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ARTICLE

Innovative marketing strategies for the successful construction of drone food delivery services: Merging TAM with TPB

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ABSTRACT

This study merged the technology acceptance model (TAM) with the theory of planned behavior (TPB) to examine how to form behavioral intentions in the context of drone food delivery services. The results of data analysis showed that all six hypotheses within the model that merged the TAM and the TPB were statistically supported. In addition, product innovativeness moderated the relationship between the subjective norm and behavioral intentions. In the latter part of this study, implications for the food service industry as well as implications for the tourism industry were presented.

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KEYWORDS
Drone food delivery services; technology acceptance model; theory of planned behavior; product innovativeness

Introduction

Nowadays, it is amazing to see how food technology has advanced and how it affects consumers in the food service industry (Brouwers, 2018). Among new food technologies, drone food delivery services have become one of the most important topics in the fourth industrial revolution (Khan et al., 2019). Drone food delivery services are services that use unmanned aerial vehicles (UAV) to deliver food to customers (Hwang et al., 2019). Because food is delivered through the sky and thus can avoid traffic jams, drone food delivery services can reduce delivery times, (Statistica, 2018). Drone food delivery services are not yet legal in many countries. However, utilizing drone food delivery services have great potential to cater needs of customers. Nevertheless, studies regarding drone food delivery services are not many in the academia. For example, previous studies on drone delivery services have mainly emphasized the environmental benefits of drones (e.g., Park et al., 2018), the regulation and technology issues (e.g., Jaramillo et al., 2019), and the perceived risk of drone food delivery services (e.g., Hwang & Choe, 2019).

Investigating behavioral intentions is very important in the study of consumer behavior because those will lead to actual behavior (Doll & Torkzadeh, 1988). That is, if consumers show a high level of behavioral intention to use new technology, they are likely to use it. Indeed, Khan et al. (2019) mentioned that it is first necessary to investigate consumer behavioral intentions toward their use drone food delivery services to utilize to their full potential. The Technology Acceptance Model (TAM) focuses on how consumers adopt new technologies (Davis, 1989). However, only using TAM to explain behavioral intention to use drone food delivery services is not enough and fails to take into account some salient characteristics of drone food delivery services because TAM excludes the fact that that technology could be used outside the organizational settings (Rauniar et al., 2014).

On the other hand, the theory of planned behavior (TPB) is a well-known theory that explains the individuals' general behaviors. According to TPB, three main antecedents (attitude, subjective norms, and perceived behavioral control) are influential for the consumer decision-making process (Ajzen, 1991). Using delivery service for a meal can be considered consumers' general behavior. However, if new technology such as drone is involved in the service, only applying TPB to explain consumers' intention to use drone food delivery services is not enough.

Consumers might not only be motivated to use drone food delivery services by social influence (e.g. subjective norms) and individuals' resources (e.g., time, opportunities), but also be prompted by their perceptions of the values associated with the new technology (e.g. ease of use, usefulness). Therefore, this study attempted to merge the two theories (TAM, TPB) to explain consumer behavioral intentions toward using drone food delivery services. As far as we know, this is the first attempt.

Moreover, the concept of product innovativeness has received a considerable amount of attention for its

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attempts to explain consumers' behavioral intentions in the context of technology, because the adoption of a new technology depends on the level of product innovativeness (Feng et al., 2016). For that reason, a large body of research has been conducted on the role of product innovativeness as a moderator (e.g., Fu & Elliott, 2013; Lee & O'Connor, 2003; Li et al., 2019), and it suggests that it would be significant to identify the differences in consumer behavior according to the level of product innovativeness in relation to adopting a new technology. However, the moderating role of product innovativeness was not examined in the study of drone food delivery technology.

Thus, integrated model of TAM and TPB would aid in more accurately predicting consumer behavioral intentions toward using drone food delivery services. Furthermore, the moderating role of product innovativeness in the relationship between consumers' perceptions of drone food delivery services and behavioral intentions to use will be explored. The purpose of this study was to investigate (1) the causal relationships between perceived ease of use and perceived usefulness, (2) the effects of the perceived ease of use and the perceived usefulness on attitude, (3) the impact of attitude, the subjective norm, and perceived behavioral control on behavioral intentions, and (4) the moderating role of product innovativeness in this process.

Literature review

Industry trend of drone food delivery services

Although drones were originally designed for military purposes, they have been developed and used for various purposes since then (Divya, 2019). In recent years, drones have been used more widely as logistical devices (Grind Drone, 2020), and their use in the food service industry is no exception. Tests of drone food delivery services have been completed successfully through the following procedure. First, customers order food through a restaurant's mobile application. Second, restaurant staff puts the customer' meal in a drone at the place where the drone can launch. Third, customer receives the meal via a wire or directly from the drone. Finally, the drone goes back to its original location to wait for another delivery service request (Pymnts, 2018).

Utilizing drone food delivery services has several advantages. First, such a service can save time, because it delivers food from a restaurant to a targeted place through a remotely controlled system (Statistica, 2018). That approach is faster than a human delivery service, thus leaving operators at restaurants with more time to attend to other important tasks. Second, drone food delivery services are environmentally friendly, because they can minimize the air pollution generated by delivery motor vehicles (Grind Drone, 2020). Third, in terms of safety, delivery people do not have to risk their lives due to accidents caused by motor vehicles (Chung et al., 2014). Fourth, delivery drones are more efficient than humans are in terms of accuracy, because drones have a higher accuracy rate with delivering materials to the right places than humans do (Grind Drone, 2020).

Flytrex is a start-up companies that specializes in developing drone delivery services, and Flytrex has mentioned that a drone can carry a six-pound package and arrive in five to 10 minutes within an aerial distance of three miles. According to their statement, a drone can make five deliveries per hour, whereas human deliverers can complete only two and half deliveries within the same hour (Pymnts, 2018). Furthermore, UberEats has stated that they believe drone food delivery services will help solve problems caused by urban mobility, such as traffic jams (Bandoim, 2018; Desatoff, 2018).

Because of all of those benefits, many corporations have shown an interest in the new drone technology, and a number of drone food delivery services have been tested around the world. For example, the London-based chain YO! Sushi tested drone delivery from the kitchen to the customer Table in 2013 (CNN News, 2013). Also, Francesco's Pizza in India delivered a pizza with a drone in 2014, and that same year the Casa Madrona hotel in the U.S. successfully delivered champagne to guests using drones (Spiegel, 2014). Amazon announced in 2013 that the company planned to start its drone delivery program within several years (Bastone, 2018), and the company finally tested its first drone delivery with success by initiating Prime Air in 2016 (Desatoff, 2018).UberEats is currently operated by delivery partners who deliver food using their cars, bikes, or on foot, but the company is highly interested in launching food-delivery drones by 2021 and is currently involved in the process of testing commercial drones. For example, UberEats hosted an event in Dallas and tested the use of drones to deliver food to people on the event grounds in 2018 (Bandoim, 2018).

Although many companies are quite interested in using drones to provide food delivery services, commercial drones are not yet legal in most countries. For example, in the United States, commercial drones are strictly regulated by the laws of the Federal Aviation Administration. There, drones have to operate at a height below 400 feet, and a human pilot needs to stand by on the ground (Bandoim, 2018). On the other hand, in 2017, Iceland became the first country to approve commercial drone food delivery services. Although city landscapes make it difficult to reach all

parts of a city, drone food delivery services now allow customers in remote areas can enjoy such things as California rolls and fast foods more quickly and easily than ever before (Flytrex, 2017; Rainey, 2018). In China in 2018, the government gave commercial drone food delivery services permission to operate, and now customers can enjoy food from 100 different restaurants operating in Shanghai's Jinshan Industrial Park (BBC News, 2018).

A thorough literature review on drone food delivery services makes it evident that the services will not have a problem with commercialization in the near future. However, very little restaurant literature exists on this topic at the academic level, because the technology is very new (Hwang et al., 2019; Hwang & Choe, 2019; Jaramillo et al., 2019; Park et al., 2018). Jaramillo et al. (2019) investigated the use of drones for food delivery. They explored the key success factors for drone food delivery services from societal, technological, logistics, service and legal perspectives. However, this study mainly focused on the legal and technology issues and failed to investigate these issues from consumers' perceptions. Hwang and Choe (2019) explored the influence of consumers' perceived risk on the overall image of drone food delivery services and desire and behavioral intention to use the services. This study investigated how to improve the intention to use drone food delivery services from consumer perspectives but did not explore consumers' perceptions of the efforts and values associated with new technology. In addition, unlike our study, Kim and Hwang (2020) examined how the eco-friendly aspects of drone food delivery services aid to form behavioral intentions using the TPB and the norm activation model.

Previous academic literature does not provide enough information about consumers' perceptions of drone food delivery services, and it fails to identify factors that affect consumer behavioral intentions toward using such services based on existing theories. In that respect, the results of this study will be invaluable to the commercialization of drone food delivery services.

Technology acceptance model

Since TAM was introduced in the academia, the theory has been become very popular because the theory is simple, supported by data, and being adaptable to predict the use of new technology (Rauniar et al., 2014). The model focuses on how the characteristics of a new technology affect consumers' perceptions and how the customers ultimately use that technology (Davis, 1985; Venkatesh & Davis, 2000). The main point of TAM is that usefulness and the ease of use perceived by consumers are linked to consumers' attitudes toward using a new technology. Furthermore, the consumers' attitudes toward using a new technology have been shown to be critical on the use of new technology (Davis, 1985; Zahid et al., 2010).

Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance", while perceived ease of use refers to "the degree to which an individual believes that using a particular system would be free of physical and mental effort" (Davis, 1985, p. 26). In addition, when a consumer has a favorable evaluation or appraisal of the consumption product, he (she) is considered to have a positive attitude toward the product (Ajzen, 1991). In other words, attitude is a summary evaluation of an object of thought (Bohner & Wänke, 2002). More importantly, previous studies have shown that the perceived ease of use of a new technology influences people's attitudes toward that technology (e.g., Chang et al., 2016; Davis et al., 1989; Kim et al., 2008; Porter & Donthu, 2006; Sahli & Legohérel, 2016). Furthermore, previous studies show that perceived usefulness is influenced by perceived ease of use (e.g., Davis et al., 1989; Herrero & San Martín, 2012; Porter & Donthu, 2006; Sahli & Legohérel, 2016). For example, Porter and Donthu (2006) tested the TAM to examine the Internet usage of consumers and demonstrated that in the context of Internet usage, ease of use positively affected usefulness. According to Herrero and San Martín (2012), when potential tourists perceived a high ease of use for a website, they were more likely to perceive that website to have a high level of usefulness. In sum, if the technology is easy to use, it will result in greater usefulness for consumers.

Furthermore, Kim et al. (2008) investigated the variables that influenced tourists' acceptance of mobile devices. In their study, tourists who indicated that their interaction with mobile devices was clear and understandable thought that mobile devices made their travel more interesting. Similarly, Chang et al. (2016) identified factors affecting Chinese tourists' intentions to use a medical travel app based on the TAM. Their work revealed that when Chinese tourists perceived that the medical travel app was easy to use, they then formed a positive attitude toward the new app.

Lastly, studies on technology acceptance in various fields have shown that when consumers think that a new technology is useful, then they are more likely to generate favorable attitudes toward a new technology (e.g., Chang et al., 2016; Kim et al., 2008; Kim et al., 2008; Porter & Donthu, 2006; Sahli & Legohérel, 2016). For instance, Porter and Donthu (2006) found that the

more that people perceived the Internet to be useful, the more favorable their attitudes were toward its use. In addition, Kim et al. (2008) examined the acceptance behavior of hotel front office systems in the hospitality context and discovered that when hotel employees perceived that a new hotel front office system improved their productivity, they believed that using the new technology system was a good idea. Sahli and Legohérel (2016) studied consumers' acceptance of information technology, in terms of booking tourism products online. Their results revealed that the more people perceived tourism websites to be useful, the higher their level of positive attitude was toward those websites.

Theory of planned behavior

The TPB has been a popular social psychology theory to explain behavioral intentions in the context of new technology (e.g., Ajzen & Madden, 1986; Amaro & Duarte, 2015; Ramadan et al., 2017; Yu et al., 2018). The TPB is an expanded theory of the TRA, which explains behavioral intentions through attitudes and subjective norms (Ajzen, 1991), but the two differ in that the TPB explains consumers' behaviors by considering both volitional and non-volitional aspects (Armitage & Conner, 2001; Hsieh et al., 2016; Perugini & Bagozzi, 2001).

As noted previously, attitude is an individual's psychological tendency that is formed by some degree of favor or disfavor toward a certain object (Eagly & Chaiken, 1993). Next, when an individual perceives a high level of subjective norm, this means he (she) feels social pressure to perform (or not perform) a particular behavior (Ajzen, 1985; Lu et al., 2010). For example, parents, spouses, friends, and/or teachers may have certain expectations and opinions about a person's particular behavior. If that person perceives a high expectation from those reference groups and is motivated to comply with them, the person is said to have a high level of subjective norm (De Groot & Steg, 2007; Sparks & Pan, 2009). Perceived behavioral control is similar to people's confidence in their ability to perform a certain behavior (Bandura, 1982). If individuals consider that it is difficult to perform a particular behavior, then he (she) is said to have a low level of perceived behavioral control.

Previous literature has suggested that consumers' favorable evaluations of a new technology is positively related to their acceptance and intention to use that new technology (Amaro & Duarte, 2015; Kim et al., 2008; Sahli & Legohérel, 2016). For example, Amaro and Duarte (2015) presented an integrative model that they based on TPB to explore factors affecting consumers' intentions to purchase travel online. In their study, consumers' attitudes toward online travel shopping were discovered to be the major component that influenced their intention to purchase travel online. Interestingly, Kim et al. (2008) examined the direct relationship between employees' attitudes toward a new hotel front office system and its actual usage, without going through the employees' intention to use it. Kim et al. (2008) discovered that a very strong positive relationship existed between attitude and the actual usage of the new system.

Subjective norm has proven to be an important factor that affects behavioral intentions. For instance, Watjatrakul (2013) used a mobile messaging service offered by universities as a study domain and discovered the significant effect that subjective norm had on the participants' intention to use the universities' mobile messaging service. In addition, Kaushik et al. (2015) extended the TAM by testing additional antecedents to predict tourists' behavioral intentions to use a self-service hotel technology. In their results, the subjective norm was one of the most important variables that significantly affected customers' intentions to adopt the hotels' self-service technology.

Most studies that have adopted the TPB to explain individuals' technology acceptance have confirmed the significance of perceived behavioral control on people's acceptance of a technology (e.g. Lu et al., 2010; Luarn & Lin, 2005; Yang & Su, 2017; Yu et al., 2018). For example, when mobile banking systems were first introduced in the market, Luarn and Lin (2005) attempted to identify the predictors that determined users' acceptance of mobile banking. On the basis of behavioral control, those researchers introduced the concept of perceived self-efficacy and the perceived financial cost and the both factors were related to consumers' willingness to use a mobile banking system. That result demonstrated the significant effect of behavioral control on intention to use (Luarn & Lin, 2005).

Product innovativeness

In today's highly competitive market, most companies are under growing pressure to develop innovative products and services that are responsive to customers' increased technical and operational requirements (Olson et al., 1995). Product innovativeness can be defined as "a measure of the potential discontinuity a product (process or service) can generate in the marketing and/or technological process …." (Garcia & Calantone, 2002, p. 113) That is, product innovativeness reflects, from a consumer's perspective, the degree to which a new technology or a product's differentiated

attributes and features are embedded in a product (Wu et al., 2004). The absence of product innovativeness is an important underlying explanation for the failure of a new product (Cooper, 2019). Hence, many researchers have asserted that product innovativeness should be studied in order to develop a more powerful body of literature that explains customer behavior and intentions in the domain of a new technology. As an example, a meta-analysis based on 95 correlations of product innovativeness with new product performance was discovered to be significant, and the effects of product innovativeness on customers' adoption of a new product were generally positive (Szymanski et al., 2007). In other words, product innovativeness can be a vital factor in the success of new products or services because it has a significant impact on customers' positive behavioral intentions, and as a consequence, it delivers promising financial results to companies.

Theoretical background of the conceptual framework

According to Venkatesh and Davis (2000), TAM is one of the most influential models that can be used to explain individuals' usage of new technology. However, only using TAM to explain behavioral intention to use drone food delivery services is not enough and fails to take into account some salient characteristics of drone food delivery services. The reason is TAM was originally developed with an emphasis on the design of systems which were used in organizations to improve efficiency of employees. Moreover, TAM does not include the role of others in affecting individuals' attitude toward the new technology (Rauniar et al., 2014). Numbers of psychological scholars indicated that individual behaviors that involve using new technology are strongly affected by other people particularly who are close to the individuals such as families, friends, and colleagues (Lee & Wan, 2010). In addition, consumers' confidence or ability to use the new technology is worth to investigate to identify the actual acceptance of the technology (Ramadan et al., 2017). Therefore, in order to understand behavioral intention to use drone food delivery services, social influence on individuals and individuals' resources also should be taken into account in the conceptual model.

Since the focus of the present study is mainly on the psychological aspects of individuals who may be the potential users of drone food delivery services, TPB was chosen in our study along with TAM for the development of the research model. TPB is one of the most popular socio-psychological models for understanding and predicting consumer behavior (Ajzen, 2015). In addition, TPB is known as an appropriate theory for predicting behavioral intentions such as to use new technology (de Graaf et al., 2019; Venkatesh & Brown, 2001). However, there is a critique that TPB overlooks the fact that individuals may execute behaviors on a daily basis, which is more like a habit or automatic behavior rather than going through a conscious decision-making process, which is an assumption of TPB (Bagozzi et al., 2001; Park et al., 2017; Verplanken et al., 1998). There is less possibility that the action of using drone food delivery technology has become a habitual or mindless state by most customers because drone food delivery services are not fully commercialized yet in the market.

While TPB has been widely adopted to examine the individuals' general behaviors, TAM has been used to predict consumers' specific technology acceptance. It is believed that using drone food delivery services involve general behavior (e.g. order a meal from a restaurant) and specific technology (e.g., drone technology). Therefore, in our study, we deliberately integrated TAM and TPB to explore consumers' behavioral intention to use drone food delivery services.

A number of empirical studies also have found support for both the TAM and the TPB being able to explain consumers' acceptance of and intention to use new technology-related services (e.g. Amaro & Duarte, 2015; Casaló et al., 2010; Chang et al., 2015; Lu et al., 2010; Singh, 2015; Yang & Su, 2017; Yu et al., 2018). For example, Chang et al. (2015) combined TAM and TPB to explain users' behavioral intentions to use telehealth systems in hospitals. In their study, when users considered that new telehealth system was useful and easy to practice, they generated more positive attitude toward the new technology. Unlike our study, Chang et al. (2015) proposed that perceived usefulness can directly influence intention to use but the results indicate that perceived usefulness only indirectly influences intention to use through attitude.

Lu et al. (2010) applied the TAM and the TPB to discuss the factors that affected taxpayers' willingness to use an online tax filling system. Their results indicate that when users perceived that online tax filling system was useful and quite easy to handle, they formulated more favorable attitude toward the new system. By applying the TAM and TPB, Yang and Su (2017) explored how learners responded to information technology and new teaching methods, and they discovered that attitude was the most significant factor that affected learners' behavioral intention. Moreover, subjective norm and behavioral control were also significant variables that affected learners' intentions to use a new teaching method.

Yu et al. (2018) attempted to explain people's intentions to use a new technology system that can share

a bike, which is a new form of the sharing economy. They also integrated TAM and TPB in their study and found that when people considered that commercial bike-sharing systems was useful and easy to use, they generated good attitude toward the bike-sharing system. However, the subjective norm did not affect the intention to use bike sharing.

In the current study, combined TAM and TPB was further extended to include the concept of product innovativeness. Product innovativeness has been widely studied and found to have a moderating role in the context of new technology because individuals' adoption of new technology products and services differ depending on the level of product innovation (Cooper, 2019; Lee & O'Connor, 2003). Empirical studies have also corroborated that argument. Fu and Elliott (2013) incorporated the TRA and the elaboration likelihood model (ELM) to explain consumers' purchase intentions for a technology product, and they found that the effects of consumers' attitudes on their behavioral intentions toward using a product will be stronger when the consumers perceive that the product has a high level of innovativeness. In addition, Lin et al. (2013) analyzed 196 new product development (NPD) projects of high-tech firms, and their results revealed that product innovativeness moderated the impact of customer participation on NPD outcomes. Feng et al. (2016) also found that the impact that customer involvement had on a new product's performance varied depending on the product's technological newness and market newness. More specifically, they asserted that the performance effect exerted by customer involvement is stronger under an environment of low technology newness and high market newness. More recently, Li et al. (2019) discovered that the influence of customer involvement on NPD cost performance was stronger when consumers perceived that the product has a high level of innovativeness.

Based on the empirical supports discussed above, it is assumed that relationships of consumers' attitude, subjective norm, behavioral control, and intentions could be different, depending on consumers' product innovativeness perception toward drone food technology.

The conceptual model is proposed in the Figure 1. The proposed conceptual model is unique and different from that of previous studies because integrated TAM and the TPB is expected to suggest an appropriate conceptual framework for examining consumers' intentions to use drone food delivery services which has not been attempted previously. Moreover, including product innovativeness as a moderating variable is expected to provide new insight to explain how to improve consumers' behavioral intention to use drone food delivery services. Based on discussion, we propose the following hypotheses.

Hypothesis 1: Perceived ease of use positively affects perceived usefulness.

Hypothesis 2: Perceived ease of use positively affects attitude.

Hypothesis 3: Perceived usefulness positively affects attitude.

Hypothesis 4: Attitude positively affects behavioral intentions.

Hypothesis 5: Subjective norm positively affects behavioral intentions.

Hypothesis 6: Perceived behavioral control positively affects behavioral intentions.

Hypothesis 7a: The relationship between attitude and behavioral intentions will be stronger when consumers perceive a high level of product innovativeness.

Hypothesis 7b: The relationship between subjective norm and behavioral intentions will be stronger when consumers perceive a high level of product innovativeness.

Hypothesis 7c: The relationship between perceived behavioral control and behavioral intentions will be stronger when consumers perceive a high level of product innovativeness.

Methodology

Measurement

In this study, measurement items for perceived ease of use and perceived usefulness were adapted from Davis (1985) and Davis et al. (1989). The measurement items for TPB were applied from previous studies (Ajzen, 1991; Perugini & Bagozzi, 2001). Additionally, measurement items for product innovativeness was adapted from Song and Xie (2000) and Tsai et al. (2015): "Drone food delivery services are highly innovative–totally new to the foodservice industry," "Drone food delivery services rely on technology that has never been used in the foodservice industry before," and "Drone food delivery services

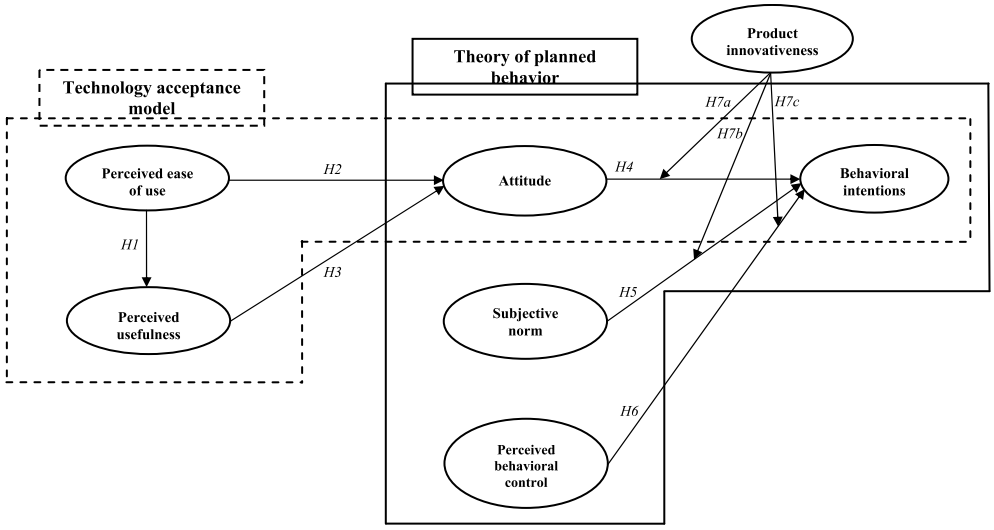

Figure 1. The proposed conceptual model. The moderating role of product knowledge as incorporated into the technology acceptance model (TAM) and the theory of planned behavior (TPB)

are one of the first of its kind introduced into the food-service industry." All of the items were modified to fit the context of the current study. To measure all the constructs, Likert type scales were used. (1) was strongly disagree, while (7) was strongly agree.

Data collection

The reliability of the measurement items was assessed by conducting a pretest. Respondents did not have a good understanding of a drone delivery services since drone delivery services have not been fully commercialized in many countries. To overcome that problem, we asked respondents to fill out the questionnaire after watching a video that was approximately 2 minutes and 30 seconds long that explained the system of the drone food delivery services well (see the Appendix). For example, the video shows how customers order food and how it is delivered to them using drones. The online survey company used in this study is the largest online survey company in Korea, and the survey for this study was conducted for three days.

Based on the pretest data collected from a total of 50 restaurant customers who had used food delivery services during a period of six months, we confirmed that all of the constructs had a high level of reliability, because the Cronbach's alpha values were greater than .70 (Nunnally, 1978). Data then were collected for the main survey by using the same procedure as the pretest. The online survey company sent an invitation email to a total of 2,794 members, and 346 members finished the survey. From that, 16 outliers were excluded for multivariate outliers and visual inspections. Therefore, 330 samples were used for the data analysis.

Data analysis

Demographics of samples

Demographic information of the sample is shown in Table 1. Out of a total of 330 respondents, there were more males (n = 192, 58.2%) than females (n = 138, 41.8%). 38.2% (n = 126) of the respondents were 20s. In

Table 1. Profile of the samples (n = 330).

Variable	n	Percentage
Gender		
Male	192	58.2
Female	138	41.8
Age		
20s	126	38.2
30s	102	30.9
40s	68	20.6
50s	34	10.3
Mean age = 34.88 years old		
Monthly house income		
$6,001 and over	60	18.2
$5,001-$6,000	37	11.2
$4,001-$5,000	48	14.5
$3,001-$4,000	53	16.1
$2,001-$3,000	75	22.7
$1,001-$2,000	45	13.6
Under $1,000	12	3.6
Marital status		
Single	188	57.0
Married	139	42.1
Widowed/Divorced	3	.9
Education level		
Less than high school diploma	34	10.3
Associate's degree	52	15.8
Bachelor's degree	194	58.8
Graduate degree	50	15.2

Table 2. Confirmatory factor analysis: items and loadings.

Construct and scale item (Skewness, Std. Error of Skewness, Kurtosis, and Std. Error of Kurtosis)	Standardized loading[a]
Perceived ease of use	
Learning to use drone food delivery services seems to be easy to understand. (−.101,.134, −.372,.268)	.844
It seems to be easy to use drone food delivery services when ordering food. (−.085,.134, −.593,.268)	.933
It does not seem to be difficult to use drone food delivery services. (−.215,.134, −.317,.268)	.931
Perceived usefulness	
Drone food delivery services would enable me to receive food more quickly. (−.420,.134, −.063,.268)	.862
Using drone food delivery services could make it easier for me to receive food. (−.261,.134, −.250,.268)	.936
Using drone food delivery services seems to be convenient when receiving food. (−.225,.134, −.186,.268)	.922
Attitude	
Unfavorable – Favorable (−.713,.134,.050,.268)	.886
Bad – Good (−.555,.134,.121,.268)	.934
Negative – Positive (−.426,.134, −.355,.268)	.939
Subjective norm	
Most people who are important to me think I should use drone food delivery services when ordering food. (−.167,.134, −.337,.268)	.902
Most people who are important to me would want me to use drone food delivery services when ordering food. (−.156,.134, −.280,.268)	.956
People whose opinions I value would prefer that I use drone food delivery services when ordering food. (−.116,.134, −.179,.268)	.963
Perceived behavioral control	
Whether or not I use drone food delivery services when ordering food is completely up to me. (−.240,.134, −.408,.268)	.870
I am confident that if I want, I can use drone food delivery services when ordering food. (−.212,.134, −.518,.268)	.917
I have resources, time, and opportunities to use drone food delivery services when ordering food. (−.194,.134, −.436,.268)	.938
Behavioral intentions	
I will use drone food delivery services when ordering food. (−.270,.134,.043,.268)	.952
I am willing to use drone food delivery services when ordering food. (−.572,.134,.136,.268)	.909
I am likely to use drone food delivery services when ordering food. (−.417,.134,.039,.268)	.962
Goodness-of-fit statistics: χ^2 = 260.184, df = 120, χ^2/df = 2.168, p <.001, NFI =.961, IFI =.979, CFI =.978, TLI =.973, RMSEA =.060	

[a]All factors loadings are significant at p <.001
NFI = normed fit index, IFI = incremental fit index, CFI = comparative fit index, TLI = Tucker-Lewis index, RMSEA = root mean square error of approximation

Table 3. Descriptive statistics and associated measures.

	No. of items	Mean (Std dev.)	AVE	(1)	(2)	(3)	(4)	(5)	(6)
(1) Perceived ease of use	3	4.90 (1.19)	.817	**.930**[a]	.450[b]	.410	.278	.479	.476
(2) Perceived usefulness	3	4.67 (1.34)	.823	.203 [c]	**.933**	.510	.403	.422	.549
(3) Attitude	3	4.81 (1.39)	.846	.168	.260	**.943**	.520	.428	.771
(4) Subjective norm	3	3.87 (1.47)	.885	.077	.162	.270	**.958**	.312	.592
(5) Perceived behavioral control	3	5.03 (1.17)	.826	.229	.178	.183	.097	**.934**	.508
(6) Behavioral intentions	3	4.53 (1.42)	.916	.227	.301	.594	.350	.258	**.979**

AVE = Average Variance Extracted
a. composite reliabilities are along the diagonal, b. correlations are above the diagonal, and c. squared correlations are below the diagonal

the case of monthly household income, 22.7% (n = 75) of the people answered that they have monthly 2,001 USD and 3,000, USD and that was followed by 6,001 USD and higher (n = 60, 18.2%). In addition, 57.0% (n = 188) indicated that they were single. Last, 58.8% of the respondents had a bachelor's degree (n = 194).

The measurement model

A confirmatory factor analysis (CFA) was conducted. The results indicated that the model contained acceptable statistics in terms of fit (Table 2) (Byrne, 2001). The scores of all standardized loadings were statistically significant at the .001 level.

From Table 3, we see that the values of composite reliability ranged from .930 to .979, which suggested that the measurement items for each construct had high levels of internal consistency (Hair et al., 2006). The average variance extracted (AVE) values exceeded the recommended threshold of .50 (Fornell & Larcker, 1981), which indicated that convergent validity was supported. Lastly, the values of AVE were higher than the squared correlations. Therefore, this study does not have issues regarding discriminant validity (Fornell & Larcker, 1981).

Structural model evaluation

The structural equation modeling (SEM) analysis was used to examine the proposed relationships. The model fit was satisfactory (Byrne, 2001). The SEM results also indicated that all the proposed hypotheses (H1–H6)

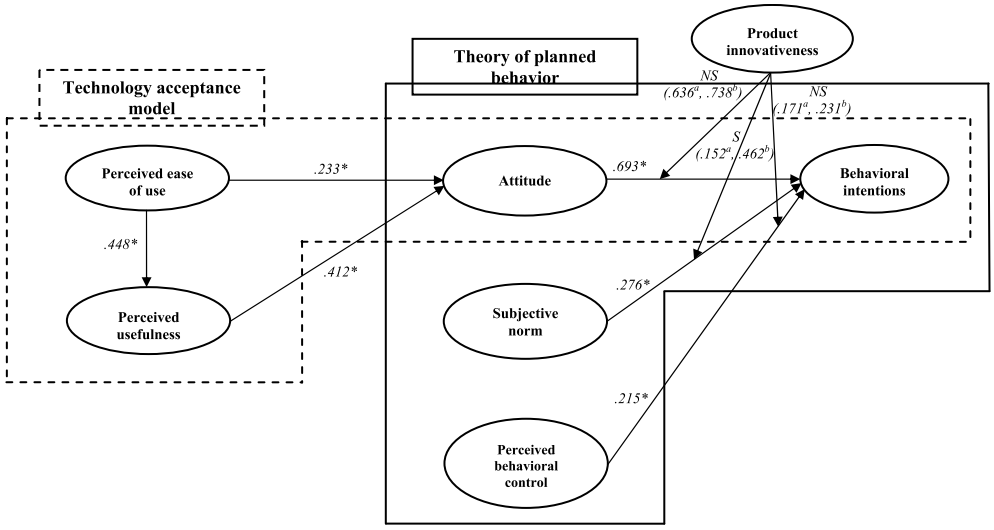

Figure 2. Standardized theoretical path coefficients. *p <.05 S = significant; NS = not significant a. path coefficient for the low product innovativeness group, b. path coefficient for the high product innovativeness group

Table 4. Standardized parameter estimates for structural model.

				Standardized Estimate	t-value	Hypothesis
H1	Perceived ease of use	→	Perceived usefulness	.448	8.227*	Supported
H2	Perceived ease of use	→	Attitude	.233	4.119*	Supported
H3	Perceived usefulness	→	Attitude	.412	7.205*	Supported
H4	Attitude	→	Behavioral intentions	.693	15.275*	Supported
H5	Subjective norm	→	Behavioral intentions	.276	6.936*	Supported
H6	Perceived behavioral control	→	Behavioral intentions	.215	5.377*	Supported
H7a	The moderating role of product innovativeness in the relationship between attitude and behavioral intentions					Not supported
H7b	The moderating role of product innovativeness in the relationship between subjective norm and behavioral intentions					Supported
H7c	The moderating role of product innovativeness in the relationship between perceived behavioral control and behavioral intentions					Not supported

Goodness-of-fit statistics: χ^2 = 490.247, df = 129, χ^2/df = 3.800, p <.001, NFI =.926, IFI =.945, CFI =.944, TLI =.934, RMSEA =.092
*p <.05
NFI = Normed Fit Index, IFI = Incremental Fit Index, CFI = Comparative Fit Index, TLI = Tucker-Lewis Index, RMSEA = Root Mean Square Error of Approximation

were statistically supported. Figure 2 and Table 4 present the results of SEM.

Testing the moderating role of product innovativeness

To check the moderating role of product innovativeness, we employed the multiple-group analyses suggested by Byrne (2001). For this, 330 respondents were divided into two groups using the median value of product innovativeness: a high level of product innovativeness group (n = 176) and a low level of product innovativeness group (n = 154). After that, the chi-squared difference between the constrained model and the unconstrained model was evaluated to check the moderating effect of product innovativeness (Anderson & Gerbing, 1988).

First, H7a was tested. The results of the cross-group invariance tests for the high level of product innovativeness group and the low level of product innovativeness group indicate that significant chi-square difference was not found on the relationship between attitude and behavioral intentions. That is, the coefficient value of the path from attitude to behavioral intentions were similar in both groups. Thus, H7a was not supported.

Second, H7b was tested. The results of the cross-group invariance tests for the high level of product innovativeness group and the low level of product innovativeness group indicate that significant chi-square difference was found at the .05 level on the relationship between subjective norm behavioral intentions. In other words, the coefficient value of the path from subjective norm to behavioral intentions in the high level of product innovativeness group was significantly greater than the coefficient value in the low level of product innovativeness group. Therefore, H7b was supported.

Third, H7c was checked. The results of the cross-group invariance tests for the high level of product innovativeness group and the low level of product innovativeness group indicate that significant chi-square difference was not found on the relationship between perceived behavioral control and behavioral intentions.

That is, the coefficient value of the path from perceived behavioral control to behavioral intentions were similar in both groups. Thus, H7c was not supported.

Discussion and implications

Theoretical implications

First, the enhanced framework integrating the TAM and the TPB had been applied previously to identify the critical determinants in various fields of interest, such as massive open online courses, online travel shopping, and online tax filing systems (e.g., Amaro & Duarte, 2015; Lu et al., 2010; Yang & Su, 2017; Yu et al., 2018). However, this kind of extensive research effort had not been conducted in drone food delivery services until now. This study is therefore theoretically meaningful by being the first to merge the TAM and TPB to advance our knowledge of drone food delivery services.

Second, this study supported the positive associations among the variables rooted in the TAM and TPB (H1, H2, H3, H4, H5, and H6). Our data provided new evidence to the existing literature that supported the TAM, by verifying both the causal relationship between the perceived ease of use and the perceived usefulness (Porter & Donthu, 2006; Sahli & Legohérel, 2016), and the significant impact of both the perceived ease of use and the perceived usefulness on attitude (Chang et al., 2016; Kim et al., 2008). In addition, our study supported the hypothesis that volitional and nonvolitional factors both influence consumers' behavioral intentions, and these results are consistent with prior research built on the TPB in the field of new technology (Amaro & Duarte, 2015; Kim et al., 2008). Accordingly, this study enriched the current literature by verifying the significant associations among variables that explain behavioral intentions and that stem from the TAM and the TPB.

In addition, through merging the TAM and TPB, this study discovered the salient role of psychological tendency, such as attitude ($\beta = .693$, $p < .05$), and our findings were fairly consistent with those of Yang and Su (2017) and Yu et al. (2018). In that respect, this study confirmed the importance of consumers' attitude when they consider using drone food delivery technology.

Third, this study has an theoretical contribution because the moderating role of product innovativeness was examined in the drone food delivery service areas. Particularly, our analyses found that the effect of the subjective norm on behavioral intentions to use drone food delivery services was greater when consumers perceived higher than average levels of product innovativeness (high: $\beta = .462$, $p < .05$ vs. low: $\beta = .152$, $p < .05$).

Contrary to Fu and Elliott (2013) results, however, we found that the association between attitude and behavioral intentions was not moderated by product innovativeness. Attitude is often described as the consumers' affective response and as a more enduring effect in customer behavior (Han et al., 2015; Hosany & Prayag, 2013), whereas product innovativeness is a cognitive and rational judgment of the uniqueness of drone food delivery services (Hwang et al., 2019; Wu et al., 2004). These different notions may be the reason for our finding that the moderating effect of the degree of product innovativeness was statistically insignificant in the relationship between attitude and behavioral intentions.

Managerial implications for the food service industry

Above all, we conclude that the formation of a favorable attitude is now proven to be very important for inducing behavioral intentions toward using drone food delivery services. Therefore, food service companies should focus on building consumers' positive attitudes, and, as our analysis verified, they can effectively manage that initiative by triggering the new product's perceived ease of use and perceived usefulness. For instance, simple graphics or a demonstration of the process of drone food delivery services can be used to educate potential customers about how easily the services can be requested and how convenient drone-based food delivery is. Because currently a very substantial number of food delivery orders are placed using mobile applications, simple inputs (e.g., touch-based) to select a drone-based delivery and messaging service in each step (e.g. food ready → drone launched → 5 minutes out → drone arrived) on mobiles will enhance the customers' perception that the drone-based food delivery is a straightforward process.

Improving customers' perceived ease of use would also be the wise response in an effort to cope with consumers' reluctance to change their behavior. On the other hand, simulations or trial experiences to enlighten the usefulness of drone food delivery services should be offered to potential customers so that they can experience the services' superior features, including being faster and easier (Flytrex, 2017; Pymnts, 2018). Promoting process simulations is a better communication strategy for reducing affective uncertainties and anxiety, and that reduction builds positive behavioral intentions in the near-future adoption scenario (Castaño et al., 2008). Hence, test run activities or a sharing of the whole delivery journey with a drone

can be effective in inducing a positive attitude. For example, a drone equipped with a small camera can be utilized to broadcast the real-time delivery journey and thus can help consumers to understand its superiority and its assurances of a successful delivery. By doing that, the perceptions of both enhanced ease of use and usefulness will likely lead to a favorable attitude toward drone food delivery services. Consequently, behavioral intentions will be strengthened.

Second, based on our analytic results' revelation of the critical role of the subjective norm in increasing behavioral intentions, food service companies are advised to concentrate on viral marketing, which creates the environment for proactive volitional word-of-mouth. Furthermore, the benefits of drone food delivery services have been well investigated through numerous tests in the field. Examples include drone delivery's accessibility to remote areas, rapid movement, environmental protection, and decrease in the number of traffic accidents that occur during human delivery (Hwang et al., 2019; Shavarani et al., 2018). Promotion of customer-driven messages in social communities and by electronic word-of-mouth is also recommended and can be achieved through posting interesting events online to spread the benefits of drone-based food delivery services. For instance, campaigns can be conducted to boost active communication regarding drone food delivery services' pro-environmental roles, such as in reducing carbon dioxide emissions, and their respect for life, such as by decreasing traffic accidents. Such an initiative stressing the greener and safer aspects of drone food delivery services can also be efficiently managed through comparing drone deliveries with the current means for food delivery. Such created volitional recommendations should improve the subjective norm by generating more opportunities for consumers to be influenced positively by the people around them, and consequently should lead to higher behavioral intentions toward using drone food delivery services.

Third, our analysis revealed that the magnitude of the subjective norm's positive effects on behavioral intentions toward using drone food delivery services is greater when product innovativeness is high. Hence, food service companies should advertise proactively about how innovative drone-based food delivery is to its community of early adopters, or "lighthouse customers." That is, advertising the service's newness and advanced technology in the food service industry should target the group of people who are most sensitive to new technology, in order to induce a stronger effect in the causal link between the subjective norm and behavioral intentions. Inviting such people to the laboratory or a field experiment could also be an option to consider.

In technology research, consumers have a tendency to use a product or service when they perceive that it has a high degree of innovativeness (Danneels & Kleinschmidt, 2001) and when the importance of its functional aspects has been emphasized to generate their continued usage intentions (Ozturk et al., 2016). Accordingly, we recommend encouraging lighthouse customers' considerable and candid feedback about the degree of product innovativeness of drone-based food delivery, with elaboration on the variety of enhanced benefits from the drones' advanced capabilities, in order to accelerate the acceptance of this new technology through a strengthened subjective norm. That should result in additional potential customers who are enthusiastic about a high level of product innovativeness and should enhance the causal relationship between the subjective norm and behavioral intentions.

Managerial implications for the tourism industry

Practical implications of the current study are not simply limited to the food service industry but can be broadened to the tourism industry. From the tourism marketing perspective, it is recommended that destination marketing organizations (DMOs) actively promote drone food delivery services to potential tourists because the services can be a unique tourism activity or an important tourism product. For example, food delivery services are very common and advanced in South Korea, in which the current study was conducted. Korean consumers enjoy pizza, black bean sauce noodle, and fried chicken not only at home, but also outdoors through delivery services. Recently, lunch box delivery services have become popular among tourists at some national parks, bringing diverse consumption benefits to hikers of national mountains (Korea Tourism Organization, 2020). These are very novel and interesting to many foreigners who have never experienced food delivery services at their home countries (Kim, 2016). International tourists are very curious about these delivery services and are willing to experience the Korean food delivery culture (Korean Englishman, 2016). Therefore, not only local food itself but also the way of eating the food can attract tourists to enjoy the destination's culture.

Likewise, DMOs can emphasize that drone food delivery services are one of the unique tourism activities that can be enjoyed in a destination. Thus, DMOs need to emphasize the attractiveness of drone food delivery services when promoting their tourism activities in their websites, videos, and other promotional materials. It is expected that including images such as enjoying drone food delivery services in the middle

of the busy city or in a remote place such as a national park could stimulate potential tourists' curiosity. To conclude, the research model of the current study can be applied to tourists and new finings can be utilized for tourism marketing in the future study.

Limitations and future research

First, the results of this study may not be applicable to other regions, because the study was conducted only with data collected from Korea. Second, this study focused only on drone-based food delivery services. Therefore, the results may not be able to apply in other types of food delivery services. Because drone food delivery services were still in the precommercial stage in Korea, a video was provided to our respondents to enhance their understanding of the services. In order to overcome that limitation, we recommend that future research studies collect data from respondents who actually have used such food delivery services. Lastly, an online survey method is very popular in the social sciences, but it causes selection biases (Wright, 2005). Thus, it is also good to consider other survey methods in future studies. Thus, it is also good to consider other survey methods in future studies. Lastly, this study examined the relationships between constructs using SEM, however, future research needs to study be applied using the experimental design method to control variables that can affect consumers' attitudes and behaviors.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix.

Screenshots from videos
Source from Yogiyo (2016).