisfy the first objective, to identify the perceived service quality of parcel locker delivery from the customer perspective.

The second objective aimed to prioritize the perceived service quality and started with assessing the attributes from the customers' point of view. The optimal weight of each main attribute and its corresponding sub-attributes were computed using Bayesian Best-Worst Method. The findings show that Privacy Security is perceived as the most important criteria with the optimal weight of 0.3562, followed by Convenience (0.2776), Functionality (0.2465), and Enjoyment (0.1198). The optimal weight of the sub-attributes was also being computed. To prioritize the service quality attributes, a Pareto chart analysis was performed and the findings show there are seven prioritized sub-attributes, which are 'Personal information privacy', 'Locker security', 'Location convenience', 'Usability', 'Parcel content privacy', 'Error-free', and 'Time flexibility'.

To achieve the third objective, initial alternative solutions towards the prioritized service quality attributes were listed, which were examined further by the panel of experts. There were in total of nine experienced parcel locker users to assess the importance of each alternative solution using two rounds of the Delphi survey, and the findings show there were a total of fourteen specifications were endorsed.

Acknowledgements

The authors would like to acknowledge the respondents and experts of Jakarta Metropolitan Area who took part in this study.

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