SOBER
PROCEEDINGS

CIBES 2024 / 4th Current Issues in Business and Economic Studies Conference

ADOPTION INTENTION OF DRONE TECHNOLOGY IN MALAYSIAN FOOD DELIVERY SERVICES: AN EMPIRICAL INVESTIGATION OF PREDICTORS AND CHALLENGES

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Abstract

The current Industrial Revolution era seems to enforce new ways of implementing online food delivery services, one of which is the use of drone delivery. One of the problems is that the existing food delivery services use human riders which are prone to accidents, for example about 1600 death cases were reported in 2020 involving p-hailing (food and parcel) riders. Also, the use of drones is needed to help victims of natural disasters such as floods, typhoons, and landslides. Malaysia has commenced the trial use of drone food delivery to tackle these problems. Particularly, consumers' behavioural intentions to use drone food delivery services have been laid low with complex aviation rules and regulations. Hence, the main objective of this study is to examine the predictors of adoption intention in drone food delivery among food delivery providers and consumers in Malaysia. Furthermore, it aims to investigate the readiness of food delivery service providers and collaborators in adopting drone technology and to examine the moderating effect of the generational gap on the relationships between specified predictors and adoption intention. The research methods used are qualitative and quantitative research designs. The quantitative data will be collected using an online survey and will be analysed using structural equation modelling (SMART PLS). For qualitative technique, the telephone interviews with 15 food delivery service providers and drone collaborators will be conducted and analysed using verbatim analysis. The expected output is a new adoption

Cited: Sulaiman, Y., Rahman, M. A., Mohamad, M., Abdghani, N. H., & Musa, R. (2024). Adoption intention of drone technology in Malaysian food delivery services: An empirical investigation of predictors and challenges. *Sustainability, Organization, Business and Economic Research (SOBER), 2*, 31-47. doi: 10.5281/zenodo.14602497

Selection and peer-review under responsibility of the 4th Current Issues in Business and Economic Studies Conference.

intention model of drone food delivery services in Malaysia. The result will be significant to the nation in terms of increasing the adoption of delivery drones hence increasing automation in line with the Fourth Industrial Revolution (IR 4.0). This research also improves the economy and societal benefit through efficient supply chain and transportation of services in urban and affected areas such as the spread of diseases or natural disasters, i.e., floods and landslides.

Keywords: adoption intention, drone technology, food delivery services, technology readiness, technology acceptance, Malaysia

1. INTRODUCTION

The title is about the adoption intention of drone food delivery services in Malaysia. The title is new in the drone area because limited empirical studies have been done before on drone adoption intention in food delivery services in Malaysia. Such empirical studies on drone food delivery services have been conducted in the USA and Korea. Secondly, the underpinning theories have not been used in drone studies since the models have only been used in traditional marketing areas. Hence, more empirical studies using underpinning theories need to be conducted to close these gaps. The current industrial revolution era seems to enforce new ways of implementing marketing strategies such as in online food delivery services using drones. However, the usage of drones is very limited and has not been adopted by food delivery services in Malaysia. Drone has been used in other industries in Malaysia such as for border security surveillance, area photography, agriculture, topography, (New Straits Times, 2015), and natural disasters such as flood relief operations including delivery of critical supplies, [Noor Atiqah, 2021), but not in food delivery services. Hence, Malaysian marketers must step up the usage of drones for food delivery because other countries such as Spain where drone food delivery is delivered to yachts (Aerocamaras) (Espinoza, 2021), Singapore (i.e., Food Panda) (Abdullah, 2020), United Kingdom (Amazon.com) (Morrison, 2021), Thailand (Minor Food Group) (Tan, 2020), and the United States (i.e., Wing, Amazon.com, Google) (Vincent, 2021), have already widely used this new drone technology. The existing food delivery services use human riders who are prone to accidents due to busy traffic, for example, about 1600 death cases were reported in 2020 involving p-hailing (food and parcel) riders (EdgeProp, 2020). Therefore, the usage of drone delivery is needed because it can reduce accidents and death cases as reported earlier.

The drone's adoption and usage might expand due to its innovative roles and usefulness in surveying, tracking, security, surveillance, and logistics. Furthermore, during the novel Coronavirus, COVID-19 pandemic, which affected not fewer than 320 million people worldwide with a death toll of over 5.52 million and in Malaysia, there were 2.8 million affected cases and a total 31,750 of deaths (JHU CSSE, 2022), no contact services are highly preferred, the demand for drone delivery service has been driven up hence increase automation in line with the Fourth Industrial Revolution (IR 4.0). As a result, it has driven society and the authorities to reconsider, understand, and make use of drone innovation, especially in food delivery services in Malaysia. Furthermore, only a few empirical theoretical studies have been conducted regarding drone adoption intentions in Malaysia such as Chamata (2016); Nier, Wahab, & Daud (2020). However, the mentioned studies investigated drone application for general purposes (e.g., stock take activity at logistic firms and parcels) instead of drone adoption intention in food delivery services. Therefore, the current research will contribute to the development of the body of knowledge on drones' adoption intention. In other words, the current research will indirectly increase the awareness of Malaysian citizens towards drone food delivery services. Besides, the suggested model for drone adoption intention would benefit

entrepreneurs interested in investing in drone technology and policymakers who may use it to consider modifying aviation regulations in favour of drone technology. Thus, there is a need to study the adoption intention of drone applications and usage in food delivery services in Malaysia. In other words, the current study aims to investigate the readiness of food delivery service providers and collaborators in adopting drone technology and to examine the moderating effect of the generational gap on the relationships between specified predictors and adoption intention. This study can assist the government in promoting the adoption of delivery drones, thereby advancing automation in line with the Fourth Industrial Revolution (IR 4.0). In addition, it will benefit society by helping to address urgent issues during disasters in areas unreachable by conventional methods and by reducing environmental hazards quickly and efficiently.

2. LITERATURE REVIEW

2.1. Malaysian Drone Food Delivery Services

Drone delivery services in Malaysia have been tested in Cyberjaya in June 2019. This testing is continued by AirAsia Group Bhd. and officially launched by the Minister of Science, Technology, and Innovation on 3rd March 2021 (Hanif, 2021). Drone food delivery has been tested in the main city, which is Cyberjaya because customers who order food delivery are busy and prefer convenience and are mainly from main cities (McCarthy, 2020). Furthermore, the usage of drones is more suitable in main cities to overcome traffic congestion.

The first trial test was conducted by Express Food, while the drone was provided by Average Drone Sdn. Bhd. which has been in operation since 2014. According to its CEO, Hamdee Hamdan stated that the cost of delivery through drones could be as low as RM2.50. The drone can be flown through light rain however cannot fly in heavy rain (Malay Mail, 2022).

2.2. Factors Affecting Consumer's Acceptance of Drone Food Delivery Services

The usage of drone production through various sectors has grown as the distribution of drones has improved efficiency and operating efficiencies (Avanti, 2019). This has also been considered effective in emergency circumstances. Consumers aged 18 to 34 had positive perceptions about these drone food delivery services available. We have viewed drone delivery as new, futuristic, revolutionary, and useful, albeit risky. For example, with drone delivery, they get their purchased merchandise, like food, faster (Khan, Tausif, & Javed, 2019). In addition, consumers have also seen drone delivery services as a relatively environmentally friendly option (Hwang & Kim, 2019).

Drone usage was a fast and inexpensive service delivery tool as it reduced delivery time to as low as 30 minutes and delivered the goods to the doorstep of the customer, which in effect improved the competitiveness and versatility of customers in everyday life (Gagliordi, 2019; Kapser & Abdelrahman, 2020). These benefits underpin the desire of consumers to pursue

drone food delivery services because it is a fast, cost-effective, and environmentally friendly alternative. The usage of drone delivery expanded due to its innovative roles and usefulness in surveying, tracking, security, surveillance, and logistics especially during the novel Coronavirus, COVID-19 pandemic, which affected not fewer than 320 million people worldwide with a death toll of over 5.52 million.

2.3. Generation Gap

Considering the rise of new technology and a lack of communication between both older and younger people, generational differences have an impact on not just relationships but also day-to-day activities. Through a series of well-organized programs that included training seminars and social service initiatives, Phillips concentrated on creating a partnership model that connected universities, schools, and local communities. To break the "ice" and develop a close parent-child connection, the intergenerational gap needs to be closed by the combined efforts of both generations.

Several issues, including inequality, access, the calibre of the information, and the impact of new technology on children's educational and social development, have been brought up by the popularity of the internet. It has been observed that the older generation also seems to share this quality of ambivalence especially as their children become more expert with handling new technologies and the internet.

2.3.1. Different Perceptions of Relationships

It indicates that parents and teenagers may view their connection with one another differently. In a study, 2590 adult child and older parent dyads from the national survey of families and households were examined and their perspectives of intergenerational solidarity were contrasted. It is widely recognized that parent-child connections are among the most significant and are a significant factor in both generations' emotional and psychological well-being. These interactions have also been linked to different forms of help between the generations. Although there is generational consensus on some issues, the research found that parents are more likely to see their relationships with their kids favourably. Recent works have examined the social, and structural aspects of intergenerational relationships in later life which suggests that societies and individuals within them are ambivalent about relationships between parents and children in adulthood.

2.4. Adoption Intention

Venkatesh et al. (2003) suggested that the adoption intention to use a given technology has a significant influence on usage behaviour. In general, the term adoption intention is defined as the individual’s inclination to accomplish a given activity or behaviour, for example when the banks introduced Internet Banking, there was the adoption intention by customers and it was successful in increasing the ease of transactions and the number of transactions, therefore there

was a rise in profitability and revenues for the banking industry, (Wungwanitchakorn, 2002). Therefore, when drone technology is to be introduced for food delivery, then the consumers, as well as food and beverage suppliers, shall have the intention to adopt this effectively to gain the entire benefits from it.

Wang, Dacko, and Gad, (2008) from the University of Warwick, United Kingdom, found that perceived newness, perceived benefit, and product evaluation have a significant co-relationship with adoption intention. This therefore supports that in the digital era with process innovation and the search for convenience and speedy services, the usage of drone/UAV systems for food delivery is expected to be a fruitful choice. Moreover, Yoo, Yu, and Jung (2018) have concluded that drones are less expensive, faster, eco-friendly, and so innovation may be positively related to the adoption intention of customers in favour of drone technology being introduced for food delivery but privacy risks, delivery risks, performance risks and complexity are hurdles for the drone delivery adoption.

Prabowo and Nugroho (2019) found that it is necessary to strengthen user perception in engaging any new products and services, therefore positive user attitudes and convenience motivation are vital in encouraging 732 respondents of users to adopt online food delivery in 10 cities in Indonesia. Moving on, in Fiji, it was understood that social influence is crucial in perceived usefulness and perceived ease of use for women to adapt themselves to tech-savvy goods and services (Sathye, Prasad, Sharma, Sharma, & Sathye, 2018). Further to that, Chen, Choi, and Charoen (2019), in a study entitled "Drone Delivery Services: An Evaluation of Personal Innovativeness, Opinion Passing and Key Information Technology Adoption Factors" surveyed 182 respondents and found that marketing, technology adoption and personal innovativeness support customers' intention to adopt drone delivery services and hence this concludes that customers nowadays are mature and willing to accept drone delivery services. Recently, in 2020, Knobloch and Schaarschmidt identified that there exists physical risk, loss risk, financial risk, data risk, noise risk, harassment risk, or spy risk in engaging drone technology in delivery services, hence the risks shall be reviewed and prevented by suppliers willing to engage drone technology for food delivery (Knobloch & Schaarschmidt, 2020). Overall, it can be seen from the above journal articles that the analysis of adoption intention for drone technology to be introduced for food delivery is positive and can be successful via marketing, technology adoption, social influence, perceived newness, perceived usefulness, and personal innovativeness. However, privacy risks, delivery risks, performance risks, and complexity shall be avoided when drone technology is to be introduced for food delivery so that customers feel secure and protected when engaging the services using drone technology.

2.5. Underpinning Theories

Established theories related to adoption behaviour such as the TAM, TRI, and TRAM models will be reviewed as possible underpinning theories to be used in this study. This study is unique, as the use of drones is very limited in Malaysia and has been applied in other industries but not

in food delivery services. In previous studies, TAM, TRI, and TRAM models have been adopted in fields such as border safety surveillance, photography, land surveying, medical, and agricultural sectors, but not in food delivery. Therefore, applying these theoretical frameworks to food delivery services is a novel approach.

2.6. Technology Acceptance Model

2.6.1. Technology Readiness and Acceptance Model (TRAM)

TRAM is the latest development that blends the growing personality dimension of TRI with the unique aspect dimension of TAM. It discusses how personality factors can affect the experience of an individual, and how it incorporates new technology. The dimensions of TRI personalities are comparable to TAM. Throughout this case, the addition of actual use complements the previously conducted study.

2.6.2. Technology Readiness Index (TRI)

TRI was used to calculate the general beliefs and thoughts of an individual towards delivery drone technology. TRI was chosen because it could discern whether a person was a user of the technology. This may also group users in a more nuanced way based on positive and negative beliefs about the system. Parasuraman (2000) stated that individuals who possess optimism and innovation, as well as experience less discomfort and feelings of insecurity, are more likely to adopt new delivery technology. They are optimism, innovation, discomfort, and insecurity.

2.7. Predictors of Adoption Intention in Using Drone Technologies

Based on the idea of TRAM which has been tested through numerous studies, when a technology is taken into consideration on usefulness that might be a chance to use those technologies. TRAM suggests that the perceived ease of use and perceived usefulness are concurrently figuring out an individual's aim to utilize this technology.

2.8. Antecedents of Optimism

An extra-optimistic approach is generally more powerful in accomplishing the anticipated outcomes. In other words, optimists generally tend to bring awareness to bad activities and could get hold of the extra flawed technology. Optimism appears in the generation as extra beneficial and smooth to apply and they are now no longer so troubled about the bad outcomes of technology (Kuo, Liu, & Ma, 2013). Optimism is an inclination to trust that most humans will enjoy the best as opposed to the wrong matters in life (Walczuch, Lemmink, & Streukens, 2007).

2.9. Delivery Risks

Delivery risks are generally the chance or probability of risk of default of delivery due to various factors and they may exist due to multiple factors such as physical risk, loss risk, financial risk,

and performance risks. This list is not exhaustive because there could be other factors that may contribute to delivery risks. This means that the supplier of food delivery or service provider could fail in accomplishing their side of services to customers and this is high in using drone/UAV systems for food delivery. In a 2020 journal article by Ngui entitled "Crashed! Why Drone Delivery is Another Tech Idea Not Ready to Take Off", delivery risks have been identified for engaging drone technology for food delivery because this area is unregulated, dangerous, and intimidating because confusion can arise in many ways (Tom, 2020). Therefore, there has been reluctance by food services to use drone technology for food delivery (Choe, Kim, & Hwang, 2021). Moreover, Schenkelberg (2016)] found in his study entitled "How reliable does a delivery drone have to be?" explained that drones are subject to delivery risks due to sensor failure, gearbox or motor failure, logic failure, strike on the power line, tree, shotgun blast or bird, battery exhaustion, battery charging fault causing fire and malicious attack or hacking to disrupt delivery. Hence, the optimal solution to delivery risks whilst using drone technology for food delivery shall be taken to achieve reliability in using drone technology for food delivery. Apart from that, Hwang and Choe (2019) in their study entitled "Exploring perceived risk in building successful drone food delivery services" examined the delivery risks' impact on the image of drones being reliable in food delivery services. In this study, it was concluded that there are time risks, performance risks, and psychological risks in delivering food to customers using drone technology and this leads to a negative image, thus reducing the adoption intention of food suppliers and customers. In addition, identified that there exist delivery risks such as physical risk, loss risk, financial risk, data risk, noise risk, harassment risk, or spy risk in engaging drone technology in delivery services, hence the risks shall be reviewed and prevented by suppliers willing to engage drone technology for food delivery.

2.10. The Conceptual Framework

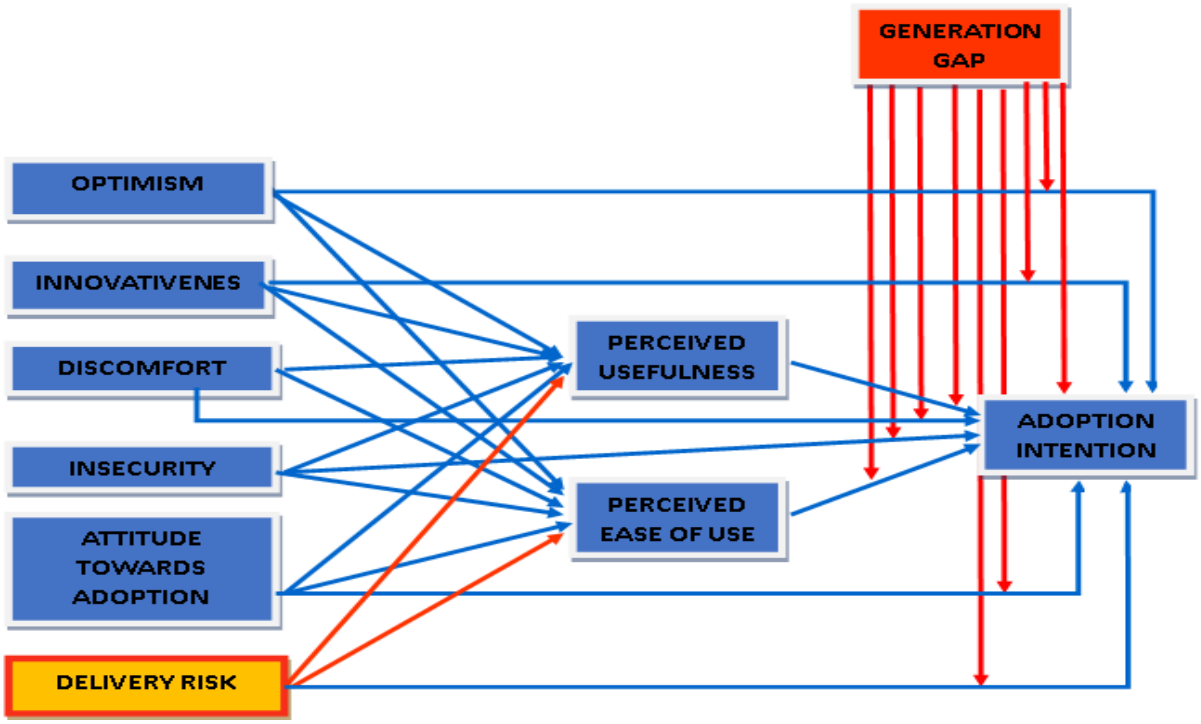
This study is unique since the usage of drones is very limited and it has been used in other industries but none in food delivery services in Malaysia. In previous studies, TAM, TRI, and TRAM have been adopted in other fields such as border safety surveillance, photography, land survey, and medical and agriculture sectors but not in food delivery services. Hence, the usage of these underpinning theories is a new application for food delivery services.

The first gap in the usage of drone technology for food delivery services in Malaysia is still scarce. However, it has been widely used in the USA, Europe, and some Asian countries such as Singapore and Thailand. Hence, drone usage in food delivery can be applied and is a necessity in Malaysia. This vacuum is a good opportunity for food delivery services and other small businesses to embark on this advanced technology usage of drones in line with IR 4.0. The second gap is regarding very limited empirical studies conducted in Malaysia in drone studies compared to other countries such as South Korea, USA, Spain, etc. The third gap is the existing studies on drones have been conducted in other settings such as the telecommunication industry. Additionally, there is an effect of the generation gap on technology adoption.

Millennials (generation Y) have often led older citizens in their adoption and use of technology, and this largely holds till today. However, older generations, such as Generation X and baby boomers, have seen a major increase in digital use (Vogels, 2019). As a result, there is a pressing need to bridge the gap as technology continues to evolve.

Optimism, innovativeness, discomfort, insecurity, attitude towards adoption, and delivery risk are the personality dimensions that are viewed in technology readiness, personality dimensions affect people's tendency to embrace and use new technologies. In this regard with the dimensions, mental empowering is done through optimism and innovativeness, while acknowledgment and acceptance of new technology are mentally inhibited by discomfort and insecurity. The current study will encourage the government to promote the adoption of delivery drones, thereby advancing automation in line with the Fourth Industrial Revolution (IR 4.0). Additionally, it benefits society by helping to address urgent issues during disasters in areas unreachable by conventional methods and by reducing environmental hazards quickly and efficiently. Figure 1 shows the conceptual framework of the study.

Figure 1. The Conceptual Framework



3. RESEARCH METHODOLOGY

3.1. Research Design

Quantitative and qualitative research approaches will be the research designs of the study. This study adopted a quantitative cross-sectional data approach in the data collection process based on past studies. Thus, data will be collected, analysed, and summarized statistically.

Quantitative data will be obtained through an online survey to accommodate COVID-19 pandemic restrictions. This will enable us to obtain information relating to beliefs, attitudes, perceptions, or even opinions from other people in their natural environment (Graziano, & Raulin, 2004; Gay, & Diehl, 1992; Murison, 2019). The online collection method will be conducted through social media platforms such as WhatsApp, Facebook, and Instagram. For qualitative technique, telephone interviews and online focus group discussions with selected food delivery service providers and collaborators (Easyfly Autonomous Solution Sdn. Bhd. and Civil Aviation Authority of Malaysia (CAAM) will be conducted.

3.2. Sampling Method

Unit analysis of this study is consumers for the quantitative method and food delivery service providers for the qualitative method. For the quantitative method, a multistage sampling method will be conducted based on generation gap and location. Generation will be divided into four: Gen baby boomers, X, millennial (Y), and Z. The reason for selecting generation gaps is the adoption level of technology varies among each gap. The location will be in Kuala Lumpur, Selangor, Penang, and Johore, and selected food delivery service providers in Malaysia. The main reasons for selecting the four states are (1) drone services have been tested and used in main cities such as Cyberjaya, AirAsia Group Bhd., and lately, flood relief in Selangor (2) customers who ordered food delivery are busy and prefer convenience and are mainly from main states, (3) usage of drone is more suitable in main states to overcome traffic congestion (4) the selected states are representing most developed and populous states in Malaysia.

For the qualitative method, the researchers will conduct telephone interviews with 15 selected food service delivery providers in Malaysia. Also, telephone interviews will be conducted with CAAM and drone collaborator, Easyfly Autonomous Solution Sdn Bhd to interrogate information regarding rules and regulations on drone aviation policy.

3.3. Population

The population for consumers will be based on the population of citizens in each of the four states (Selangor, Kuala Lumpur, Penang, and Johore) selected for the study and the population of food delivery service providers will be based on all food delivery service providers in Malaysia.

3.4. Sample Size

The sample size is 384 or about 400 samples will be needed according to Krejcie and Morgan (1970) based on the sample size table which is calculated based on the population size specified above, i.e., the number of consumers in Selangor, Kuala Lumpur, Penang, and Johore and selected food delivery service providers in Malaysia.

The sample size for the qualitative method through in-depth telephone interviews is 15 selected food service delivery providers in Malaysia. The 15 food service delivery providers are selected

using systematic random sampling i.e., every fourth company in the directory list. According to the four locations (Kuala Lumpur, Selangor, Penang, and Johore), the three most popular food delivery service providers selected for each state from a total of 67 across Malaysia. Also, in-depth telephone interviews with two authorities will be conducted: CAAM and drone collaborator, Easyfly Autonomous Solution Sdn Bhd to obtain information regarding rules and regulations on drone aviation policy.

3.5. Data Collection Technique

For the quantitative method, a non-probability online survey method will be used. Several studies have been conducted to validate the use of non-probability sampling for online surveys. For this study, 800 questionnaires will be distributed online using social media platforms such as WhatsApp, Facebook, and Instagram method to Malaysian consumers in Kuala Lumpur, Selangor, Johor, and Penang. The method will be used to ensure a high response rate (DeFranzo, 2023). For the qualitative method, the researchers will conduct telephone interviews with 15 selected food service delivery providers in Malaysia. Also, telephone interviews will be conducted with CAAM and drone collaborator, Easyfly Autonomous Solution Sdn. Bhd. to interrogate information regarding rules and regulations on drone aviation policy.

3.6. Measurement of Construct

The variables of this study will be adapted from relevant past studies (adoption intention of drone, optimism, innovativeness, discomfort, insecurity, attitude towards adoption, perceived usefulness, perceived ease of use, and delivery risk). All measurements will be pilot-tested to determine their reliability and suitability for the drone sector using factor analysis. All variables are measured using a 5-point Likert Scale from 1-strongly disagree to 5-strongly agree based on arguments from past studies. For the qualitative method, structured questions will be designed to accommodate RQ1 and RQ2. Additionally, structured questions will be developed to tap information from focus group discussions (FGD) with collaborators, such as Easyfly Autonomous Solution Sdn. Bhd. and CAAM.

3.7. Analysis Method

Analysis methods for quantitative for this study are descriptive statistics using Statistical Package for Social Science (SPSS) version 20.0 and structural equation modelling (SEM) using partial least square (SMARTPLS) version 3.2.7. Hypotheses will be tested with SMARTPLS 3.2.7 to predict the extent to which independent variables (optimism, innovativeness, discomfort, insecurity, attitude towards adoption, and delivery risk) explain the dependent variable (adoption intention) with the mediating effects of perceived usefulness and perceived ease of use, and the moderating effect of the generation gap. This quantitative analysis will answer research objectives three to seven (RO3-RO7). In the qualitative method, a verbatim analysis of interview sessions will be conducted by examining open-text feedback from food service providers and collaborators to gain insights into their sentiments, opinions, and

experiences regarding drone technology usage. This qualitative analysis will address research objectives one and two (RO1-RO2).

4. CONCLUSION

A journal article entitled "Consumer Acceptance of Drones in Urban Areas" found that drones may still have a high level of significant delivery risks when engaged for commercial purposes in Pakistan and hence retailers are reluctant to convert their traditional delivery services modes to drone/UAV systems. This was also the position in the study by Kellermann, Biehle, and Fischer (2020), which highlighted that the emerging technology in drone technology proposes solutions for the environment and traffic but has delivery risks that outweigh its benefits, and hence may not offer a widespread solution in food delivery. Moreover, Mittendorf, Franzmann, and Ostermann (2017)] pointed that innovation and advancement in technology are vital for reducing delivery risks that exist when using drone technology. Even Hii, Courtney, and Royall (2019) confirmed that delivery risks such as sensor failure, and gearbox or motor failure exist when using drone technology systems. Therefore, precautions and contingency planning are a must for businesses engaging drone technology in delivery services.

In conclusion, delivery risks exist when using drone technology in food delivery so delivery service companies shall analyse both the pros and cons and engage in strategic planning tools to reduce service delivery failure risks in using drone technology so that customer confidence and reliability are kept at a high level. Therefore, the current study will help the industry increase the efficiency of supply chain and transportation in food delivery services. Managers should leverage these insights to refine their service offerings, focusing particularly on service quality and user experience. By addressing consumers' concerns about delivery risks and discomfort, managers can enhance customer satisfaction and increase adoption rates. Additionally, it can assist the government in promoting the adoption of delivery drones, thereby advancing automation in line with the Fourth Industrial Revolution (IR 4.0).

ACKNOWLEDGEMENT

This research was supported by the Ministry of Higher Education (MoHE) Malaysia through the Fundamental Research Grant Scheme (FRGS/1/2022/SS01/UUM/02/5).

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