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TOWARDS THE ADOPTION OF DRONES IN FOODSERVICE INDUSTRY: A GENERIC MODEL DEVELOPMENT

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ABSTRACT

Drone technologies have recently received a great deal of attention due to their high mobility, low cost, and flexible deployment. It is anticipated that drones will be part of our daily life, just like smartphones. The wide deployment of drones in different domains such as healthcare, agriculture, traffic monitoring, firefighting, national defense, rescue activity, and delivery services such as food and retail. Drones are expected to have a significant contribution to food delivery services by saving time, cost, environment, and people's life by reducing traffic congestion, wages, carbon emission, and accidents, respectively. Recently, big corporations, such as Amazon and DHL, have deployed drones as an alternative to traditional delivery methods. However, service providers of drone food delivery (DFD) services need to identify significant factors that influence potential consumers' to use drone delivery. Existing models lack a comprehensive basic theory that addresses factors that influence consumers' intention and behavior. To overcome this limitation and propose a more comprehensive model, relevant research studies from the domain of drone delivery services and other emerging technology such as IoT, Autonomous Vehicles, and Mobile Banking are identified, reviewed, analyzed, and ten potential factors are subsequently extracted. The model is expected to inspire food-service sub-sectors in planning for the adoption of drone technology adoption in evaluating an existing DFD or developing a new one.

Keywords: *Drone, Food Delivery, Generic Model, Acceptance Model*

1. INTRODUCTION

The delivery services using traditional means such as motorcycles have potential issues including increasing traffic congestion and accidents, the required time of delivery is very dependent on the traffic status, limited destinations can be covered, adding to that, it is potentially harmful to the environment due to the increase in carbon emissions [6]. Thus, using drones in such a domain could be marked as an efficient and green alternative. Nevertheless, despite the benefits that the drone possesses over traditional deliveries, from the customers' perspective, the drone has potential risks including threats to our privacy, security, and physical safety [9] [10] [31], and this could be the main reason behind why traditional delivery remains more popular in some countries [32] [33]. Drones are predicted to have a substantial impact on food delivery services, as Asia Economy reported [19]. Every year, 1500 people are injured, and around 30 are killed. 50% of those injured/killed are young under the age of 29 [19]. Therefore, drones are important and promising in the foodservice industry [6]. However, current studies lack a comprehensive research model investigating factors influencing consumers' intention to accept drone delivery in the food-service industry, although the commercialization of such services is foreseeable. Therefore, it will be imperative to identify consumers' influential factors in DFD services adoption. Hence, service providers of DFD services need to identify significant factors that influence potential consumers to use drone delivery. Although few studies [20] and [23] are found to be ideal as the benchmark for this research, these studies lack a comprehensive basic theory that addresses factors that influence consumer's intention and behavior. To overcome this limitation and propose a more comprehensive model, this study utilizes TAM and UTAUT2 as basic theories to construct the generic model.

The study deploys TAM and UTAUT2 as fundamental theories. Nine studies have been

identified as relevant to this research. These studies are in the area of Drone Delivery Services (any kind of delivery). It is found that studies that address drone delivery services, in general, are enough to construct the model of this study. However, to strengthen our model and ensure the inclusion of other potential factors, we conducted a quick review of other studies that address the acceptance of other emerging technologies such as IoT, Autonomous Vehicles, and Mobile banking. This study is significant because it contributes to the behavioral studies related to drone delivery services, specifically for the foodservice industry. The research develops a model associated with the utilization of drone delivery services. Hence, the decision-makers can utilize this research to enhance the customers' acceptance of the services. Generally, this study is important for customers and delivery companies in the food-service industry. The model is expected to inspire food-service sub-sectors in planning for the adoption of drone technology adoption in evaluating an existing DFD or developing a new one. Thus, more industries will get support for their initiatives to transform from the traditional food delivery methods to the delivery using drones. This study also indirectly supports the realization of Industry 4.0 by utilizing drones to automate the food delivery process instead of manual delivery. Finally, according to Statista [34], in Malaysia only, the number of users of online food delivery is 6.2 million, and the number would be increased to 13.5 million by 2024, while the revenue in 2020 is US$211 million and this amount would increase to US$410 million by 2024. With the significant number of users, revenue, and government efforts to ensure social and physical contact amid COVID-19, drone food delivery, besides being reportedly profitable, could be used as a potential alternative solution to reduce unnecessary contact between people.

In this paper, the related literature studies of drone technology and its delivery services acceptance are reviewed. The review is categorized into four main sections; the first section describes drone technology and its significance in delivery services. The second section discusses the theories that support the development of the proposed model, including the Technology Acceptance Model (TAM), Motivated Consumer Innovativeness (MCI), and Diffusion of Innovation (DOI). In addition, since the drone is often associated with a risk factor, this study extends the discussion to different perceived risk types. The third section presents a review of works related to the adoption of drone delivery services. Subsequently, it extracts the factors that have been used by researchers to investigate drone delivery services. Lastly, based on the literature review, the fourth section presents the generic model of the study as well as the development of the related hypotheses.

2. LITERATURE REVIEW

2.1 Overview on Drone Technology

The business implementation model has dramatically been changed due to the wide adoption of new technologies. This includes the industry of hospitality and tourism. One prominent example of this, the technology of self-service using digital kiosks that is widely adopted by various domains such as self-check-in and check-out in hotels, airports, and recently used in restaurants to enhance service quality by automating the process [23] [35]. Recently, drone technology has received significant attention, and it is expected that drones will be part of our daily life, just like smartphones [1] [2]. The drone can autonomously fly or remotely control based on embedded software and integrated hardware such as computers, sensors, cameras, GPS [36].

Drones are categorized according to the type such as single-rotor, multi-rotor, Fixed-Wing [37], autonomy degrees such as partial automation, conditional automation, and full automation, the size and weight, and the power source such as fuel cell, batteries, and solar cell. [38] [39] [40]. Previously, drones were expensive and exclusively utilized in the military domain, however, this created a basis to use a drone in the civil market. Nowadays, many industries started using this technology for civil use, and it becomes increasingly inexpensive and available for purchase by civilian consumers [41]. In 2015, the use of drones in the military was 72%, followed by the commercial sector 23%, and in the civil sector 5% [3] [4].

Although the use of drones in public is a new experience to human society, the possible applications of the drone can be seen in various domains such as Military, Entertainment, Services, Environmental, Security, and others. Besides, drones attached with different payloads have several potential applications such as rescue operations by carrying water, food, medicine for rescue, and delivery services such as food and retail delivery [5] [6].

2.2 Drone Technology and Delivery Services

Since the World Economic Forum in 2016 has mentioned about the industry revolution 4.0 (IR

4.0) that stressed maximizing productivity, efficiency, and sustainability by integrating new technology into existing industries, drones were one of the innovative technology that received a great deal of intention as it can be employed in many industries [42]. In 2014, the global market of the drone reached $553 million, and yearly growth is predicted to be 16.9% [43].

Although the traditional drone has been broadly utilized in the military sector, it is believed that the drone market will be led by the civil sector [44]. Thus, the features that distinguished Drone technology has attracted attention from different industries and delivery services companies to invest in this promising technology such as Amazon, Mercedes- Benz, Google, United Parcel Service, and DHL [8]. Further being efficient, amid the Covid-19 pandemic, delivery drones can potentially be used to reduce unnecessary contact between humans. The emergence of the drone delivery idea can be traced back to December 2013 when Amazon disclosed their initiative of experimenting with the deployment of drones as an alternative to traditional delivery methods [7].

In recent years, big corporations launched similar initiatives such as Mercedes-Benz, United Parcel Service, and DHL to adopt drones for delivery purposes [8]. Several successful attempts of delivery using drones have been made in many countries. For example, in Australia, a mission of rescue was carried out by a drone that dropped the floating equipment and saved two boys [11]. In Korea, a drone has succeeded in delivering mail weighing 8 kg to a small island about 4 km away from land in 10 minutes compared to ships that take about two hours [12]. In the food-service industry, drone delivery has received significant attention due to the high growth of this domain. According to the star [13], food delivery has become very popular, and it has never been as it is now, and this trend will keep rising in 2020 onwards. The confidence in the growth of the food delivery market is also supported by data revealed by Google and Temasek that shown more than 90% of South-East Asians connected to the internet via their smartphones. In addition, it is also reported by the star [13], it is planned for online food delivery in the region to reach over US$8bil (RM24bil) in market size by 2025. Consequently, drone technology is expected to be the disruption of technology in this domain.

2.3 Drone Food Delivery (DFD)

In the food-service industry, drone food delivery (DFD), which means the ordered food online, will be delivered to consumers using a drone and is attracting increasing attention. An earlier drone was involved in some special tasks, and customers were doubtful about the commercialization of DFD services. Still, after successful testing attempts of DFD services by many countries, expectations rapidly increased about the potential benefit from utilizing this technology.

Recently, many companies have worked on providing DFD services. For example, in New Zealand, Domino's Pizza has successfully delivered Pizza using a drone to a customer about 32 km away within 5 min. After this successful attempt, Domino's Pizza was authorized by the New Zealand government to deliver food using drones [6]. Another successful attempt in Dubai, Costa Coffee, located on Jumeirah Beach Road has launched a project called Coffee-Copter to deliver food and beverages to customers on the beach after 82 percent of customers said they would agree to have a drone deliver their food and beverages. Before using the drone, it was difficult to serve certain kinds of beverages such as serving ice coffee on the sandy beach, but it becomes much more convenient [14]. In addition, in Korea, one of the very famous delivery companies called Yogiyo makes a successful first test flight in delivering food using an auto-piloting drone [15]. In Malaysia, a local drone company called Average Drone is also successfully tested the use of drone in the food-service industry, A six-propeller drones manufactured by the company named 'Express Food' were able to accommodate a weight of up to 800g and can be modified drone to accommodate a weight of up 3kg. The service first started in 2019 in Cyberjaya, the most technologically advanced town in Malaysia. The food is delivered within a two-kilometer distance of the Futurise building, the duration less than 12 minutes from the time the order was placed until the time the food is delivered, a mobile application has also been developed to facilitate customers to order their food [16]. In America, Uber was awarded the right to test commercial food delivery via drone. Afterward, Uber announced a new application called Uber Eats in partnership with McDonald's [17]. In Singapore, a drone developed by F-drones was deployed to vitamins to a ship owned by Eastern Pacific Shipping. The drone delivered 2kg of vitamins on the boat on the 19th of April 2020, lasted seven minutes and was over a distance of 2.7km. The use of drones will save up to 80% of the cost compared to current practice using small boats and helicopters. Besides, drones are more

environmentally friendly [18]. In Korea, due to the decline in manpower, drones are expected to be a potential solution, mainly, it was reported by [19] every year, 1500 people get injured and around 30 are killed. Sadly, 50% of those injured/killed are young under the age of 29. Thus, in the food-service industry, drones are important and promising; even though there are some legal conditions for commercialization, many tests have proved no issue with drone services from a technical perspective [6].

While the attempts to deploy drones in the food-service industry focus on the technical aspects, as mentioned earlier in Australia, New Zealand, Dubai, Korea, Malaysia, America, and Singapore, studies from the behavioral aspects are still in their infancy. On top of that, when a new technology-based service is introduced, it is very crucial to examine and understand consumers' motivations to identify a set of actions that influence the acceptance and fulfill a consumer's target [24] [25]. The literature studies have examined drones according to three aspects public acceptance, regulations, and technology [45]. Progress has been achieved in all of these aspects but varying degrees. As shown in Section 2.5, technology has good progress as many successful attempts have been made by many countries, as mentioned earlier. Concerning regulation, legal bodies in different countries are working towards realizing the wide usage of drones in a civilian context [6]. Public acceptance is one of the aspects of using drones on a large scale [46]. According to Aydin [47], this is the era of drone technology; nevertheless, technology development is not solely dependent on science and technology advancement but also on the acceptance of this technology by the public.

3. EXISTING THEORIES AND MODELS

TAM has been applied in diverse fields to understand how consumers accept and adopt new technology such as internet banking, autonomous driving, e-Health applications, cloud computing, the internet of things, smart cities. For example, Ghani, et al., [59] investigated customer adoption issues to seek internet banking services in Pakistan using TAM. Another study in Greece by [60], deployed the TAM model to examine the consumers' intentions towards adopting autonomous driving. The study has shown that TAM can explain a considerable variance in customer intention and acceptance of autonomous driving. Another study by Hoque, et al., [61] deployed TAM that examined citizens' (patients') perspective towards e-Health applications in Bangladesh. They found that the model can explain the behavior of patients toward the adoption of e-Health applications. Moreover, a study in a private university in Malaysia was conducted by [51] to investigate students' perceptions of using Facebook for learning. Two more variables were integrated with the original TAM to empowering the theory with a high capability of understanding the acceptance and use of new technologies. The results show that constructs have significant positive relationships with intention and behavior to use.

TAM has been proven as a fundamental theory by numerous previous studies to understanding the causal relationships among users' internal beliefs, attitudes, and intentions towards the adoption of new technology. In this research work, TAM has been adopted as a basic theory to demonstrate factors that influence consumers' perceptions about drone food delivery services in a student's campus. More precisely, the two main constructs of TAM: ease of use and usefulness are employed to be a significant key factor in the research framework.

In the early stages of adopting new technology or business, a need for understanding an individual's acceptance or rejection is very crucial and helpful regarding future development to determine the key factors that drive user acceptance. Many research studies have discussed this ongoing issue and come up with many models that help identify factors that influence an individual's and organizational acceptance of new technology. One of the fundamental theories in technology acceptance, TAM, which has been discussed in Section 2.5.1. However, many studies have reported that TAM theory is insufficient to explain the variation in user acceptance. To overcome this problem, the TAM theory is usually extended by integrating other theories such as MCI, the Theories of Reasoned Action, and Planned Behavior and Diffusion of Innovation (DOI) [26]. Therefore, a comprehensive, guiding model was needed to investigate the adoption of an emerged among individuals. Eventually, the UTAUT was proposed by Venkatesh et al. [26]. UTAUT integrates other models and theories findings such as TAM, TRA, TPB, DOI, TAM2 to constitute a comprehensive model.

In Jordan, Alalwan, et al., [28] investigated factors influencing the adoption of mobile banking services by customers, the study was conducted using UTAUT2 with Trust. The results showed that the model could predict a customer's behavioral intentions. In another study, Shao & Siponen [30]

deployed UTAUT2 to explain IT acceptance in a consumer context. The findings support the crucial role of the UTAUT2 model in explaining consumers' use of online technology and services. Recently, Palau-Saumell, et al., [29] used UTAUT2 to examine the adoption of mobile applications for restaurant searches and/or reservations (MARSR) by Spanish users and found that the model's constructs are significantly related to use. With comparing to the theories and models that have been used in predicting consumer's intention, the three added constructs in UTAUT 2 make it more robust in predicting and analyzing people's technology acceptance behaviors.

As mentioned earlier UTAUT 2, is developed based on the integration of several models and extended to meet both organizational and consumer perspectives [27] [28]. As shown in Table 1, the factors perceived usefulness in TAM, a relative advantage in DOI, functionality in MCI are similar to the performance expectancy in UTAUT2 [27] [20] [6]. In addition, the factors of ease of use in TAM, cognitively in MCI, complexity in DOI, are similar to the effort expectancy in UTAUT2 [27] [20] [6]. As well as, our analysis shows that the hedonically and socially in MCI are similar to the hedonic motivation and Social influence in UTAUT2. For this reason, we utilize UTAUT2 as a fundamental theory to predict consumers' intentions towards drone food delivery services. However, according to some studies, the habit factor could not be examined if the technology is still new. This variable requires customers to have rich experience using such technology [28] [58]. Although it has been proven to be significant [27], as mentioned earlier, DFD is not fully established in many countries. Therefore, consumers could not develop any habitual behavior towards this technology.

In this study, the TAM variables, ease of use, and usefulness will be adopted since they are similar to UTAUT2 as shown in Table 1. Also, the remaining independent variables of UTAUT2 will be added to the generic model proposed in this research.

Table 1: Comparison between UTAUT2 and other Models

Variables	TAM	DOI	MCI	UTAUT	UTAUT2
Usefulness/ functionality/ performance expectancy	√	√	√	√	√
Ease of use/cognitively/ complexity/ effort expectancy	√	√	√	√	√
Social influence/ socially			√	√	√
facilitating condition				√	√
hedonic motivation /hedonically			√		√
price value					√
habit					√

4. PREVIOUS STUDIES ON DFD

This section presents the previous studies that discussed drone delivery services from an adoption and acceptance perspective among consumers. The finding of the earlier studies' discussion will result in a clear understanding of the used approaches, methods, theories, and models, as well as the factors. Based on the information provided in the literature review, we will propose a generic model from the pool of search articles through the search engine related to the drone delivery services in general, which resulted in nine articles. The following paragraph presents a summary of the main ideas and findings of these studies.

Yoo et al [20] used the Theory and TAM model and DOI to construct the basic model since these models have similar constructs and could complement each other. They applied TAM and DOI along with other factors such as perceived technology factors, perceived risks, individual characteristics to hypothesis development. An online survey was conducted among 296 U.S. participants. The result showed that all factors are significant except the factors compatibility, delivery risk, mass media channel, environmental concerns were not significant.

Another quantitative study was conducted by Khan, et al. [4] in the Pakistani urban consumer market. The study was dependent on another study by Ramadan et al [21] that proposed a conceptual model only. The model was developed by deploying the Theory of Planned Behavior (TPB) and perceived risks customers may encounter during operation. The perceived risks encompass two variables safety and privacy. The study examined the relationship between the variables of

perceived risks and intention to adopt drone delivery technology. The results indicated that privacy concern was the most significant factor regarding drone adoption. Simultaneously, safety, criminal activity, and the effect on the environment do not hold substantial value in the model.

In another study, Anbaroğlu [45] addressed challenges and suggested solutions regarding parcel transportation using drones in urban areas. The challenges were divided into societal, public authority, and technological. From the societal perspective, the most significant factors were: physical safety, privacy, and perception. The study also predicted that with ongoing research, the UASs would deliver parcels in the coming years. Yoo, et al. [52] in Korea examined the factors affecting attitudes and intention of users to use drone delivery services for domestic logistics. They deployed TAM to explore the correlation service of the new technology. It was found that there is a causal relationship between the drone delivery service user and individual innovation, bedsides. There is also a causal relationship between the accommodation behavior and intention of use, with economic efficiency and convenience. However, perceived risk was found not significant.

Another study by Chen et. al [22] investigated factors affecting the adoption of drone delivery services by users. The conceptual model was developed with the support of three main theories - utility marketing theory, information technology adoption theory, and social network theory. A total of 157 participates were surveyed, including college students and their related family members. Hwang and Kim [23] investigated the consequences of a green image of drone food delivery services by proposing that a green image of drone food delivery services affects an individual's attitude toward using the services with considering the moderating role of gender and age. A total of 427 participants have been surveyed for testing 12 developed hypotheses among Korean citizens. The findings showed that a green image of drone food delivery services has positively affect attitude toward using the services. Besides, gender and age played partly as a moderator.

Hwang & Choe [23] conducted a study on the relationship between perceived risk in this new technology and image of drone food delivery services and finally explored the effect of the image of drone food delivery services on desire, intentions to use, and willingness to pay more. Data analysis showed that the three types of perceived risks (i.e., time risk, performance risk, and psychological risk) negatively influence the image of drone food delivery services and, thus, lead to increasing desire, intentions to use, and willingness to pay more.

In the early stage of adopting new technology such as drone delivery services, it might initially seem frightening or improbable from the customers' perspective. By identifying these concerns and challenges that might affect them, they would eventually get realized due to economic necessities and technological advancement. From reviewing the previous studies, we found that most of the societal concerns and challenges regarding adopting drone delivery was revolve around perceived risk (i.e. performance risk, privacy risk). Besides, personal innovativeness plays a vital role in drone delivery acceptance among consumers. As shown in Figure 1, the number of publications in each year reveals an increasing trend with growing interest to adopt DFD.

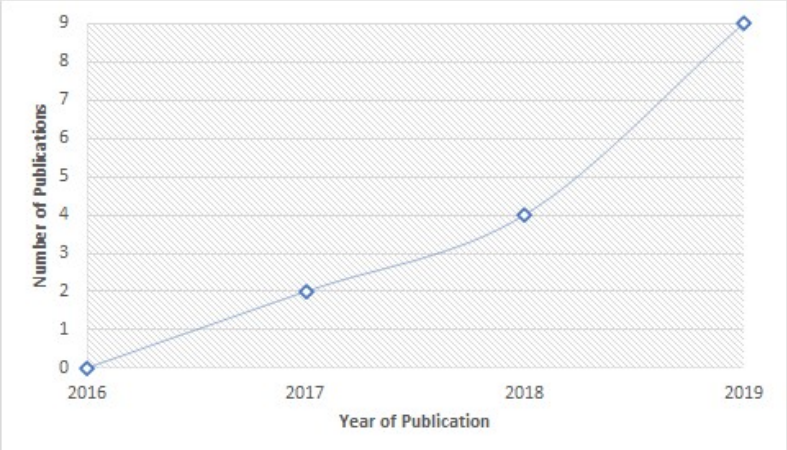

Figure 1: *The Current Trend of using DFD*

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5. VARIABLES SELECTION PROCEDURE

To identify the most influential factors, we conceive a procedure consists of four stages to select the potential factors as shown in Figure 2. The stages of the proposed process to extract potential factors have been used by various studies [51,], but not in s systematic manner as the one that we present in this paper. We have compiled different methods from different studies to filter the consolidated factors, and we subsequently put these methods in a systematic procedure to ensure proper flow in extracting the influential factors for further development.

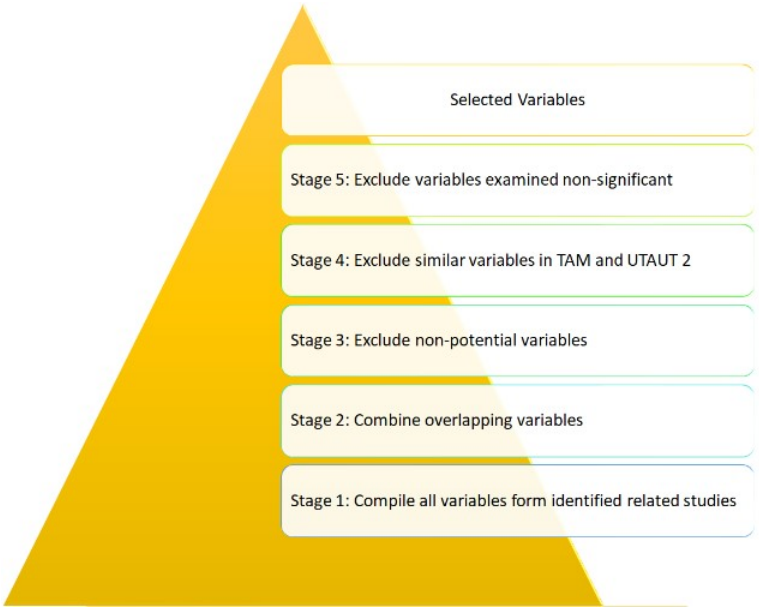

Figure 2: Selection of Potential Factors

When the proposed procedure was applied to all identified factors, the number was reduced from 38 to 3 factors as shown in Figure 3. Table 2 shows the complete procedure through five stages to extract the potential factors that influence the adoption of Drone Food Delivery.

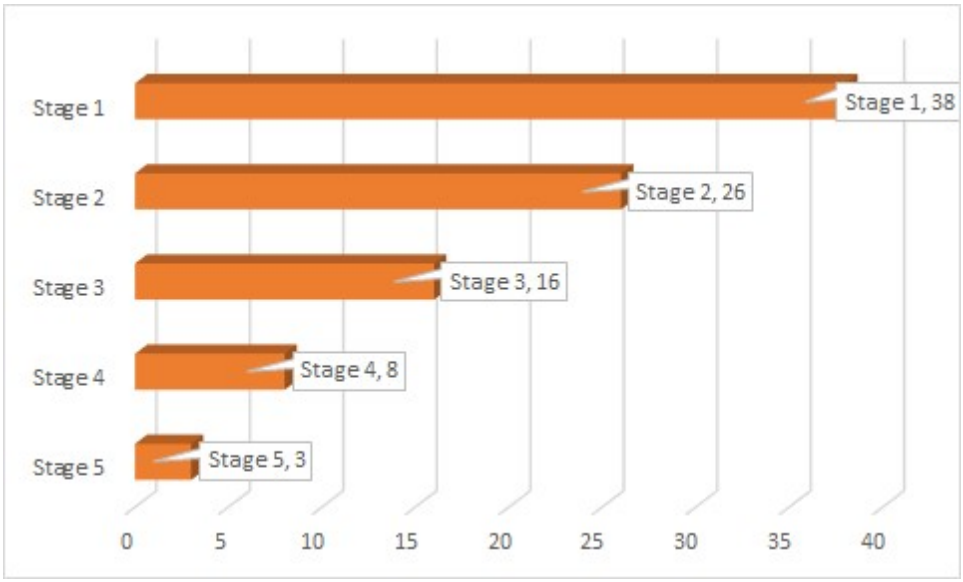

Figure 3: Exclusion Process

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Table2: Potential Factors Selection Process (Grey Box →Dropped factors in each stage)

#	Stage #1	Stage #2	Stage #3	Stage #4	#Stage 5
1.	Relative advantage	Relative advantage	Relative advantage		
2.	Complexity	Complexity	Complexity		
3.	Compatibility	Compatibility	Compatibility		
4.	performance risk	performance risk	performance risk	performance risk	performance risk
5.	privacy risk	privacy risk	privacy risk	privacy risk	privacy risk
6.	delivery risk	delivery risk	delivery risk	delivery risk	
7.	Personal innovativeness	Personal innovativeness	Personal innovativeness	Personal innovativeness	Personal innovativeness
8.	Mass media channels	Mass media channels	Mass media channels	Mass media channels	
9.	Environmental concern	Environmental concern	Environmental concern	Environmental concern	
10	Functionally MCI	Functionally MCI	Functionally MCI		
11	Hedonically MCI	Hedonically MCI	Hedonically MCI		
12	Cognitively MCI	Cognitively MCI	Cognitively MCI		
13	Socially MCI	Socially MCI	Socially MCI		
14	Green image of drone food delivery				
15	Financial risk	Financial risk			
16	time risk	time risk			
17	privacy risk				
18	performance risk				
19	psychological risk	psychological risk			
20	privacy risk				
21	safety risk				
22	performance risk				
23	personification of the drone	personification of the drone			
24	Privacy Concerns				
25	Safety Concerns	Safety Concerns	Safety Concerns	Safety Concerns	
26	Level of Criminal Activity	Level of Criminal Activity	Level of Criminal Activity	Level of Criminal Activity	
27	Effect on Environment				
28	Personal innovativeness				
29	Economics	Economics			
30	Convenience	Convenience			
31	Perceived risk	Perceived risk			
32	Perceived ease of use	Perceived ease of use	Perceived ease of use		
33	Perceived usefulness	Perceived usefulness	Perceived usefulness		
34	Opinion passing	Opinion passing	Opinion passing		
35	Personal innovativeness				
36	Physical safety				
37	Perception	Perception			
38	Privacy risk				

6. STUDIES IN OTHER EMERGING TECHNOLOGIES

From reviewing a number of studies in other domains [28] [48] [49] [50 [53] [54] [55] [56] [57], as shown in Table 3, we discovered potential factors which the Trust that can be included in the proposed generic model in this study. Trust is considered one of the most influential factors by many studies [28] [55] [56]. According to Gefen et al. [57], customer trust in new technology can be operationalized as the accumulation of customer beliefs of integrity, benevolence, and the ability to enhance customer willingness to depend on that technology. Zhang et al. [54] investigated the factors affecting users' acceptance of automated vehicles (AVs). Data were collected from 216 respondents. The findings show that the initial Trust was the most critical factor in promoting a positive attitude towards AVs. Moreover, the study in [28] proposed his model based on assimilated factors from UTAUT2 along with Trust. A questionnaire was conducted to collect data, 343 participants were completed the survey. The findings showed that Trust is the most critical factor that positively affects behavioral intention in adopting mobile banking customers. Another study by [53] examined the factors that affect the adoption of Internet of Things (IoT) services by the customers of Telecommunication companies. Trust was found significant, and one of the most influential factors. However, due to limited studies in DFD adoption, the trust effect has not been investigated yet. For this purpose, we will integrate Trust into our generic model for a better understanding of DFD acceptance.

Indeed, over the IS literature, it has been highly argued that trust could have a different pathway to influence user behaviors. For example, Ghazizadeh et al. [62] in his Automation Acceptance Model (AAM) extended TAM with trust and compatibility. Furthermore, he examined the effect of trust and compatibility on attitude and Behavioral Intention through Perceived Ease of Use and Perceived Usefulness. Trust was empirically supported by Choi and Ji [55] and Xu et al. [48] to have a crucial effect not only directly on behavioral intention but also indirectly on perceived risk, Perceive Ease of Use, and Perceived Usefulness. Moreover, Kaur and Rampersad [64] assumed that reliability, security risk, and privacy risk indirectly influence adoption through trust. Zhang et al. [54] assume that initial trust in Autonomous Vehicles (AV) was built upon perception factors (perceived usefulness, perceived ease of use, Performance Risk, and Privacy Risk) and was a key determinant of AV acceptance.

In addition, Dutot et al. [63] investigated the effect of trust on the Perceived Usefulness and Perceive Ease of Use of smartwatches. Dutot et al. [63] in their model extended (TAM) with trust and hypothesized it to have a positive effect on the Perceived Usefulness and Perceive Ease of Use of smartwatches. As well, Singh & Sinha [65] and Alraja et al. [66] tested the mediating effect of perceived trust in the fields of mobile wallet technology and IoT. To conclude, trust could play a significant role in shaping human behavioral intention because drone technology is still in the early stage of adoption.

Table 3: *Summary of Studies Related to the Trust in Emerging Technology*

Author	Domain
Ghazizadeh et al. [62]	automated vehicles (AVs)
Choi and Ji [55] and Xu et al. [48]	automated vehicles (AVs)
Kaur and Rampersad [64]	automated vehicles (AVs)
Zhang et al. [54]	automated vehicles (AVs)
Alalwan et.al [28]	mobile banking
Dutot et al. [63]	Smart watches
Singh & Sinha [65]	mobile wallet technology
Alraja et al. [66]	IoT-Based Healthcare

7. ADOPTED VARIABLES IN THIS STUDY

To construct the adoption model, this study has identified 10 factors that have a potential impact on the adoption of food delivery services using drone technology. As shown in Table 4, the variables came from two theories and four research studies.

Table 4: Adopted Variables in this Study

#	Factor	Source
1	Perceived Usefulness	TAM
2	Ease of Use	TAM
3	Social Influence	UTAUT2
4	Facilitating Condition	UTAUT2
5	Hedonic Motivation	UTAUT2
6	Price Sensitivity	UTAUT2
7	Personal Innovativeness	Khan et al.[4]
8	Privacy Risk	Chen et al. [22]
9	Performance Risk	Yoo et al [20]
10	Trust	Gefen et al. [57]

8. DFD GENERIC MODEL DEVELOPMENT

In this study, the generic model is developed based on the literature studies of drone delivery adoption and the conceptualization of TAM and UTAUT2. The generic model shown in Figure 4 encompasses nine independent constructs that were elicited from the reviewed papers and theories as presented in the previous section. The nine variables are anticipated to influence the behavioral intention that in turn, affects the use behavior of Drone Food Delivery (DFD) services. The following sub-sections will discuss each variable.

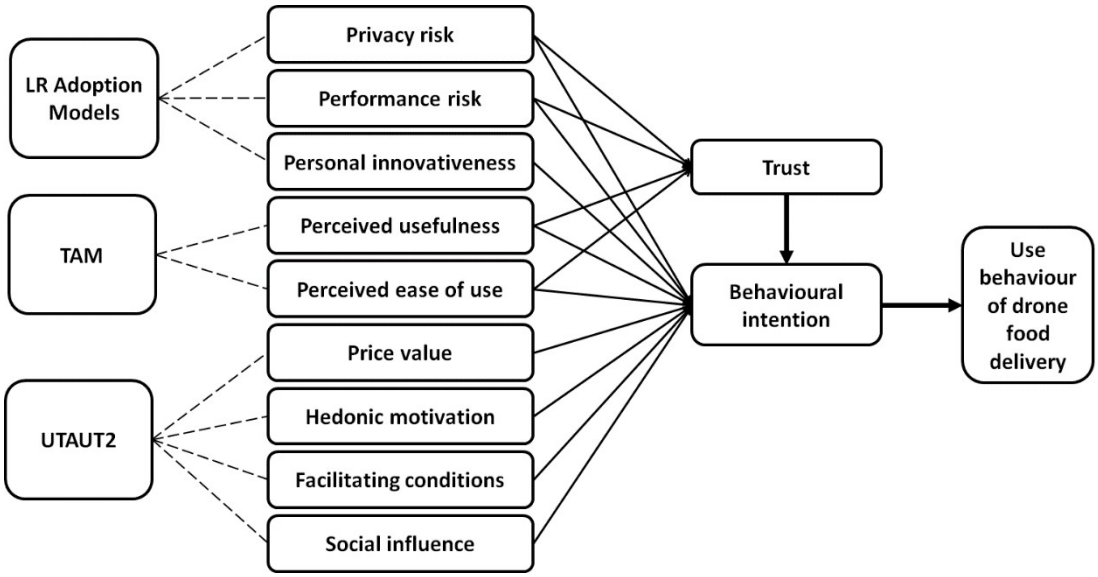

Figure 4: The Proposed Generic Model

9. LIMITATION

Although this study has conducted comprehensive research to propose a generic adoption model of drone technology in food delivery that could be replicated by future studies and applied to different domains, the model is yet to be examined using an experemtntal study. Although it is not expected that the factors will get change, the experimental study can shed some light on the most influential factors that require priority response by decision-makers to be adopted first.

10. CONCLUSION

In this chapter, we reviewed the literature on drone food delivery services. First, we gave an overview of drone technology, delivery services, and drones in food deliveries. Through the extensive review, we have highlighted the existing attempts, importance, and challenges. Subsequently, we presented the selected theories, TAM and UTAUT, to understand and measure how consumers adopt new technologies. To point out the strength of UTAU2, a comparison was made with other theories such as TAM, DOI, MCI, UTAUT. We Subsequently conducted a comprehensive review of the existing studies that examine the factors that affect the acceptance of Drone Food Delivery (DFD) services. Nine studies have been identified as relevant to this research. These studies are in the area of Drone Delivery Services (any kind of delivery). Many variables have been identified with different degrees of significance. To extract the potential variables to be involved in this study, we have set a selection procedure that consists of five stages include, (i) compile all variables, (ii) combine overlapping variables, (ii) exclude non-potential variables, (vi) exclude similar variables in TAM and UTAUT2, (v) exclude variables examined non-significant by other studies. However, to strengthen our model and ensure the inclusion of potential factors, we also conducted a quick review of other literature that address the acceptance of other emerging technologies such as IoT, autonomous vehicle, and mobile banking. Finally, we have presented the adopted variables in this study, the proposed generic model, and the associated hypothesis.

In the early stage of new technology adoption, an intensive marketing campaign through media channels is highly recommended, such as

television, newspapers, and the internet, to familiarize the consumers about the advantages of moving to the new delivery mean and make word-of-mouth effective. Decision-makers are advised to launch a training program and hold a workshop to educate the food delivery providers. In our future work, we shall test the proposed model using an experimental study to understand further the different impacts of the selected factors to give a more accurate recommendation to decision-makers on which factors have higher priority to be adopted first.

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