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## Article

# Consumers' adoption of parcel locker service: protection and technology perspectives

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## MARKETING | RESEARCH ARTICLE

# Consumers' adoption of parcel locker service: protection and technology perspectives

Hyun Sang An<sup>1</sup>, Arim Park<sup>2\*</sup>, Ju Myung Song<sup>3</sup> and Christina Chung<sup>4</sup>

**Abstract:** This study examines consumers' decision to select parcel locker service with regard to privacy concerns and perceptions toward technology based on protection motivation theory and the technology acceptance model. A total of 310 consumers using online shopping and delivery services in the 10 most populated metropolitan areas in the United States were recruited. The responses in the final sample were analyzed by using Structural Equation Modeling (SEM). The findings of this study show that consumers' perceived trust in technology-based service (rather than privacy concerns) more strongly evoke parcel locker service adoption intention in consumers' sequential decision-making process, which encompasses threat/coping appraisal, protection motivation, perceived innovativeness from a new service, service trust, perceived usefulness, perceived ease of use, and attitude toward the new service—outdoor parcel locker service. This study provides managerial implications for retailers who need to deliver packages to consumers. This study attempts to understand consumers' decision-making process toward adopting parcel locker service by considering two approaches: technology assessment and privacy protection.

**Subjects:** Consumer Psychology; Supply Chain Management; Industry & Industrial Studies

**Keywords:** parcel locker; protection motivation theory; technology acceptance model; consumer decision-making

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## 1. Introduction

E-commerce sales surpassed in-store sales for the first time in 2019, and 230.5 million U.S. consumers shopped online at least once in 2021 (Coppola, 2021). Consequently, millions of packages are delivered daily around the world. Even though online shopping is quickly changing the landscape of the retail industry, consumers' last mile logistics routine has rarely changed (Risher et al., 2020). The online version of last mile logistics varies greatly but still faces substantial challenges in practice and new problems not yet fully understood in academia.

One problem frequently occurs is that the dramatic surge in online shopping, especially triggered by lockdowns to curtail the spread of COVID-19, has generated ample volumes, but margins are undermined by costs on the final mile. For instance, supply chain networks have been under pressure from this surge in volume, resulting in extended transit times as well as constraints on shippers and rising costs from residential delivery surcharges. As quoted in an article by Putzger (2020), "Ninety-seven percent of organizations believe last mile delivery models are not sustainable since 99% of consumers are not willing to pay the total cost of last mile delivery."

The second problem is that last mile delivery refers to the most precarious part to the final consumers with regard to the security of delivered items. Many online shoppers tend to request that their packages be delivered to the front of their home, and they are left unattended (Rout et al., 2022). Consequently, many delivered packages are stolen, which is known as porch piracy. In fact, more than 1.7 million packages are stolen on a daily basis in the U.S. (Risher et al., 2020), and 51% of online shoppers did not receive at least one package they had ordered online in the past six months (Panko, 2019). Thus, a consumer who lost a package must wait until the seller redelivers it. In the case of a supply chain disruption during the COVID-19 pandemic (Kirby, 2021), the waiting period is likely to be an annoyance that might negatively affect consumer satisfaction.

The third problem is that victims of porch piracy are concerned about privacy issues unavoidably caused by online purchases. The combination of consumer's name, contact information, and home address can be a gateway to information theft (Porter, 2017). If online sellers cannot deliver packages on time, or if the packages are stolen, they must pay double for the delivery and/or product costs to resend the item or compensate for the lost packages. Additionally, if customers are jeopardized by identification theft, the sellers' reputation management may be undermined, possibly leading to business failure.

To resolve such issues, companies have started to engage their customers with a new delivery method: parcel locker service, by which sellers deliver packages, and consumers can pick them up whenever convenient (see, Figure 1). This system introduces three benefits to both companies and consumers. First, it offers significantly lower delivery costs by using a hub location to deliver packages. So, it improves the operational efficiency involved with last mile transportation costs. According to Putzger (2020), parcel locker service is more than three times faster, with a less-than -10% cost, compared to conventional door-to-door delivery service.

Second, the service alleviates consumers' concerns about physically contacting others. Andre Veskimeister, head of Omniva's parcel business, asserts, "In the pandemic, outdoor lockers are the safest option to deliver. Contactless and social distancing solutions were in high demand from a high percentage of consumers. An additional impetus for parcel locker solutions had come from a heightened desire for contactless delivery solutions which has registered growth of 40–50% in the markets it operates in" (Putzger, 2020).

Third, online shoppers can prevent package loss by using a secure locker. As package theft caused by porch piracy increases, consumers are reporting where their packages are left. According to Panko (2019), 57% of online shoppers say that their packages are typically left in an outdoor, unsecured area (such as a front porch) upon delivery. Secure package pick-up kiosks

**Figure 1. Parcel locker example (Panko, 2019).**



can provide a more convenient, time-saving, and safer alternative if consumers are concerned about timeliness and are afraid of possible identity theft.

With all these benefits, parcel locker services are currently in the implementation stage (Vakulenko et al. 2019). Industrial reports show a rising trend in this service, as locker mobile app downloads have gone up by 46% (Putzger, 2020). Accordingly, this study aims to determine the impacts of factors affecting consumers' attitudes on parcel locker service and their behavioral responses to this service. To date, most studies have focused only on operational benefits such as cost-savings or delivery-time reduction. Thus, there is lack of empirical evidence on the role of intrinsic and extrinsic factors in using parcel lockers from the consumers' perspective, resulting in a gap in the existing literature. However, this study examines consumers' decision process in adopting parcel locker service with regard to the usefulness of this service and privacy concerns using protection motivation theory (PMT) and the technology acceptance model (TAM). This study particularly addresses the following research question: *What influences consumers' decision to adopt parcel locker service to maximize their shopping experience while resolving package loss and privacy concerns?*

Incorporating the PMT and TAM, a hypothetical research model has been developed by adopting the constructs of threat and coping appraisals, protection motivation, perceived innovativeness, service trust, perceived ease of use and usefulness, attitude, and intention to use. This study contributes to extending empirical literature and providing a research framework based on PMT and TAM, primarily focusing on consumers' adoption of parcel delivery locker services. In addition, the results of the study provide theoretical foundations in studying parcel locker service and managerial implication for retailers in adopting a delivery system.

## **2. Literature review and hypotheses development**

### **2.1. Explanation of each concept**

#### **2.1.1. Parcel locker service**

A parcel locker service refers to a type of last mile delivery that enables online shoppers to receive items on a flexible schedule within an available pick-up timeframe, even if the recipient is absent during delivery (Iwan et al., 2016). Delivering items to a parcel locker hub location saves delivery operating costs (compared to home delivery) by reducing the delivery-time window (Song et al., 2016).

Moreover, (Van Duin et al., 2020) argue that consumers and carriers (i.e., truckers) will retrieve package information since all service is offered via real-time data-based technology. Consumers

can reduce the possibility of having fewer delivery accidents and losses. Moreover, there is less risk of personal information breaches owing to the fact that consumers do not need to disclose their home address.

### 2.1.2. *Protection motivation theory (PMT)*

Protection Motivation Theory (PMT) was developed to explain an individual's behavioral alterations shaped by fear appeals. First proposed by Rogers (1975), this theory posits that an individual's protection motivation is formed by cognitive assessment, including threat and coping appraisals. First, threat appraisal involves evaluating a noxious menace caused by external factors that consist of perceived vulnerability or susceptibility to the threat and severity of the menace (Rogers, 1975). Susceptibility or vulnerability refers to the level of probability in which the threat occurs, while the severity indicates the seriousness of the harmful event if it actually happens. Second, a coping appraisal evaluates an individual's capability of managing the menacing incident, including response efficacy and self-efficacy. Response efficacy involves evaluating the effectiveness of an individual's preventative behavior, whereas self-efficacy involves evaluating an individual's capability of executing preventative behavior. This theory argues that protection motivation (controlled by both threat and coping appraisals) underlies an individual's behavioral changes (Rout et al., 2022; Kim and Kim, 2016; Li, 2012). Because customers who use parcel locker services want to prevent unfavorable situations such as lost packages and private information theft, threat and coping appraisals play a critical role in parcel locker service use.

### 2.1.3. *Technology acceptance model (TAM)*

With the rapid development of technology, consumers decide whether they will accept the new technology or not based on the technology's perceived ease-of-use and perceived usefulness (Davis, 1989). Perceived ease-of-use (PEOU) refers to the degree to which a person believes that using a particular service will be effortless (Davis, 1989). Perceived usefulness (PUSE) indicates the degree of a person's perception of his or her performance enhancement through the technology (Davis, 1989). Han et al. (2020) assert that these factors are critical to developing companies' new services. Thus, the Technology Acceptance Model (TAM) is widely used to understand consumers' attitudes and behaviors toward new technology (Erskine et al., 2020; Azjen, 1980). Because this theory can evaluate consumers' perceptions toward new technologies, many prior studies have applied this theory to online shopping (Rout et al., 2022; Tong, 2010) or social network service advertising (Muk and Chung, 2015). In the context of parcel locker services, consumers are prepared to use this technology with the expectation of positive outcomes (e.g., on-time delivery pickup). Yan et al. (2019) show that PUSE and PEOU positively influence consumers' product usage intention. Also, Chen et al. (2020) find that perceived ability and value positively affect consumers' attitudes toward automated parcel stations. Therefore, this theory can help provide an understanding of consumer behavior in regard to positive attitudes toward parcel locker services.

## 2.2. *Hypotheses development*

### 2.2.1. *Effect of threat and information protection motivation*

PMT is designed to predict how individuals' perceived threats and evaluated ways of coping with those threats activate their internal motivation to protect themselves. Thus, this theory is helpful in explaining the relationship between 1) threats raised by personal information and property theft and protection motivation and 2) seemingly possible protection methods and protection motivation. Understanding these relationships is critical, given that consumers' internal motivation to protect themselves from a threatening environment (such as private information theft and package loss) can be an initial precursor affecting their attitudinal assessment to adopt parcel locker service.

According to PMT, when individuals perceive a threat, they develop an appraisal of the threat based on its severity and susceptibility (Chou & Chou, 2016). For example, consumers worried about identity or package theft are fearful and anxious in the first stage (Mousavi et al., 2020). If

this threat is likely to occur, and if the results are believed to be substantial, consumers will be nervous about disclosing their personal information, including their name and/or home address. In addition, consumers tend to cope with these threatening situations by assessing any approaches that can prevent these situations and evaluating their capabilities to adopt these approaches (Chen, 2016; Mousavi et al., 2020). PMT asserts that these two cognitive assessment processes (i.e., threat and coping appraisals) stimulate individuals' protection motivation (Kim and Kim, 2016), especially during the pandemic (Chen et al., 2022; Wang et al., 2022). Hence, this study explores whether consumers are motivated to protect their personal information and property by recognizing the threat severity and susceptibility associated with online shopping, and propose the following hypotheses:

**H1a: Threat appraisals positively affect consumers' protection motivation.**

**H1b: Coping appraisals positively affect consumers' protection motivation.**

#### 2.2.2. *Effect of perceived innovativeness, perceived usefulness, and perceived ease of use*

This study adopts TAM to examine the effect of perceived innovativeness (INNO) on consumers' attitudes toward parcel locker services via PUSE and PEOU. Oliver et al. (1997) argue that knowledge or information about products or services can influence consumers' attitudes toward them via internal cognitive processes, even if they do not have direct experience with the products or services. Moreover, consumers' subjective values and beliefs can influence their behavior (Hwang et al., 2019). Therefore, when consumers perceive innovativeness from parcel locker service, they evaluate its usefulness and ease of use, which may eventually impact their attitude toward the service. Previous studies have shown a positive relationship between perceived innovativeness and attitude. For example, Tong (2010)'s study on e-shopping finds that innovative technology positively affects American consumers' PUSE and PEOU. Fagan et al. (2012)'s study on virtual reality (VR) finds that an individual's perceived innovativeness on VR simulation significantly and positively affects his/her PUSE and PEOU, and eventually impacts the consumer's higher degree of willingness to use VR simulation. Won et al. (2022) test the relationship between an application system enabled by innovative technology and app users' PUSE and PEOU. The study finds that greater PUSE and PEOU regarding innovative technology are highly associated with innovativeness. As such, the following hypotheses are examined:

**H2a: Perceived innovativeness toward parcel locker service has a positive impact on the perceived ease of use in parcel locker service.**

**H2b: Perceived innovativeness toward parcel locker service has a positive impact on the perceived usefulness of parcel locker service.**

#### 2.2.3. *Effect of trust, perceived usefulness, and perceived ease of use*

Trust is driven by an individual's perception and contributes to "the occurrence of [a] good or bad result" (Deutsch, 1962; Arora and Sahney, 2018). On the other hand, Cheng et al. (2019) find that the perception of trust is a critical factor in terms of understanding a technology user's behavior. With TAM, trust plays a vital role when consumers are willing to use new technology-based services. In particular, trust promotes consumers' engagement in the online shopping context. Even though previous studies have not directly tested consumers' perspectives, PUSE and PEOU are positively influenced by consumers' trust in the online transaction process (Candra et al., 2020). For example, Hu et al. (2019) find that the more users trust a service provider, the more willing they are to adopt the provider's services. With this in mind, the current study tests how consumers' trust toward a new service (i.e., parcel locker service) affects their PUSE and PEOU toward the

service. Therefore, we hypothesize that consumers' perceived trust (TRST) on parcel locker service will positively impact PUSE and PEOU:

***H3a: Trust in parcel delivery locker service has a positive impact on the perceived ease of use in parcel locker service.***

***H3b: Trust in parcel delivery locker service has a positive impact on the perceived usefulness of parcel locker service.***

#### *2.2.4. Effect of protection motivation and attitude*

Previous studies have extended the relationship between information protection motivation and behavioral intention (Chou and Chou, 2016). According to Chen (2016), a person who is motivated to protect her/his privacy forms an attitude toward suggested protective mechanisms before s/he accepts the recommendations and adjusts his/her behavior for better protection. Additional studies on the relationship between privacy protection motivation and attitude has supported the sequential mechanism between protection motivation and attitude (Kursan-Milaković and Miocevic, 2022; Mousavi et al., 2020). Applying this relationship to the context of parcel locker service, consumers who are motivated to protect their personal information and property (e.g., delivered packages) are expected to determine how likely they will accept and use the service (e.g., attitude; Mousavi et al., 2020). Accordingly, the following hypothesis is developed:

***H4a: Protection motivation has a positive impact on attitude toward parcel locker service.***

#### *2.2.5. Effect of perceived usefulness, perceived ease of use, and attitude*

Next, this study has hypothesized the relationships among PUSE, PEOU, and attitude toward using parcel locker service based on the following literature. A number of prior studies have supported the finding that PEOU and/or PUSE have a positive impact on consumers' attitude formation (Won et al., 2022; Hu et al., 2019). In terms of attitude, perceived ease of use and perceived usefulness are critical factors in utilizing information technology (Davis et al., 1989). Tong (2010) finds that consumers' PUSE of online shopping affects their attitude toward online purchases, which consequently influences their behavioral intention to shop online. Moreover, Fagan et al. (2012) concludes that VR technology users' PEOU positively influences their intention to adopt new technology via the degree of their beliefs toward using advanced technology (i.e., attitude), which enhances their adoption behaviors in VR simulation technology. Lee et al. (2019) also show that PUSE and the PEOU are direct determinants of technology adoption via consumers' attitudes in using VR technology (Brandon-Jones and Kauppi, 2018). This study assumes that consumers' PUSE and PEOU on parcel locker service will positively influence their attitude on this service. Thus, the following hypotheses are proposed:

***H4b: Perceived ease of use has a positive impact on attitude toward parcel locker service.***

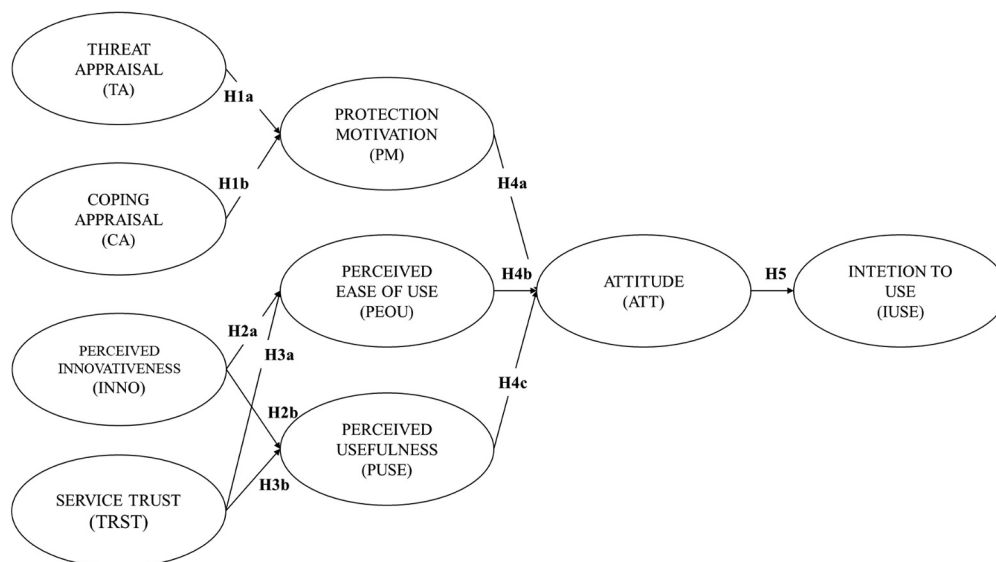
***H4c: Perceived usefulness has a positive impact on attitude toward parcel locker service.***

#### *2.2.6. Effect of attitude and consumer intention to use parcel locker service*

Lastly, this study examines the relationship between consumers' attitude and their behavioral outcome—intention to use parcel locker services. Measuring emotional attitude is critical, given that behavioral intention is a concept that can help predict actual behavior by its influential power (Núñez-Barriopedro et al., 2021; Azjen, 1980). In addition, the TAM framework is helpful in explaining how consumers' intention to adopt and use a certain service is driven by their attitude (Davis, 1989; Han et al., 2020). Based on this theoretical framework, the particular relationship between



Figure 2. Research model.



individuals' attitude and their behavioral intention has long been discussed. For example, Festinger (1957) contends that individuals' behaviors are led by their attitudes. Moreover, Azjen (1980) argue that people's attitudes positively influence their behavioral intentions. Pookulangara et al. (2011) posit that consumers' attitudes are a reliable determinant in predicting their behavioral intentions. More recently, Gebert-Persson et al. (2019)'s study on an online insurance claim setting depicts consumers' attitudes on such technology-based services as being positively related to their intentions to adopt and use such services based on the TAM framework. Won et al. (2022) also validate the finding that sport-related mobile shopping service users' attitudes on services positively influence their willingness to adopt and use such technologies. Thus, this study proposes the following hypothesis:

**H5: Attitude toward parcel locker service has a positive impact on intentions to use it.**

Derived from the aforementioned literature reviews, a hypothetical research model is developed based on the PMT and TAM frameworks to scrutinize U.S. online shoppers' privacy and property protection motivation, technology perspective, attitudes toward new technology-aided services, and how they impact online shoppers' intentions to adopt parcel locker services (see Figure 2).

### 3. Research methodology

#### 3.1. Questionnaire design

This study adapts 9 constructs along with 27 measurement scales used in previous studies. All items chosen to measure each construct are designed using a 7-point Likert scale (e.g., 1 = Strongly disagree; 7 = Strongly agree), except for the attitude (ATT) construct measured by a 7-point bipolar scale (e.g., Good: Bad) (see Table II).

#### 3.2. Population and sampling

Using G-Power version 3.1.9.4., the minimum sample size was calculated by an a priori power analysis with a correlation biserial model under a one-tailed t-test. It is indicated that a minimum sample size of 111 is required under a statistical power of .95 and an effect size of .3, based on Cohen (2013), Faul et al. (2007), and Soper (2021) also validates the sample size and recommends

a more conservative minimum sample size of 216 for the model structure to have 9 constructs and 27 observed variables.

### **3.3. Data collection and sample characteristics**

Based on the minimum sample size calculated, this study invited 322 online survey participants. By following Yuen et al. (2019), which limits the sample to the top 10 U.S. cities to examine consumers' online shopping behavior, subjects living in the top 10 U.S. metropolitan areas (e.g., New York, NY; Los Angeles, CA; Chicago, IL; Houston, TX; Phoenix, AZ; Philadelphia, PA; San Antonio, TX; San Diego, CA; Dallas, TX; and San Jose, CA) were recruited via Qualtrics' panel service. The panel provided subjects with detailed information regarding the parcel locker service (e.g., how it works and which companies have adopted this service). In the final sample, 12 subjects who had not completed the survey were excluded, and 310 subjects who had engaged in online shopping or any other type of delivery service remained. Subjects from each age group in their 20s, 30s, 40s, and 50s were evenly recruited (25% respectively), and the respondents in these age groups aptly represent the major online shopping groups in the top 10 largest cities in the U.S. (Shibu 2020; Coppola, 2021). The final sample consists of 55.2% male and 44.8% female respondents. Approximately 71% of the respondents reported being worried about having their packages stolen or damaged; in addition, more than half of the respondents had direct or indirect experience of personal information theft (see Table 1).

## **4. Data analysis and findings**

### **4.1. Reliability and validity of the measurement model**

#### **4.1.1. Common method variance (CMV)**

As suggested by Podsakoff et al. (2003), common method variance (CMV) was tested by Harman's one-factor analysis using SPSS 28, given that CMV is debatable in single self-report online surveys. The one-factor analysis extracted 36.05% of the total variance and validated that the data are less likely to have CMV issues because the total variance extracted is less than 50% (Sakrabani and Teoh, 2020).

#### **4.1.2. Exploratory factor analysis**

To examine the validation of the key constructs, Exploratory Factor Analysis (EFA) was run based on varimax rotation. The Kaiser criterion of the eigenvalue exceeding 1 was used to evaluate the factor loading. Hence, 27 items were extracted, which had the lowest factor loading of .62 and the highest being .91, and an under cutoff value of .5 across 10 dimensionalities with an eigenvalue exceeding 1. A Cronbach's alpha exceeding 0.70 indicates that the proposed model has acceptable internal consistency and validity (Nunnally, 1978) (see Table 2).

#### **4.1.3. Confirmatory factor analysis**

A confirmatory factor analysis (CFA) was run to test the measurement characteristics of the proposed model by AMOS 28. This study adopted the following indices (Hair et al., 2018):  $\chi^2$ , Tucker Lewis index (TLI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). The CFA resulted in a tolerable model fit with  $\chi^2 = 519.64$ ,  $df = 287$ ,  $p$ -value  $< .000$ , TLI = .958, CFI = .965, and RMSEA = .051 (90% confidence interval: .044–.058). Also, the construct validity was assessed by calculating the construct reliabilities, average variance extracted (AVE) percentages, and inter-construct correlations.

All standardized factor loading estimates ( $\lambda$ ) were significant ( $p < .000$ ). The lowest factor loading estimate ( $\lambda$ ) was .67, and the highest was .93. The average variance extracted estimates (AVE) were .65, .73, .73, .65, .74, .61, .76, .79, and .80 for TA, CA, PM, INNO, TRST, PEOU, PUSE, ATT, and IUUSE, respectively. Further, the construct reliability estimates were all acceptable, with the lowest being .85 and the highest being .92 (see Table 3). Discriminant validity was assessed by comparing the square root of the average variance-extracted ( $\sqrt{AVE}$ ) percentage for any two

**Table 1. Sample descriptions**

	Sample	Respondents
Sex	Male	171 (55.2%)
	Female	139 (44.8%)
Housing type	Single-family home	203 (65.5%)
	Multi-family home	11 (3.5%)
	Apartment	59 (19%)
	Townhome	13 (4.2%)
	Condo	17 (5.5%)
	Campus dormitory	1 (0.3%)
	Others	6 (1.9%)
Housemate	Single-person household	60 (19.4%)
	Living with family members or someone else (e.g., roommate or housemate)	250 (80.6%)
Monthly Income	Under \$1,000	22 (7.1%)
	\$1,001—\$2,000	48 (15.5%)
	\$2,001—\$3,000	51 (16.5%)
	\$3,001—\$4,000	36 (11.6%)
	\$4,001—\$5,000	21 (6.8%)
	\$5,001—\$6,000	37 (11.9%)
	Over \$6,000	95 (30.6%)
Concerns for package delivery		
• Do you worry about stolen or damaged packages?	Yes/No	Yes: 221(71.3%); No: 89 (28.7%)
• Have you ever had trouble finding where a package should have been left?	Yes/No	Yes: 149 (48.1%); No: 161 (51.9%)
• Have you ever stolen personal information before?	Yes, I have direct experience.I have indirect experience.No, I have not.	Yes: 80 (25.8%); Indirect: 61 (19.7%); No: 169 (54.5%)

constructs with the correlation estimate between these two constructs (Fornell and Larcker, 1981). Both the convergent validity and discriminant validity of the model were supported, and good reliability was also established (see Table 3).

#### 4.2. Hypotheses testing and results

Structural Equation Modeling (SEM) assessed the overall theoretical model specification while testing the hypotheses. The SEM results indicate a satisfactory fit of the data with  $\chi^2 = 786.79$ ,  $df = 304$ ,  $p$ -value < .000, TLI = .917., CFI = .928, and RMSEA = .072 (90% confidence interval: .066—.078). The SEM structural path results show that all relationships among the constructs are significant.

The hypothetical path between threat appraisal (TA) and protection motivation (PM) shows that TA has a significantly positive impact on PM ( $\beta = .376$ ,  $p < .001$ ). Thus, H1a is supported. The hypothetical relationship between coping appraisal (CA) and PM reveals a significantly positive value as well ( $\beta = .461$ ,  $p < .001$ ). Hence, H1b is also supported. In H2a, the proposed path between INNO and PEOU turns out to be significantly positive ( $\beta = .274$ ,  $p < .01$ ). As a result, H2a is supported. The expected positive relationship between INNO and PUSE also turns out to be significant ( $\beta = .471$ ,  $p < .001$ ). Thus, H2b is supported. Moreover, the proposed positive relationship

**Table 2. Exploratory factor analysis results**

Item	Questions	Source	Factor Loading	Cronbach's Alpha
TA1	I find the transmission of my personal information (e.g., home address) risky.	Johnston and Warkentin (2010)	0.85	.841
TA2	Personal information (e.g., home address) theft seriously affects my life.		0.91	
TA3	If my personal information (e.g., home address) is shared with a third party, it would negatively impact my privacy.		0.70	
CA1	I can protect my personal information (e.g., home address) by using parcel locker service.	Mousavi et al. (2020)	0.82	.890
CA2	Parcel locker service offers me privacy protection by not revealing my personal information (e.g., home address).		0.81	
CA3	It is helpful for me to use parcel locker service to protect my personal information (e.g., home address).		0.73	

(Continued)

**Table 2. (Continued)**

Item	Questions	Source	Factor Loading	Cronbach's Alpha
PM1	I intend to protect my personal information (e.g., home address) or personal property (e.g., item purchased) when I shop online by using a hub post (e.g., parcel locker) in order to not use my home address.	Mousavi et al. (2020)	0.76	.890
PM2	I am sure that I will protect my personal information or personal property (e.g., item purchased) when I shop online by adopting any possible way (e.g., parcel locker service).		0.72	
PM3	I may do something (e.g., use parcel locker service) to protect my personal information (e.g., home address) or personal property (e.g., item purchased) when I shop online.		0.71	
INNO1	Parcel locker service seems unique.	Hwang et al. (2019)	0.72	.850
INNO2	Parcel locker service seems new.		0.87	
INNO3	Parcel locker service seems creative.		0.74	
TRST1	I trust that the parcel locker service has the necessary capabilities and resources to carry out its operations.	Pavlou (2003)	0.73	.892
TRST2	I trust that the parcel locker service has sufficient experience to handle the work properly.		0.77	
TRST3	I trust that the service provider will fulfill its service commitments while using the parcel locker.		0.77	

(Continued)

**Table 2. (Continued)**

Item	Questions	Source	Factor Loading	Cronbach's Alpha
PEOU1	Using parcel locker would not require much mental effort.	Lee et al. (2019)	0.83	.787
PEOU2	Learning to use the parcel locker would be easy for me.	Brandon-Jones and Kauppi (2018)	0.62	
PEOU3	I would find the parcel delivery locker easy to use.	Tong (2010)	0.74	
PUSE1	Using the parcel locker would make it easier to pick up the package.	Tong (2010)	0.73	.903
PUSE2	Using the parcel locker would improve my online shopping experience.		0.72	
PUSE3	Overall, using the parcel locker is advantageous.		0.68	
ATT1	<i>I feel the parcel locker service is ...</i>	Hwang et al. (2019)		
ATT2	Bad: Good	An et al. (2020)	0.79	.917
ATT3	Negative: Positive Unlikable: Likable		0.74 0.79	
IUSE1	Assuming that I needed to shop online, I would probably choose to deliver items to the parcel locker.	Park et al. (2022)	0.78	.948
IUSE2	I will use the parcel locker service if the online retailer offers such an option.		0.79	
IUSE3	In the near future, I will use the parcel delivery locker service.		0.81	

TA: Threat Appraisal; CA: Coping Appraisal; PM: Protection Motivation; INNO: Perceived Innovativeness; TRST: Service Trust; PEOU: Perceived Ease of Use; PUSE: Perceived Usefulness; ATT: Attitude; and IUSE: Intention to Use

between TRST and PEOU reveals significance ( $\beta = .748, p < .001$ ). Thus, H3a is supported. The hypothesized positive relationship between TRST and PUSE demonstrates significance ( $\beta = .471, p < .001$ ;  $\beta = .372, p < .001$ , respectively) as well. Therefore, H3b is supported. The hypothesized path between PM and attitude (ATT), between PEOU and ATT, and between PUSE and ATT all turn out to be significant ( $\beta = .160, p < .001$ ;  $\beta = .399, p < .001$ ;  $\beta = .480, p < .001$ , respectively). Hence, H4a, H4b, and H4c are supported. Lastly, the proposed path between ATT and consumers' intention to use parcel locker service (IUSE) reveals a significantly positive impact ( $\beta = .890, p < .001$ ). Therefore, H5 is supported (see Table 4 and Figure 3).

## 5. Discussions and implications

### 5.1. Discussions

The test results address the research question by supporting the hypothesized sequential paths among TA, CA, PM, INNO, TRST, PUSE, PEOU, ATT, and IUSE. The results demonstrate that U.S. online shoppers' perceived trust in technology-aided service (TRST) is the strongest initial motivator for them when adopting a new service that protects them from threats, although other initial factors (including CA, TA, and INNO) are also significantly positive determinants. This result also suggests that shoppers tend to rely more on external versus internal sources when they confront any threats; moreover, they internally assess the severity and susceptibility of a threatening situation as well as their ability to shun the threat. Thus, delivering a trust (as opposed to a fear) appeal message would be more effective in terms of the protective service attracting attention from threatened consumers.

On the other hand, it is possible that today's online shoppers show this tendency because they disregard threats from package loss due to well-supported customer care systems in which online sellers generously compensate any delivery complications by redelivering the item at no extra charge or offering store credit when packages are stolen or delivered to the wrong destination. In addition, today's consumers are already used to providing their personal information for online transactions and understand that their online and offline activities are being tracked at a certain level (Auxier et al., 2019). Thus, they may not be worried about their name and address being used in online transactions. These assumptions are also supported by the finding that online consumers' attitude formation toward parcel delivery locker service is more significantly influenced by PUSE and PEOU than their protection motivation. This unique finding that technological efficacy in preventive services surpasses consumers' protection need provides more essential theoretical and managerial implications.

### 5.2. Theoretical implications

In this study, the theoretically hypothesized model empirically explains consumers' sequential behavioral tendencies in evaluating possible threats (e.g., package loss and identification theft) and consumers' internal mechanisms to avoid these. Further, the model shows how consumers assess the technological efficacy of such services, form their attitudes, and adopt the new technology-based services (i.e., parcel delivery locker service) by validating the pertinence of the PMT and TAM frameworks.

First, the proposed model posits that consumers' threat and coping appraisals are critical factors influencing their parcel locker service adoption via the protection motivation within the PMT framework. In line with Chou and Chou (2016), a context that generates a threat in terms of its severity and vulnerability provokes individuals' psychological motivation to protect themselves. Also, in line with Bolkan (2018) and according to the results, a situation that jeopardizes the security of personal information and property increases individuals' protection motivation, along with behavioral intentions to lessen or avoid the threat by identifying their capability. Therefore, theoretically, this study provides a better understanding of consumers' cognitive evaluation of threats and coping mechanisms, along with behavioral intention to adopt parcel locker service by emphasizing the role of internal protection motivation. In addition, the findings demonstrate that

Table 3. Correlation matrix, CR, AVE, and convergent and discriminant validity

	Mean	SD	CR	AVE	TA	CA	PM	INNO	TRST	PEOU	PUSE	ATT	IUSE
TA	4.87	1.40	.85	.65	<b>.80</b>								
CA	5.30	1.19	.89	.73	.37	<b>.86</b>							
PM	5.05	1.36	.89	.73	.47	.50	<b>.86</b>						
INNO	5.33	1.15	.85	.65	.23	.55	.41	<b>.81</b>					
TRST	5.41	1.13	.89	.74	.17	.58	.46	.53	<b>.86</b>				
PEOU	5.39	1.17	.83	.61	.21	.55	.43	.53	.73	<b>.78</b>			
PUSE	5.00	1.44	.90	.76	.23	.51	.66	.54	.58	.58	<b>.87</b>		
ATT	5.22	1.51	.92	.79	.21	.50	.52	.43	.59	.57	.65	<b>.89</b>	
IUSE	4.83	1.54	.92	.80	.28	.49	.68	.56	.58	.62	.85	.68	<b>.90</b>

CR: Composite Reliability; AVE: Average Variance Extracted; The square root of the Average Variance Extracted  $\sqrt{AVE}$  is indicated in boldface; All correlations are significant at the .01 level (2-tailed).



**Table 4. Hypotheses testing results of the structural model**

Hypothesis		$\theta$	S.E.	p-value	Result
H1a:	TA → PM	.376	.064	<.001	Supported
H1b:	CA → PM	.461	.068	<.001	Supported
H2a:	INNO → PEOU	.274	.071	<.001	Supported
H2b:	INNO → PUSE	.471	.081	<.001	Supported
H3a:	TRST → PEOU	.748	.068	<.001	Supported
H3b:	TRST → PUSE	.372	.069	<.001	Supported
H4a:	PM → ATT	.160	.059	<.01	Supported
H4b:	PEOU → ATT	.399	.071	<.001	Supported
H4c:	PUSE → ATT	.480	.085	<.001	Supported
H5:	ATT → IUSE	.891	.061	<.001	Supported

The coefficients ( $\theta$ ) are a standardized value.; S.E.: standard error

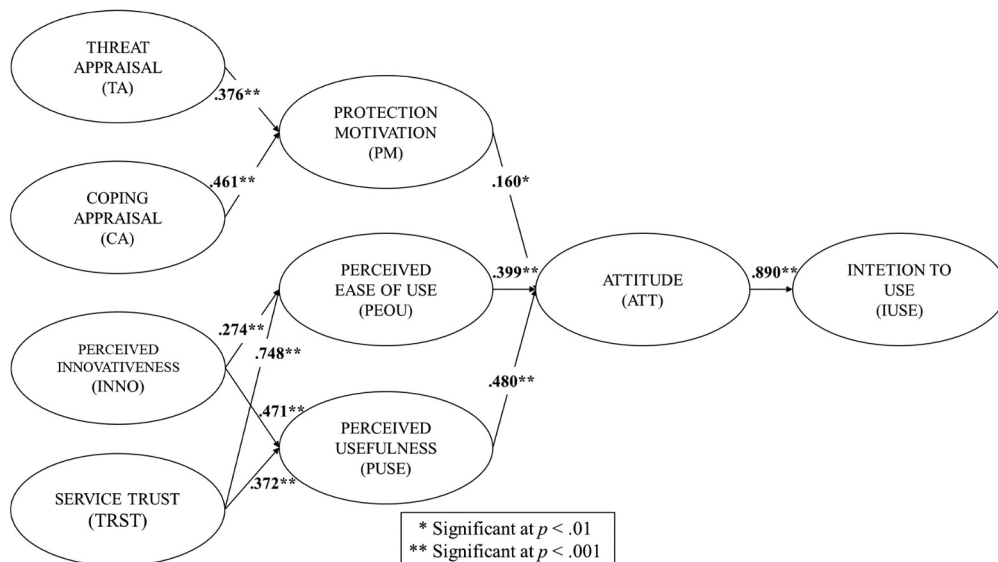
the proposed technology efficacy-related antecedents of parcel locker service adoption—i.e., TRST and INNO—explain a substantial proportion of the variance in PU and PEOU; these are shown to be stronger determinants of parcel delivery locker service adoption than threat-related factors.

Second, this study uniquely contributes to the current literature on the integrated framework of PMT and TAM, with the finding that consumers’ cognitive evaluation of the technology rather than of the threat itself and consumers’ self-efficacy are stronger determinants of parcel locker service adoption intention. The sequential linkage between consumers’ attitude and their behavioral response—i.e., intention to use the service—validates the foundation of TAM (Mousavi et al., 2020). Therefore, this study provides theoretical evidence that technological efficacy could be a more appealing component than protection motivation in consumers’ new service adoption.

**5.3. Managerial implications**

The findings also suggest managerial implications from a practical perspective, especially for sellers delivering packages to consumers via online shopping. Owing to the rapid growth of e-commerce and technology, parcel locker services can present a potential opportunity as a unique distinction in overcoming current competition among e-commerce providers by adding

**Figure 3. Hypotheses testing results.**



value to last mile services. Picking up packages at a parcel locker as an additional delivery option may mitigate consumers' security concerns and increase convenience. For example, some packages are still stolen or lost using home delivery service. Such a situation creates many challenges for both consumers and companies.

From the consumers' perspective, this problem results in product loss and privacy concerns (e.g., identification theft) since packages display sensitive information such as one's address and name. From the companies' view, failing to deliver packages on time undermines their reputation due to consumer dissatisfaction, which may adversely affect customer retention. Companies also need to double their delivery and product costs to compensate for delivery problems. Therefore, parcel locker service as a new form of product delivery may help customers save time while offering enhanced security (i.e., package and personal information protection). This study found that consumers' behavioral intention to adopt the parcel locker service positively correlates with consumer's direct/indirect experiences of losing packages ( $r = .301, p < .001$ ) and personal information ( $r = .203, p < .001$ ). Thus, parcel locker service provides a more effective and efficient option for consumers who value convenience, timeliness, personal information and property safety. Additionally, parcel locker service may be attractive to consumers who wish to avoid engaging in face-to-face contact, especially during the COVID-19 pandemic. Hence, adopting parcel locker services results in a win-win situation for both sellers and consumers.

More importantly, the results suggest that technology efficacy (i.e., innovativeness, perceived trust, usefulness, and ease of use) plays a more significant role in service users' adoption decision-making process. This finding suggests how sellers can target consumers in offering this delivery service. Therefore, parcel locker service providers should emphasize their technological effectiveness in maximizing consumer convenience when recruiting users. A convenience-oriented segmentation strategy may positively impact these service providers' profits (Hwang et al., 2019). Thus, as one of the marketing communication strategies, parcel locker service providers and online sellers should deliver a convenience-appeal message rather than a fear-appeal message via their marketing communications.

## **6. Conclusion and future directions**

### **6.1. Key findings**

This study examines consumers' decision to select parcel locker services with respect to privacy and technical concerns based on protection motivation theory and the technology acceptance model. This study offers theoretical and managerial implications for retailers that deliver items to consumers. Specifically, this study's proposed model shows that online shoppers are more motivated to adopt parcel delivery locker services due to technological efficacy (e.g., technological trust and innovativeness), than privacy concerns (e.g., property and/or personal information theft). Overall, the findings of this study suggest that emphasizing technical efficacy for parcel locker service adoption may be one of the most effective marketing strategies to enhance consumers' shopping convenience and increase their satisfaction.

### **6.2. Limitations and suggestions for future research**

This study has some limitations. First, the samples were collected by limiting the scope to 10 metropolitan areas in the United States only. However, people who live in small suburban areas might have different perceptions toward the parcel locker service. Thus, it would be interesting to examine differences among the regions (e.g., cities vs. suburbs vs. rural areas). Also, moderating effect of culture, product category (groceries vs. packaged goods), and/or product value (inexpensive vs. luxury) would be worth investigating in future research. In this study, consumers' gender, housing type (e.g., single-family or others—see, Table 1), and housemate do not cause any difference in behavioral intention to adopt parcel delivery locker service. It also might be because the sample of this study was collected only in metropolitan areas. Therefore, this offers another motivation to expand the study areas, including the abovementioned factors for future study.

Another limitation of this study is that it focuses on consumers who rely on delivery services for online shopping. By understanding consumers' behavioral intention, this study mainly offers implications for sellers (e.g., retailers). Consumers' generational gap in psychological barriers that hinder the service adoption would be worth investigating since consumers' age in this study showed negative correlational tendency with perceived usefulness ( $r = -.115, p < .05$ ) and the service adoption intention ( $r = -.115, p < .05$ ). Therefore, it brings a topic such as how to reduce psychological and technological obstacles in adopting the service among older generations for the next phase of the study. Additionally, future research could also consider carriers' (e.g., truckers) points-of-view in measuring the effectiveness of parcel locker services, given that they directly provide delivery services to consumers.

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