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Analysis factors associated to hygienic concerns in last-mile logistics during the pandemic: a case of Mae Fah Luang University

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ABSTRACT

Introduction: A research study of the consignee's perspective during COVID-19 of Mae Fah Luang University students with the aim of studying the receiving behavior and to explore the relationship between behavior and satisfaction of receiving parcel delivery.

Methods: Data was collected through bachelor's degree students from Mae Fah Luang University, Thailand, for their perspectives of receiving parcel behavior in COVID-19 pandemics. The analysis was conducted by descriptive analysis, reliability analysis, exploratory factor analysis, and confirmatory factor analysis.

Results: The majority of participants were received parcels less than five times per week and always wore a mask when receiving. The anxiety, reliability, and cleanliness were significant factors associated with parcel receiving behavior. The participants were most satisfied with the delivery policy and most concern about the cleanliness of the delivery companies.

Conclusion: Business providers should build a strong strategy for parcel delivery methods to promoting cleanliness, hygiene, and parcel safety. The public sectors should provide the education on parcel receiving behavior and support private sectors on hygiene condition for the society.

Keywords: *Mae Fah Luang University; Parcel receiving behavior; Covid-19 contaminated delivery; Hygiene; Last-mile logistics*

Introduction

Within months of initial case reports, COVID-19 became epidemic and quickly ballooned into a worldwide crisis; this caused the outbreak to spread rapidly to many countries, including Thailand. To aid in controlling the spread of infection, in March 2020, the government has introduced lockdown measures to reduce the spread of the virus, banning people across the kingdom from the facility from 22.00-04.00. And the public shall refrain from traveling across the province unless necessary [1].

Because of the pandemic, there have been various changes identified in peoples' shopping behaviors and the development of new practices to respond to the crisis. Make delivery service and online shopping have increasingly played a role in our daily life. People choose to use a general transportation service instead of going out to shop independently. As a result, the shipping company has begun to take the importance and strict compliance with the Covid-19 protection stipulated by the Department of Land Transport [2]. First, the transport operator cleans the vehicle with disinfectant inside and outside before loading the cargo. Second, transport operators instruct their staff to take care of their cleanliness to wear a mask at all times, and with alcohol gel to clean your hands regularly. If the driver must be in contact with the product, the driver must wear rubber gloves until the cargo has been completely delivered. Third, the transport operator shall be required to monitor the physical condition of the staff and the driver by providing a daily body temperature measurement for daily screening before work. If any officer or driver is found with a temperature exceeding 37.5 °C or has a cough sore throat, they will not be allowed to work or enter the facility until a doctor is diagnosed to check for the virus. Fourth, the transport operator takes care and cleans the area of the place of business and the location of loading and unloading with disinfectant. The transport operators must strictly follow the operational guidelines for surveillance, prevention, and control of disease prescribed by the Provincial Communicable Disease Committee to make the users trust the shipping company more. Therefore, after the service provider has given importance and has complied with the prevention section of the Department of Land Transport. Thus, the researcher is interested in studying

students' satisfaction in Mae Fah Luang University about anxiety after receiving packages and behavior when receiving the parcel in last-mile logistics process.

Literature Review

Anxiety and Customer behavior during COVID

According to early studies, people's suspicions of the coronavirus are linked to various subjects. The COVID stress Scales (CSS) was created and found the five causes of stress and anxiety symptoms related to the coronavirus in two significant samples from Canada and the United States: (1) Danger and contamination; (2) Fears about Economic Consequences; (3) xenophobia caused by the coronavirus; (4) compulsive screening and reassurance-seeking; and (5) PTSD signs [3]. Four domains of terror were defined based on philosophical research. Common fears are fear of the body, fear of significant ones, fear of not knowing, and fear of inaction [4]. Adolescent mental health stigma research is critical because puberty is when peer interactions and views have a more significant impact and value, making teenagers more vulnerable to stigma [5], [6]. Peer relationship issues have been linked to psychopathologies, such as paranoia and social anxiety disorders [7], [8].

Furthermore, early puberty is the most common age of start for the behavioral disorder, as it is during this time that neurological and emotional improvements occur [9]. Since December 2019, we have lived in a unique era, as the Coronavirus Disease 2019 (COVID-19) pandemic has ravaged the planet, causing tension and anxiety. The SARS-CoV-2 pandemic (COVID-19), which started in December 2019, has caused damage to our lives, with severe physical and mental health implications. Apart from the disease's physical symptoms, financial hardship, social isolation, quarantining, and stay-at-home or work limitations are causing heightened dread and worry worldwide [10]–[13]. These restrictions have had a significant impact on our personal, social, and professional lives. These changes and ambiguity are likely to have a significant psychological impact [14]. Anxiety and depression, and alcohol and nicotine abuse are becoming increasingly widespread due to stress [15]. Chronic disease patients, such as those with MS, are more concerned about their psychological health. They are frequently more vulnerable to the consequences of mental diseases. Psychiatric disorders (such as anxiety) might aggravate MS symptoms, including relapse rates, MRI behavior, and suicidal thoughts and behaviors [16].

Contaminate and Hygiene

The estimation results of the model parameters vary from nation to nation since the case of virus spread changes. In the sensitivity analysis of countries, infection rates from person-to-person and from contaminated surfaces or the surroundings have a high positive effect on COVID-19 spreading. The critical value of infection power, recovery rates, and the rate of virus disintegration in the atmosphere have all hampered the virus's propagation in a population. We have also discovered that if many people aware of the virus take the required self-protective measures, the outbreak will be reduced. Human coronaviruses have lived on inanimate surfaces such as metal, glass, and plastic for up to 9 days. Surface disinfection treatments can still efficiently inactivate microorganisms in 1 minute using 62-71% ethanol, 0.5% hydrogen peroxide, or 0.1% sodium hypochlorite. Other biocidal agents, such as Benzalkonium chloride (0.05–0.2%) or Chlorhexidine Digluconate (0.02%), are less effective. Early containment and prevention of future spreading will be critical to stop the ongoing outbreak and monitor the new infectious thread, as no particular medicines for SARS-CoV-2 are available.

A mathematical model on the transmission of COVID-19 was created, which is transmitted from person to person and from contaminated surfaces or environments that are infected with COVID-19 around the world in many countries. It has been discovered that an excellent way to reduce the transmission of diseases is that humans are evolving to change their behavior in a way that is good for disease prevention by following the recommendations of the World Health Organization[17], [18]. This minimizes the spread of infection from individuals and in the environment. According to the World Health Organization, washing hands often with at least 60% alcohol-based gel for at least 20 seconds or with soap and water for at least 40 seconds to eliminate germs on hands can help decrease the spread of COVID-19. To minimize the spread of infection or infectiousness, keep a distance of at least 1 meter between yourself and others, avoid touching, and wear a mask.

According to a study, taking care individual's hands effectively minimizes the transmission of disease. Furthermore, wearing a mask prevents an infected individual from spreading the virus to others and from infecting people with the virus through airborne droplets. Diarrhea and acute lower respiratory tract infections harm more than 3.5 million children under five every year. This is related to poor hygiene, including not washing hands and treating hands as carriers of viruses that enter the body [19]. Researchers conducted experiments promoting handwashing with ordinary soaps and antibacterial soaps. In Pakistan, it was found that washing hands with both regular and antibacterial soaps. It helps prevent acute lower respiratory infections and diarrhea and prevents blistering skin diseases. The enactment of social distancing measures can reduce the spread of COVID-19 [20]. The number of deaths and daily cases of infections and casualties has decreased, but the effectiveness of using this section of each country varies depending on the country.

Parcel delivery and innovation

PostNL has a 70% share of the parcel distribution market. With the increasing rivalry in parcel distribution, it is more critical than ever to remain ahead of the pack, requiring creativity [21]. Today, parcels are transported by large delivery trucks, which carry single parcels to customers' doorsteps or store locations. Since the transaction costs are reasonably high, the last mile distribution is crucial for parcel delivery. About 75% of the time is delivered on time is the most critical explanation for these increased costs. As a result, PostNL is currently searching for opportunities to lower expenses and boost operations. Drones, AGVs, and bikes are among the creative methods for distributing packages for the last mile leg listed in the literature. Delivery to a package locker is one of the ideas with the most promise. Retailers and logistics service providers are exploring and introducing creative tools such as self-service technology (SSTs) to cope with rising volumes of shipped and returned packages, consumer demands, and toughening industry competition. E-retailers consider that delivery services are critical in a customer's decision to shop with them [22].

E-shoppers and e-retailers are currently concerned about delivery challenges and expenses. As a result, the European Commission has proposed a report on e-commerce, emphasizing tangible goods of products purchased online as one of the essential variables for e-commerce development. Apart from domestic delivery services, automated allocation stations are provided with lockers and pick-up locations, and stores that provide divided drop. The gathered empirical data was used to create a database for evaluating future improvements in mobility activities connected to parcel pick-up or drop-off through parcel lockers and probable vehicle kilometers and emissions reductions. A significant aspect for improvements and reductions has been characterized as minimizing symmetric task chains of consumer pick-up or drop-off routes, which contribute to the maximum vehicle kilometers [23].

Methodology

Research instrument and data collection

The data in this paper was collected from bachelor's degree students at Mae Fah Luang University (MFU). After cleaning data for analysis, the valid samples were 406, which was calculated from Yamane (1973)'s formula with a 95% confidence level [25].

The questionnaire was divided into three parts. The first part was participants' demographics, containing gender, age, school year, school of, dormitory, monthly income, and vehicle possession. The second part was the behavior of receiving a parcel of participants, which was 13 open-ended questions. And the last part was parcel delivery satisfaction factors during COVID-19, which also divided into two categories: (1) the reliability of COVID-19 protection of both courier and parcel recipient was evaluated by a 4-point scale of satisfaction level (1 = very dissatisfied, 2 = dissatisfied, 3 = satisfied, and 4 = very satisfied); (2) the anxieties in receiving parcels was evaluated by a 4-point scale of anxiety level (1 = not anxious, 2 = slightly anxious, 3 = moderately anxious, and 4 = very anxious)

Data analysis

Descriptive statistics were used to analyze the demographics and the behavior of receiving a parcel of participants. The parcel delivering satisfaction factors anxiety factors were analyzed by several analyses. Cronbach's alpha indicated the reliability analysis with an accepted level (more than 0.7). The exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were determined the significant factors associated with behavior and satisfaction of receiving parcels of participants during COVID-19. Figure 1 illustrated a conceptual framework.

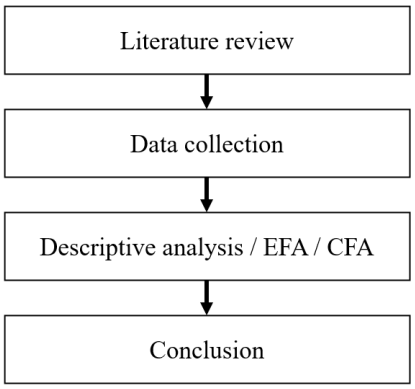

Figure 1 Conceptual framework

Results

Descriptive statistics

Table 1 presented the demographics of 400 participants from MFU's students. The majority of participants were female students, mostly aged between 21-22 years old, accounting for 63.0%. The fourth-year students dominated the survey, at 36.5%. The main residence was outside the university, which more than whom living inside university with 39.6%. Their income was between 5,001-8,000 baht per month, and they have primarily used motorcycles with 60.0% of all vehicles.

Table 2 presented the participants' behavior of receiving parcels during COVID-19 pandemics. The participants have mostly received parcels 2-5 times per week and less than two times per week, accounting for 97.3%, mainly receiving by placing the parcel at provided place of 49.0%. The majority of parcels' origin was from domestic with 97.3%. The majority of participants always wore a mask (72.5%), never wore gloves (76.3%), and sometimes washed their hands after receiving the parcel (59.8%).

The mean score was presented in Table 3. For the reliability of COVID-19 protection of both courier and parcel recipient satisfaction factors (B1-B10), the most

satisfying factors for participants were the delivery staff was wearing a mask, the reliability of delivery companies, and there are various payment methods for paying on delivery, with 3.26, 3.24, and 3.24, respectively. Moreover, the anxieties in receiving parcels (C1-C7) with the highest mean score were the anxiety about the cleanliness of delivery companies and the route that parcel had been sent, with 2.43 and 2.40, respectively.

Table 1 Demographics of participants

Categorical variables	Category	Percent
Gender	Male	21.3
	Female	68.5
	Alternatives	10.3
Age (years old)	18	2.8
	19	11.3
	20	22.0
	21	29.5
	22	33.5
	23	0.5
	24	0.5
Level	1st year	12.0
	2nd year	20.3
	3rd year	31.3
	4th year	36.5
Residence	Off-university	69.8
	On-university	30.2
Income per month (Thai Baht)	< 3,000	1.3
	3,000-5,000	30.0
	5,001-8,000	52.8
	> 8,000	16.0
Vehicle	Car	17.3
	Motorbike	60.0
	Bicycle	0.8
	None	22.0

Exploratory and confirmatory factor analysis

The results of exploratory factor analysis were presented in Table 3. The parcel delivery satisfaction factors were evaluated using principal component analysis with the varimax rotation method. The factor items with factor loadings less than 0.5 were eliminated. The extracted factors were grouped into three factors, namely anxiety, reliability, and cleanliness. The reliability was indicated by Cronbach's alpha of 0.850, ranging from 0.814 to 0.830, acceptable for analysis. The KMO was 0.875, which was adequate for analysis and Bartlett's Test of Sphericity was significant (chi-square (χ^2) = 3908.120; df = 171, p < 0.000).

The results of confirmatory factor analysis were also presented in Table 3 and Figure 2 introduced the confirmatory factor analysis in a diagrammatic model with a standardized estimate. The validating values were significantly and modified to match with the CFA model fitness with the following values: chis-squre of df ratio (CMIN/df) = 2.449, comparative fit index (CFI) = 0.949, Tucker-Lewis Index (TLI) = 0.939, root-mean-squre error of approximation (RMSEA) = 0.060, and standardized root-mean-square residual (SRMR) = 0.020, goodness-of-fit index (GFI) = 0.923, adjusted goodness-of-fit index (AGFI) = 0.897.

Factor 1: Anxiety contained nine-factor items related to the anxiety and concerns about the parcel, delivering process, and delivering involved persons.The factor loading in these factors ranged from 0.683 to 0.821. The composite reliability was 0.925, and the average variance extracted was 0.581.

Factor 2: Reliability contained five-factor items related to the reliability, system, and relationship between receiver and delivering company. The factor loading in these factors ranged from 0.575 to 0.778. The composite reliability was 0.857, and the average variance extracted was 0.539.

Factor 3: Cleanliness contained four-factor items related to the cleanliness of delivering vehicles, equipment, staff, and parcel. The factor loading in these factors ranged from 0.711 to 0.824. The composite reliability was 0.853, and the average variance extracted was 0.592.

Table 2 Behavior of receiving a parcel of participants

Categorical variables	Category	Percent
Parcel receiving frequency (per week)	< 2 times	47.5
	2-5 times	49.8
	6-10 times	2.3
	>10 times	0.5
Receiving behavior	By other people	4.3
	By myself	46.8
	Place at provided place	49.0
Origin of parcel	Domestic	97.3
	Foreign countries	2.8
Wearing mask when receiving the parcel	Never	2.5
	Sometimes	25.0
	Always	72.5
Wearing gloves when receiving the parcel	Never	76.3
	Sometimes	15.3
	Always	8.5
Hand washing after receiving the parcel	Never	8.0
	Sometimes	59.8
	Always	32.3
Use alcohol gel or disinfectant after receiving the parcel	Never	9.3
	Sometimes	64.3
	Always	26.5
Use the disinfectant spray before and after opening the parcel	Never	53.0
	Sometimes	30.0
	Always	17.0

Table 3 Factor analysis results with reliability and validity

Factors	Statements	Mean	EFA			CFA			
			Factor loadings	Alpha	% of Variance	Factor loading		CR	AVE
						UE	SE		
Factor 1: Anxiety	C2: I am worried to pick up the parcel by myself.	2.14	0.821	0.819	27.782	1.00	0.67[a]	0.925	0.581
	C1: I am concerned about the packaging could infect COVID-19.	2.19	0.813	0.818		0.94	0.66[a]		
	C3: I am worried that germs may contaminate the parcel.	2.17	0.811	0.817		1.02	0.65[a]		
	C4: I am worried with the delivery staff.	2.15	0.793	0.818		0.95	0.58[a]		
	C5: I am worried that the parcel was delivered through risky area of pandemics.	2.27	0.762	0.818		0.91	0.49[a]		
	C8: I think I have chance to get infected from receiving parcels.	2.18	0.738	0.814		0.75	0.42[a]		
	C6: I am worried that the parcel was sent from high-risk area of pandemics.	2.40	0.719	0.823		0.84	0.42[a]		
	C7: I am worried about the cleanliness of delivery companies.	2.43	0.705	0.827		0.86	0.42[a]		
	C9: I am worried if I have symptom after receiving parcels.	2.16	0.683	0.817		0.67	0.34[a]		
Factor 2: Reliability	B10: Reliability of delivery companies	3.24	0.778	0.826	16.583	1.00	0.60[a]	0.852	0.539
	B8: Distancing between receiver and courier	3.15	0.768	0.827		0.95	0.55[a]		
	B7: Various payment methods for pay on delivery	3.24	0.767	0.824		0.89	0.54[a]		
	B9: Documents or seals of cleanliness from the courier company	3.11	0.762	0.829		0.87	0.38[a]		
	B5: Delivery staff was wearing mask.	3.26	0.575	0.825		0.69	0.32[a]		
Factor 3: Cleanliness	B3: Cleanliness of delivery vehicle	3.17	0.824	0.830	15.06	1.00	0.66[a]	0.853	0.592
	B4: Cleanliness of parcel delivery recording equipment	3.12	0.786	0.825		0.95	0.59[a]		
	B1: Cleanliness of parcel	3.21	0.751	0.830		0.90	0.49[a]		
	B2: Cleanliness of delivery staff	3.16	0.711	0.830		0.75	0.44[a]		

Note: UE = Unstadardized coefficients, SE = Standardized coefficients, CR = composite reliability, AVE = average variance extracted

[a]$p < 0.001$

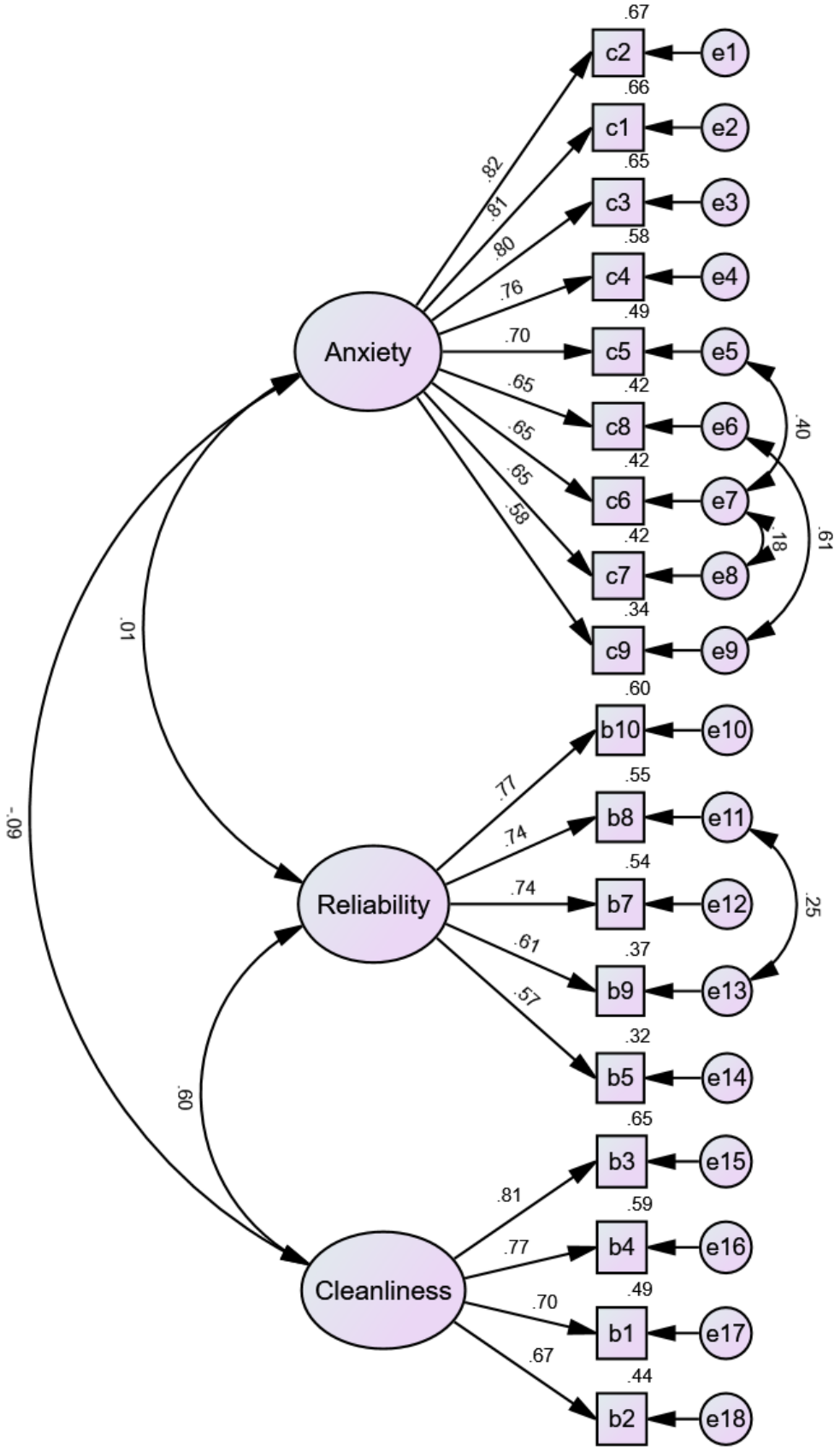

Figure 2 Diagrammatically model with a standardized estimate

Discussion and conclusion

A study of the perspective of the recipients of the parcel during COVID-19 of the student at Mae Fah Luang University that to study the relationship between behavior and satisfaction in receiving parcels of students from Mae Fah Luang University during COVID-19 using descriptive analysis, reliability analysis, exploratory factor analysis, and confirmatory factor analysis. The findings presented that the delivery policy, staff, and reliability were the most satisfying factors, followed by the cleanliness of delivery equipment and parcels while delivering. Three significant factors associated with parcel receiving behavior and satisfaction of MFU's students were anxiety, reliability, and cleanliness. The parcel delivery route until the parcel was delivered to participants were the most anxiety factor in the participants' perspectives, followed by the concerns of contamination while delivering.

In order to encourage customer to have confidence and acceptance in the safety of parcel delivery, cooperation from all sectors, both the public and private sectors, is required to lead to sustainable planning in the society. For the private sector, the business providers should develop a strong promotion plan for parcel delivery methods and can resolve concerns about the customer's receiving behavior, while also promoting cleanliness, hygiene, and parcel safety, from the beginning until the customer receives the parcel. The public sector should promote and educate the behavior of preventing risks of infection that may occur during parcel transportation in order to make the society aware of safety, and also support the private sector in parcel transportation to emphasize the hygienic condition of the percels being transported.

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Ethical considerations

This research was conducted following the Declaration of Helsinki's principles. The general study's characteristics require no formal approval from the local ethics committee's institutional review board. All subjects were notified of the study, and participation was completely voluntary. Participants were assured of the confidentiality and anonymity of the information collected through the questionnaires by the authors.

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