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Journal of Travel & Tourism Marketing

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/wttm20

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To cite this article: Jinsoo Hwang, Ja Young Choe, Young Gin Choi & Jinkyung Jenny Kim (2021) A comparative study on the motivated consumer innovativeness of drone food delivery services before and after the outbreak of COVID-19, Journal of Travel & Tourism Marketing, 38:4, 368-382, DOI: 10.1080/10548408.2021.1921671

To link to this article: https://doi.org/10.1080/10548408.2021.1921671

JOURNAL OF TRAVEL & TOURISM MARKETING
2021, VOL. 38, NO. 4, 368–382
https://doi.org/10.1080/10548408.2021.1921671

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ARTICLE

A comparative study on the motivated consumer innovativeness of drone food delivery services before and after the outbreak of COVID-19

Jinsoo Hwang[a], Ja Young Choe[b], Young Gin Choi and Jinkyung Jenny Kim[c]

[a]The College of Hospitality and Tourism Management, Sejong University, Seoul, Korea; [b]Faculty of Business Administration, University of Macau, Taipa, Macau, China; [c]Recreation, Park and Tourism/Hospitality Management, Western Illinois University, Macomb, IL, USA

ABSTRACT

This study sought to identify the importance of motivated consumer innovativeness through the moderating role of the COVID-19 outbreak in the context of drone food delivery services. The data were collected from the different periods that are before and after the COVID-19 outbreak, respectively. The structural equation modeling analysis showed that three sub-dimensions of motivated consumer innovativeness, such as functional, hedonic, and social motivations, positively affected attitude toward drone food delivery services. In addition, the attitude had a positive influence on intentions to use the services. Furthermore, the outbreak of COVID-19 moderated the relationship between functional motivation and attitude.

ARTICLE HISTORY
Received 15 January 2021
Revised 2 March 2021
Accepted 19 April 2021

KEYWORDS
Motivated consumer innovativeness; attitude; intentions to use; novel technology; drone food delivery services; Covid-19

Introduction

Embracing novel technologies has been an innovative solution used to gain a decisive competitive edge in many industries, and that applies in the hospitality industry (Anderson & Rainie, 2018; Ivanov et al., 2017). Likewise, many novel technologies have been adopted in the area of food services, and drone-based food delivery services have received an enormous amount of attention as one of the disruptive technologies (Jaramillo et al., 2019; Kim & Hwang, 2020). In fact, a drone, which is a term for an unmanned aerial vehicle, is not a new technology, because it has been used for many years for military purposes (Springer, 2013). Ever since people began to realize the benefits of drones at a large scale, such as for their accessibility, mobility, and sustainability, drones have been employed in various sectors, such as agriculture, broadcasting, cartography, and logistics (Haidari et al., 2016; Muchiri & Kimathi, 2016; Shavarani et al., 2018). Similarly, entrepreneurs in the food delivery services have endeavored to bring drones into their operations. Nonetheless, the application of drones in food delivery services is still not widely commercialized, and it is regarded as an emerging, novel technology in many places across the world (Hwang, Kim et al., 2019; Jaramillo et al., 2019).

An accurate and minute understanding of the formation of consumer acceptance is the essential prerequisite for a successful diffusion of innovative technologies. Therefore, large efforts have been made to identify the driving forces behind consumers' adoption behaviors toward technology in diverse service settings (Hwang, Lee et al., 2019; Pourfakhimi et al., 2018). The technology acceptance model (TAM) is one of the most cited theories used to explain the formation of consumer behavior toward accepting technology (Cobanoglu et al., 2015; Okumus & Bilgihan, 2014). The TAM has posited two essential determinants of users' attitude: the perceived ease of use and the perceived usefulness, which in turn significantly influence the individuals' behavioral intentions and their actual use (Davis, 1989). Even though the TAM has long been supported because of its high predictive power in the domain of technology adoption, several scholars have argued that this type of parsimonious model would be insufficient in explaining consumers' behavior completely across a wide scope of technology acceptance (Bagozzi, 2007; Rauniar et al., 2014; Venkatesh & Davis, 2000). For that reason, there have been many attempts to extend the TAM by incorporating other important factors, such as compatibility, the subjective norm, and trust, as the antecedents of technology acceptance behavior (Kaushik et al., 2015; Shin & Lee, 2014). The concept of motivated consumer innovativeness, which hereinafter will be referred to as the MCI, has been proposed as another type of process, and it has been examined as a stronger predictor of individuals' adoption of a technology (Hwang, Kim et al., 2019; Saeed et al., 2014; Viot et al., 2017).

CONTACT Jinkyung Jenny Kim jennykim1120@gmail.com School of Hotel and Tourism Management, Youngsan University, 142 Bansong Beltway, Haeundae-Gu, Busan 48015, Korea

The MCI describes the central triggers that drive consumers' innovative buying behavior, and it was proposed with four underlying dimensions: the functional, hedonic, cognitive, and social facets of motivation (Caricati & Raimondi, 2015; Vandecasteele & Geuens, 2010). According to Vandecasteele and Geuens (2010), the functional MCI and the hedonic MCI are conceptualized as consumer innovativeness, which therefore is driven by a utilitarian aspect and an affective aspect, respectively. The cognitive MCI is also described as an aspect of consumer innovativeness that is motivated by wanting to be intelligent and informed, and the social MCI refers to an aspect of consumer innovativeness that is motivated by the desire to be unique (Caricati & Raimondi, 2015; Vandecasteele & Geuens, 2010). The existing studies have tested these multiple dimensions of the MCI in various settings and have provided evidence for how these underlying motivations play a significant role in the formation of consumers' adoption behavior of innovative technologies (Hwang, Kim et al., 2019; Reinhardt & Gurtner, 2015; Saeed et al., 2014). That evidence means that the MCI should be assessed as a potential primary factor for unleashing state-of-the-art technologies, and it would be meaningful to evaluate its contribution toward building customers' positive attitudes and their behavioral intentions, on the basis of the TAM. Thus, we can form our first research question: How do the four facets of the MCI toward drone food delivery services enhance consumers' attitudes and eventually their intentions to use those types of services.

The coronavirus disease (COVID-19) is an infectious disease that is caused by the newly discovered novel coronavirus known as SARS-CoV-2 (World Health Organization, 2020a). Following the outbreak of COVID-19 in December 2019, a total of 23.06 million cases and 800,906 deaths had been confirmed as of August 23 2020 (World Health Organization, 2020b). Due to the nature of the coronavirus, which spreads primarily through the respiratory system of the people infected (World Health Organization, 2020a), governments and officials around the globe have enforced various policies and rules under the name of social distancing, which includes face-covering mandates, gathering size limits, and mobility restrictions, in an effort to combat the spread of COVID-19 (USA Today, 2020). During the COVID-19 pandemic, people generally experience negative emotions such as anxiety, fear, and frustration, which are caused by perceived risk to the chances of unpleasant results of a behavior and/or perceived uncertainty about the potential outcomes of a behavior (Foroudi et al., 2021; Shin & Kang, 2020). Hence, many changes in our daily routines have become inevitable, and they affect how people consume foods as well (Gursoy & Chi, 2020; Karim et al., 2020). With this respect, the current study nests in the theory of perceived risk (Bauer, 1960), which explicates how consumers with risk perception attempt to avoid or decrease negative outcomes, in evaluating the difference of consumer behavior before and after the COVID-19 outbreak.

Stated clearly, COVID-19 has marked another milestone in food delivery services – more specifically, contactless or distanced food delivery services. Furthermore, drones have attracted the most attention for such services because they perfectly support social distancing without human encounters (Research and Markets, 2020; Zeng et al., 2020). However, no empirical evidence exists to provide an understanding of how consumers' pre-COVID-19 responses toward these types of innovative technology differ from their responses since the COVID-19 outbreak. That knowledge gap evokes curiosity about how consumers' responses specifically toward drone-based food delivery services have changed since the outbreak of COVID-19, and that topic is another fundamental research question of the current study.

Therefore, this study was designed to increase our understanding of (1) the influence of the multidimensional MCI on consumer attitudes, (2) the association between consumers' attitudes and their intentions to use a novel technology, and (3) the moderating role of the COVID-19 outbreak in the relationship between the public's MCI and their attitude in the context of drone food delivery services. Through the course of our study and its results, the present research contributes toward filling the gap in the extant literature and to offering useful insights to practitioners in the food delivery services industry.

Literature review

Drone food delivery services

Technology-based innovations enhance the arena of operational excellence that includes service automation in the hospitality industry (Chan & Tung, 2019; Hwang, Cho et al., 2019; Moreno & Tejada, 2019; Okumus & Bilgihan, 2014). Likewise, active adoptions of technology-powered products and systems have increased, such as through the use of mobile applications, table tablets, self-service technologies, and service robots (Cobanoglu et al., 2015; Ivanov et al., 2017). In that light, drones are frequently referred to because robotics is at the heart of the disruptive technologies in the food services industry (Bamburry, 2015; Hwang, Lee et al., 2019). One of the earliest attempts to use drones with a food delivery was in 2013, when Domino's Pizza, Inc.

dispatched a drone to deliver two pizzas to a customer's door (Pepitone, 2013). Drones in the food delivery services stimulate positive effects that involve improving productivity, maximizing efficiency, and reducing the environmental footprint (Jaramillo et al., 2019; Kim & Hwang, 2020). In other words, drones are one of the innovative tools that drive the greatest return in many respects. Nevertheless, drone food delivery services are not regarded as being mature enough on a large scale, which would involve privacy and safety, and the services are still not available in many places around the world (Hwang & Choe, 2019; Ross, 2018).

Motivated consumer innovativeness (MCI)

Technological developments can promote smarter business methods by streamlining operations for industry practitioners that involve labor cost savings and higher productivity (Ivanov et al., 2017). Therefore, adding technologies into existing operations is absolutely indispensable in efforts toward improving one's chance at winning a competition in an era of new technology. However, without a detailed understanding of their consumers, entrepreneurs' adoption of an innovative technology does not guarantee the successful diffusion of the technology and an improvement in customer services (Kim & Hwang, 2020; Moreno & Tejada, 2019). To extend the TAM for better predictive power in explaining customer adoption behaviors in the technology domain, the MCI often has been examined as a significant antecedent (Hwang, Kim et al., 2019; Reinhardt & Gurtner, 2015; Saeed et al., 2014; Vandecasteele & Geuens, 2010).

The MCI is a combined terminology that integrates the notions of motivation and consumer innovativeness (Hwang, Kim et al., 2019; Vandecasteele & Geuens, 2010). Motivation refers to the psychological states that arouse and guide a person's specific behavior intended to help him or her achieve a goal (Crompton & McKay, 1997). Thus, motivation can provide reliable explanations of consumers' intentions to use technologies in pursuit of their goals. In the other half of the term, consumer innovativeness refers to an individual's propensity to try new products or services instead of remaining with the existing selections (Steenkamp et al., 1999). Thus, consumer innovativeness offers a fundamental clue about individuals' acceptance of novel technologies. By integrating the two concepts, the MCI is defined as "the internal and external factors that lead to the consumers' innovative buying behavior" (Hwang, Kim et al., 2019, p. 103).

The MCI consists of four subdimensions of motivation: the functional, hedonic, cognitive, and social aspects (Caricati & Raimondi, 2015; Vandecasteele & Geuens, 2010). The functional MCI is related to the perceived usefulness (in this case, of a technology), which has been proposed in the TAM as a key determinant of attitude and which in turn enhances customers' behavioral intentions toward a specific technology (Hwang, Kim et al., 2019). Meanwhile, the hedonic MCI illustrates individuals' innovativeness as motivated by emotional arousal and affective stimulation (Caricati & Raimondi, 2015). A person's need to have fun, enjoyment, and pleasure is often described as the hedonic MCI. The cognitive MCI, which is the third dimension of the MCI, explains the fact that novel technologies are more welcomed by individuals when the individuals' desire for intellectual creativity becomes strong (Vandecasteele & Geuens, 2010). Hwang, Kim et al. (2019) treated the notion of the cognitive MCI as being in line with the perceived ease of use, which in the TAM is another determinant of attitude, since a person's cognitive goals include the desire to have a comprehensive understanding. Last, the social dimension of the MCI deals with a fourth aspect of the consumer's innovativeness and motivates the person to differentiate himself or herself from others (Caricati & Raimondi, 2015). Thus, different MCI facets may underlie consumers' adoption behaviors, and it is very important to recognize the different MCI sources that lead to the successful diffusion of a technology (Hwang, Kim et al., 2019; Saeed et al., 2014; Viot et al., 2017). Indeed, Vandecasteele and Geuens (2010) asserted that the use of a multidimensional MCI approach is helpful for industry professionals in more effectively and efficiently identifying and pursuing customers for their innovative products or services.

The effects of motivated consumer innovativeness on attitude

Attitude is defined as "an individual's propensity to evaluate a particular entity with some degree of favorability or unfavorability" (Eagly & Chaiken, 2007, p. 583). In the context of the adoption of a technology, attitude has been widely examined as an important construct that indicates consumers' intentions to use, and their actual use of, a novel technology (Davis, 1989; Ha & Janda, 2016). Likewise, many studies have been conducted to predict consumer acceptance of new technologies in the hospitality industry, and they have provided empirical evidence that the consumer's attitude is the key variable that should be used to explain the person's willingness to embrace technologies, such as mobile location-based services (Mak et al., 2015), self-services technologies (Kaushik et al., 2015), and service robots (Ivanov et al., 2018).

In endeavors to identify the determinants that are useful for building a favorable attitude in the field of technology adoption, the MCI has been widely validated as an essential factor behind consumers' attitude (Lyu et al., 2017; Vandecasteele & Geuens, 2010). In particular, the close association between the MCI and attitude has been explained in reference to an extended version of the TAM (Hwang, Kim et al., 2019). Lien and Cao (2014) investigated the influence of individuals' psychological motivations toward a social media platform, and the path effects they identified showed that entertainment, sociality, and information enhanced the users' attitudes. Saeed et al. (2014) validated that the four motivational dimensions of the MCI– – functional, hedonic, cognitive, and social motivations––underlie the consumer's propensity for innovativeness, and they determined that the functional aspect was a salient factor for the adoption of innovation. Similarly, Lyu et al. (2017) examined the relationship between the MCI and consumers' attitude toward 3D-printed fashion products, and their empirical analysis also supported the enhanced importance of the functional aspect in the domain of technology adoption. Ramkumar and Woo (2017) explored consumers' attitude in the area of a subscription-based online service that provided periodic delivery of personalized boxes of merchandise to the customers. Their analysis sought to identify the key antecedents that led to the individuals' favorable attitude toward the service and discovered significant roles were played by the utilitarian motivation and the hedonic motivation. Lee et al. (2020) more recently derived the pursuit of practicability as a functional aspect, play and relaxation as a hedonic aspect, informational learning as a cognitive aspect, and virtual interaction to escape from reality as a social aspect that together formed the four motives for individuals' use of a smart speaker. Their empirical analysis, which was based on 330 pieces of data, illustrated how the hedonic and social factors exerted a meaningful influence on the respondents' attitudes. The stream of findings from these studies thus has supported the relationships between the MCI and attitude, so we offer the following hypotheses.

H1. The functional motivated consumer innovativeness toward drone food delivery services enhances attitude.

H2. The hedonic motivated consumer innovativeness toward drone food delivery services enhances attitude.

H3. The cognitive motivated consumer innovativeness toward drone food delivery services enhances attitude.

H4. The social motivated consumer innovativeness toward drone food delivery services enhances attitude.

The effects of attitude on intentions to use

Intentions to use are often adapted to measure individuals' behavioral intentions toward a specific technology, and also their actual behavior (Davis, 1989; Hwang, Lee et al., 2019; Kim & Han, 2020; Lyu et al., 2017; Ramkumar & Woo, 2017). Attitude, as one of the various triggers of intentions to use, has long been supported as a strong predictor in various settings, including that of technology adoption. Kaushik et al. (2015) identified a significant link between tourists' attitudes and their intentions toward adopting a self-service hotel technology. S. Ivanov et al. (2018) paid attention to the increasing adoption of robots in the hospitality sector and tested the individuals' attitudes toward the potential use of robots. Their results, which were based on 260 responses, confirmed the strong influence of attitude on the respondents' intentions to use. Hwang, Lee et al. (2019) emphasized the high innovativeness of drone food delivery services in recent times and examined how consumers' behavioral intentions were formulated. Their results, which were based on an analysis that used 324 pieces of data, revealed that consumers' positive attitudes toward using drone food delivery services increased their intentions to use the services. Similarly, Kim and Hwang (2020) incorporated the norm activation model and the theory of planned behavior in order to understand individuals' intentions to accept drone food delivery services. Those authors focused particularly on the pro-environment role of drones in food delivery services and asserted that the consumers' attitudes were essential to the inducement of positive intentions, in conjunction with the consumers' sense of a moral obligation. Lee et al. (2020) assessed the link between consumers' attitudes and behavioral intentions toward virtual reality applications in the tourism sector. Their analytic results used 247 responses from US citizens and revealed that the respondents' attitude had a significant and positive influence on their future intentions to visit a tourism destination. We formulated the following hypothesis following that logic.

H5. Attitude toward drone food delivery services enhances the consumers' intentions to use such services.

The moderating effect of the COVID-19 outbreak

The COVID-19 pandemic has profoundly impacted how food services operate, and a considerable change is underway. The most well-known fact that is used to prevent the spread of the coronavirus is for people to stay several feet apart in order to reduce face-to-face interactions (World Health Organization, 2020a). In order to minimize human-to-human contact during the pandemic, people have exhibited a reluctance to dine at restaurants (Gursoy & Chi, 2020), so the demand for drive-through, take-out, and delivery in food services has increased significantly as a result (Jain, 2020; Manivannan et al., 2020; Wen et al., 2020). This current phenomenon of consumer behavior is explained by the theory of perceived risk, which refers to the significant influence of consumers' risk perception in their purchasing decision behavior (Bauer, 1960). Similarly, Shin and Kang (2020) documented the salient role of perceived health risk in hotel customers' decision-making during the COVID-19 pandemic. Foroudi et al. (2021) determined how customers' risk perception toward the COVID-19 epidemic influenced the development of future desire towards visiting restaurants.

Also, the US Centers for Disease Control and Prevention introduced guidelines for food handling by pick-up and delivery drivers in order to minimize the number of COVID-19 cases (CDC, 2020), which means that the efforts to maintain social distancing affect how people obtain their food in their daily lives and thus increase the demand for contactless food services. Furthermore, several cases have been confirmed of delivery personnel who were infected with COVID-19 (Global Times, 2020; The Economic; The Economic Times, 2020), and that concern has driven the interest in contactless environments in the food services industry. In summary, the COVID-19 pandemic has caused a higher demand for contactless food deliveries in order to avoid human contact (Forbes, 2020; Karim et al., 2020). For instance, recently several pizza chains have launched car-side delivery and contactless pickup services (Bloomberg, 2020). Likewise, Dube et al. (2020) have recommended new safety and health protocols in the restaurant and hospitality industry. In that regard, a large portion of restaurant patrons––64.71%––have been shown to believe that the use of innovative technologies is required in the COVID-19 environment (Gursoy & Chi, 2020). Consequently, practitioners in food delivery services have been pressured to redesign how their services meet the demands of the new normal to protect both the consumers and the delivery personnel.

Indeed, there are many benefits with using drones in the food delivery services, such as saving time and gaining superior accessibility (Jaramillo et al., 2019; Kim & Hwang, 2020). More importantly, drone food delivery services in the current pandemic period have emerged as an innovative solution that guarantees no-contact environments in the food delivery services industry (Research and Markets, 2020; Zeng et al., 2020). In other words, drones are now recognized as a strong precautionary tool in the battle against COVID-19. In light of that opportunity, some authorities have lowered the bar and allowed drones to operate in the food delivery services industry. For example, Manna Aero recently received a license from the Irish Aviation Authority for drone food delivery services in Dublin (Forbes, 2020). A pilot program partnered with the drone delivery company Flytrex is being launched in North Carolina in the US to use drones for meal deliveries in order to provide contactless food delivery to stem the spread of COVID-19 (Fox News, 2020). Therefore, drones have become an innovative solution used to fight the COVID-19 pandemic, and the golden era of drone food delivery services will arrive in the near future.

Evidence supports the notion that the way people perceive drones may change. In addition, the emergence of COVID-19 may foster a different impact from the MCI facets toward drone food delivery services. On that topic, Hwang, Lee et al.'s findings (2019) validated a significant influence of the functional, hedonic, and social MCI dimensions on individuals' attitudes toward drone food delivery services but did not uncover any effect from the cognitive MCI. In response to the dramatic changes that have evolved in consumers' food consumption behavior since the onset of COVID-19 and in the important roles that have been highlighted showing drone use during the pandemic, we believed it would be meaningful to examine how those path effects differ presently.

First of all, consumers may now perceive functional motivation of drone food delivery services to be more critical than before COVID-19 because of the importance of contactless food delivery services under the circumstances of the pandemic. According to recent news reports (Chandler, 2020; McFarland, 2020), engineers working on drone technology believe that consumers could be more motivated to use drone delivery services because of its functional benefits under the circumstances of the pandemic.

Next, consumers may now consider cognitive motivation of drone food delivery services more seriously than before COVID-19. Under pandemic, consumers may perceive a wide range of health risks that they can encounter when using hospitality services (Kim & Lee, 2020; Shin & Kang, 2020). After COVID-19, it was found that consumers feel less health risk when they are provided with contactless services that involve high technology (Shin & Kang, 2020). In this regard, consumers are more likely to be concerned about various aspects of drone food

delivery services and compare its advantages and disadvantages after COVID-19 than before.

On the other hand, there is a possibility that hedonic and social motivation could have been more influential on attitude toward the drone food delivery services before COVID-19 than after. Elliot (2006) introduces the concept of approach and avoidance motivation. According to his research, sometimes people are motivated to approach some circumstances/behavior for their thriving (e.g., self-development). At the same times, individuals are motivated to avoid certain circumstances/behavior for their survival (e.g., free from health risk). Applying this concept into our study context, before COVID-19, diverse MCI could be important for consumers to create positive attitude toward the drone food delivery services such as hedonic and social motivations (e.g., Hwang et al., 2019). However, after COVID-19, the impact of MCI on attitude toward the drone food delivery services could be different. For example, consumers are more likely to be motivated to use the drone food delivery service because they want to avoid bigger risks (e.g., transmission of corona virus) rather than they want to make their life exciting or impress others by using drone food delivery services under pandemic. It is expected that using drone food delivery services is a behavior for surviving rather than thriving to many consumers. Therefore, the influence of hedonic and social motivation on attitude toward the drone food delivery services could be stronger before COVID-19.

Based on the above discussions, it is rational to assume that the ongoing COVID-19 crisis may be exerting an influence on the relationship between MCI and attitude toward the drone food delivery services. More specifically, we propose the following hypotheses.

H6a. The outbreak of COVID-19 moderates the relationship between functional motivation and attitude.

H6b. The outbreak of COVID-19 moderates the relationship between hedonic motivation and attitude.

H6c. The outbreak of COVID-19 moderates the relationship between cognitive motivation and attitude.

H6d. The outbreak of COVID-19 moderates the relationship between social motivation and attitude.

Figure 1 depicts our proposed theoretical framework, which encompasses a total of nine hypotheses related to the causal relationships among six latent constructs and the moderating role played by the COVID-19 outbreak.

Methodology

Measurements

All of the measurement items were adopted from prior research and were employed after being modified to fit the context of drone food delivery services. First, the MCI was measured with 12 measurement items that Vandecasteele and Geuens (2010) used. Second, consumers' attitudes were measured with three measurement items that were employed by Bagozzi, Dholakia, and

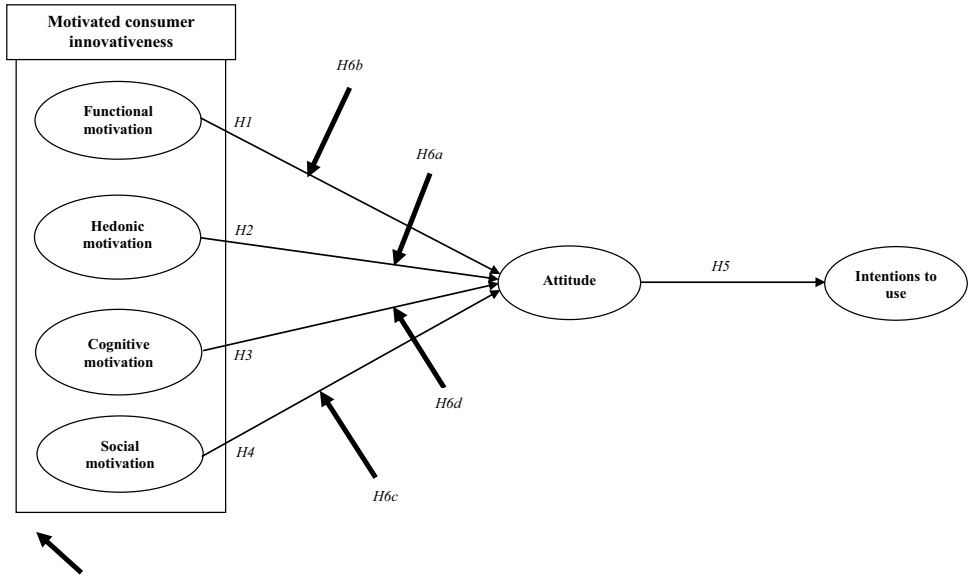

Figure 1. Proposed conceptual model. Hypothesized moderating role of before and after COVID-19 (H6a–d)

Basuroy (2003). Third, the respondents' intentions to use were measured using three items that were adapted from Han et al. (2020) and Han, Koo et al. (2020). A questionnaire was developed using the above measurement items and employing a seven-point Likert type scale that ranged from 1 = strongly disagree to 7 = strongly agree.

The data collection

In order to test the moderating role played by the outbreak of COVID-19, this study collected data at two different times: once before the COVID-19 outbreak and once after the COVID-19 outbreak. First, we collected data in February 2018, before COVID-19 had appeared, using an online survey company to examine the importance of motivated consumer innovativeness in the background of drone food delivery services. Because drone food delivery services have not been commercialized in South Korea yet, the respondents did not have a high understanding of the services. To overcome that problem, we prepared a survey system to make sure that before the respondents participated in the survey they watched a video that was 2 minutes and 30 seconds in length and clearly explained the system of drone food delivery services (see Appendix). The survey company initially sent invitation emails to 2,794 prospective participants, of whom 346 took part in the survey. After a check of the multivariate outliers and visual inspections, 26 samples were deleted. Consequently, 320 samples were used for further statistical analysis.

Then, using the same method that had been used in the first data collection described above, a second round of data collection was performed in May 2020, following the onset of the COVID-19 pandemic. The survey company sent invitation emails to a total of 1,479 prospective participants, and 343 of them participated in the survey. In that survey, 15 samples were excluded due to the multivariate outliers and visual inspections, so 328 samples were analyzed statistically.

Data analysis

Profile of the respondents

Table 1 provides the profile of the respondents. For the survey conducted before the outbreak of COVID-19, the group of 320 respondents consisted of 184 males (57.5%) and 136 females (42.5%). In addition, the number of respondents in their twenties (n = 121, 37.8%) was the largest cohort, followed by those in their thirties (n = 97, 30.3%). In terms of the respondents' educational level, 58.8% (n = 188) held a bachelor's degree. More than half of the respondents were single (n = 179, 55.9%). Regarding household income, 71 respondents (22.2%) answered that their monthly income level was between 2,001 USD US and 3,000 USD US.

Of the 328 respondents surveyed after the outbreak of COVID-19, 51.8% (n = 170) were males and 48.2% (n = 158) were females. Respondents in their thirties (31.4%, n = 103) were the largest cohort, followed by

Table 1. Profile of survey respondents.

Variable	Before the outbreak of COVID-19 (n = 320)	After the outbreak of COVID-19 (n = 328)	Merging two data (n = 648)
Gender			
Male	184 (57.5%)	170 (51.8%)	354 (54.6%)
Female	136 (42.5%)	158 (48.2%)	294 (45.4%)
Age			
20s	121 (37.8%)	98 (29.9%)	219 (33.8%)
30s	97 (30.3%)	103 (31.4%)	200 (30.9%)
40s	68 (21.3%)	96 (29.3%)	164 (25.3%)
50s	34 (10.6%)	31 (9.5%)	65 (10.0%)
Education level			
Less than High school diploma	31 (9.7%)	29 (8.8%)	60 (9.3%)
Associate's degree	52 (16.3%)	40 (12.2%)	92 (14.2%)
Bachelor's degree	188 (58.8%)	217 (66.2%)	405 (62.5%)
Graduate degree	49 (15.3%)	42 (12.8%)	91 (14.0%)
Marital status			
Single	179 (55.9%)	190 (57.9%)	369 (56.9%)
Married	138 (43.1%)	134 (40.9%)	272 (42.0%)
Others	3 (.9%)	4 (1.2%)	7 (1.1%)
Income level			
6,001$ US and over	59 (18.4%)	21 (6.4%)	80 (12.3%)
5,001$ US –6,000$ US	35 (10.9%)	8 (2.4%)	43 (6.6%)
4,001$ US –5,000$ US	50 (15.6%)	29 (8.8%)	79 (12.2%)
3,001$ US –4,000$ US	51 (15.9%)	47 (14.3%)	98 (15.1%)
2,001$ US –3,000$ US	71 (22.2%)	93 (28.4%)	164 (25.3%)
1,001$ US –2,000$ US	43 (13.4%)	65 (19.8%)	108 (16.7%)
Under 1,000$ US	11 (3.4%)	65 (19.8%)	76 (11.7%)

those in their twenties (29.9%, n = 98). In addition, the majority of the respondents (66.2%, n = 217) held a bachelor's degree, and 57.9% (n = 190) were single. Finally, the largest proportion of the respondents (28.4%, n = 93) indicated a monthly household income between 2,001 USD US and 3,000 USD US.

The confirmatory factor analysis (CFA)

Table 2 presents the results of the CFA for three models: one model for the period before the outbreak of COVID-19, one for the period after the outbreak, and one merging the two. The three models each had an adequate fit (before the outbreak of COVID-19: χ^2 = 484.569, df = 224, χ^2/df = 2.163, p < .001, NFI = .951, IFI = .973, CFI = .973, TLI = .966, and RMSEA = .060; after the outbreak of COVID-19: χ^2 = 275.165, df = 120, χ^2/df = 2.293, p < .001, NFI = .965, CFI = .980, TLI = .975, and RMSEA = .063; and merging the data from before and after the outbreak of COVID-19: χ^2 = 447.556, df = 120, χ^2/df = 3.730, p < .001, NFI = .969, CFI = .977, TLI = .970, and RMSEA = .065) (Byrne, 2001). In addition, the values of the factor loadings were equal to or higher than 0.777 for the model before the outbreak of COVID-19, were .849 for the model after the outbreak of COVID-19, and were .826 for the merged version.

As is indicated in Table 3, all of the values of the average variance extracted (AVE) for the three models exceeded .50, which suggested that that all of the constructs used in this study had a high level of convergent validity (Fornell & Larcker, 1981). In addition, all of the values of the composite reliabilities for the three models were greater than .70, which means that internal consistency was not a problem (Hair et al., 2006). Finally, the data analysis results revealed that all values of the AVE for the three models were higher than the values of the squared correlations (R^2) between any pair of constructs, thus suggesting a high level of discriminant validity (Bagozzi & Yi, 1988).

Measurement-invariance assessment

As suggested by Steenkamp and Baumgartner (1998), this study performed a measurement invariance assessment. The two groups consisted of before the outbreak of COVID-19 (n = 320) and after the outbreak of COVID-19 (n = 328). As presented in Table 4, the non-restricted model and the full-metric invariance model had acceptable fit statistics. Additionally, the difference between the

Table 2. Confirmatory factor analysis: Items and loadings.

Construct and Scale Item	Standardized Loading[a] BC (skewness and kurtosis)	AC (skewness and kurtosis)	MAC (skewness and kurtosis)
Functional motivation			
Drone food delivery services seem to be efficient.	.937 (−.866, .387)	.954 (−.603, −.433)	.958 (−.786, .011)
Drone food delivery services seem to be convenient.	.962 (−.769, .266)	.973 (−.831, .020)	.962 (−.989, .686)
Drone food delivery services are likely to shorten the delivery time.	.893 (−.725, .003)	.929 (−.872, .066)	.918 (−.961, .553)
Hedonic motivation			
Drone food delivery services seem to make my life exciting and stimulating.	.965 (−.421,-.264)	.955 (−.393, −.087)	.964 (−.403, −.178)
It seems to give me a good feeling to use drone food delivery services.	.972 (−.343, −.361)	.967 (−.353, −.261)	.965 (−.346, −.312)
Using drone food delivery services seems to give me a sense of personal enjoyment.	.911 (−.387, −.225)	.916 (−.372, −.212)	.915 (−.381, −.216)
Cognitive motivation			
I am likely to think logically when using drone food delivery services.	.903 (−.630, −.205)	.917 (−.924, .746)	.909 (−.888, .775)
I am likely to use drone food delivery services after considering various aspects of drone food delivery services.	.908 (−.516, −.463)	.931 (−.774, .332)	.912 (−.710, .228)
I am likely to use drone food delivery services after comparing its advantages and disadvantages.	.777 (−.516, −.540)	.855 (−.791, .235)	.826 (−.711, .105)
Social motivation			
Using drone food delivery services could impress others.	.834 (−.707, .008)	.880 (−.652, .207)	.834 (−.689, .171)
Using drone food delivery services could show that I am an early adopter.	.906 (−.772, .330)	.952 (−.591, .020)	.931 (−.672, .128)
Using drone food delivery services could distinguish me from others.	.792 (−.490, −.173)	.849 (−.450, −.195)	.943 (−.467, −.195)
Attitude			
Unfavorable – Favorable	.889 (−.613, −.049)	.928 (−.571, −.257)	.916 (−.594, −.145)
Bad – Good	.929 (−.443, −.061)	.904 (−.496, .189)	.918 (−.468, .078)
Negative – Positive	.930 (−.371, −.429)	.937 (−.343, −.307)	.929 (−.352, −.365)
Intentions to use			
I will use drone food delivery services when ordering food.	.953 (−.168, .102)	.954 (−.283, −088.)	.950 (−.207, .192)
I am willing to use drone food delivery services when ordering food.	.879 (−.479, .142)	.960 (−.290, −.188)	.929 (−.356, −.126)
I am likely to use drone food delivery services when ordering food.	.953 (−.308, .079)	.965 (−.286, −.067)	.963 (−.285, −.012)

Goodness-of-fit statistics
Before the outbreak of COVID-19: χ^2 = 484.569, df = 224, χ^2/df = 2.163, p < .001, NFI = .951, IFI = .973, CFI = .973, TLI = .966, and RMSEA = .060
After the outbreak of COVID-19: χ^2 = 275.165, df = 120, χ^2/df = 2.293, p < .001, NFI = .965, CFI = .980, TLI = .975, and RMSEA = .063
Merging before and after the outbreak of COVID-19: χ^2 = 447.556, df = 120, χ^2/df = 3.730, p < .001, NFI = .969, CFI = .977, TLI = .970, and RMSEA = .065
BC = Before the outbreak of COVID-19, AC = After the outbreak of COVID-19, and MAB = Merging before and after the outbreak of COVID-19
[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, and RMSEA = root mean square error of approximation

Table 3. Descriptive statistics and associated measures.

	Mean (Std dev.)	AVE	(1)	(2)	(3)	(4)	(5)	(6)
(1) Functional motivation	5.22 (1.26)	.868	.952	.593[a]	.633	.589	.556	.572
	5.44 (1.31)	.907	.967	.670	.783	.726	.791	.677
	5.58 (1.25)	**.895**	**.962**	**.636**	**.739**	**.672**	**.694**	**.649**
(2) Hedonic motivation	5.73 (1.17)	.902	.352[b]	.965	.474	.717	.646	.642
	4.66 (1.45)	.895	.449	.962	.598	.756	.679	.655
	4.80 (1.45)	**.899**	**.404**	**.964**	**.555**	**.741**	**.664**	**.648**
(3) Cognitive motivation	4.94 (1.43)	.748	.401	.225	.899	.433	.423	.392
	5.40 (1.19)	.813	.613	.358	.929	.685	.697	.562
	5.52 (1.16)	**.780**	**.546**	**.308**	**.914**	**.594**	**.586**	**.511**
(4) Social motivation	5.65 (1.11)	.715	.347	.514	.187	.882	.599	.535
	5.01 (1.28)	.801	.527	.572	.469	.923	.724	.630
	5.11 (1.28)	**.817**	**.452**	**.549**	**.353**	**.930**	**.669**	**.595**
(5) Attitude	4.88 (1.31)	.839	.309	.417	.179	.359	.940	.767
	4.53 (1.36)	.852	.626	.461	.486	.524	.945	.827
	4.70 (1.35)	**.848**	**.482**	**.441**	**.343**	**.448**	**.944**	**.802**
(6) Intentions to use	4.61 (1.32)	.863	.327	.412	.154	.286	.588	.950
	3.91 (1.37)	.921	.458	.429	.316	.397	.684	.972
	4.26 (1.39)	**.898**	**.421**	**.420**	**.261**	**.354**	**.643**	**.963**

The unmarked values are for before the outbreak of COVID-19; The underlined values are for after the outbreak of COVID-19; and Values in boldface type are for merging before and after the outbreak of COVID-19
AVE = Average Variance Extracted
Shades. composite reliabilities are along the diagonal
a. correlations are above the diagonal and b. squared correlations are below the diagonal

Table 4. Measurement-invariance models.

	Models	χ^2	*df*	NFI	CFI	TLI	RMSEA	$\Delta\chi^2$	Full-metric invariance
Before and after the outbreak of COVID-19	Non-restricted model	575.272	240	.960	.976	.970	.047	$\Delta\chi^2$ (18) = 26.985	Supported
	Full-metric invariance	602.257	258	.954	.972	.967	.049	p > .01 (insignificant)	

NFI = Normed Fit Index, CFI = Comparative Fit Index, TLI = Tucker-Lewis Index, and RMSEA = Root Mean Square Error of Approximation
$\Delta\chi^2$ (18) = 34.81 and p > .01

two models was not significant ($\Delta\chi^2$ = 26.985 < χ^2 = .01 (df = 18) = 34.81), which indicated that the full metric invariance was statistically supported.

Structural equation modeling (SEM)

This study used an SEM analysis to identify whether the proposed hypotheses were accepted or rejected, and the

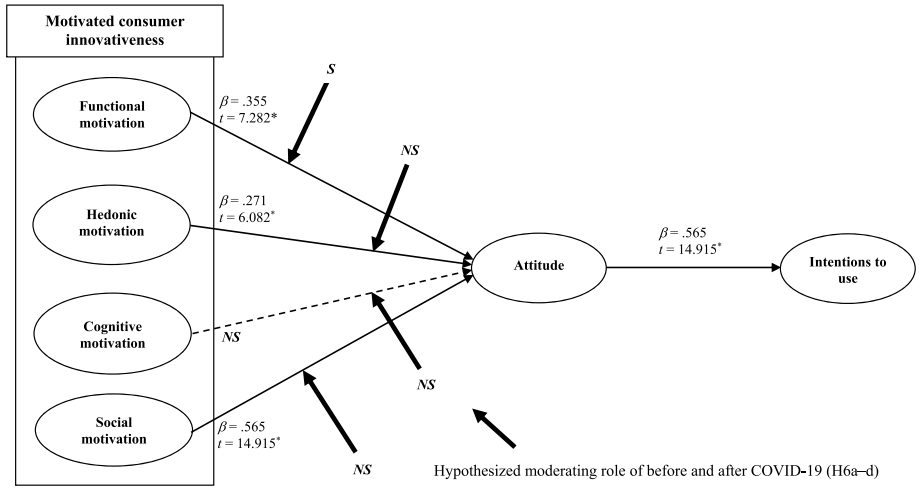

Figure 2. Standardized theoretical path coefficients. χ^2 = 492.724, df = 124, χ^2/df = 3.974, p < .001, NFI = .966, CFI = .974, TLI = .968, and RMSEA = .068NFI = normed fit index, IFI = incremental fit index, CFI = comparative fit index, TLI = Tucker-Lewis index, and RMSEA = root mean square error of approximation*p < .053: S = Significant and NS = Not Significant

Table 5. Moderating role of the outbreak of COVID-19.

	Unconstrained model						
	Before the outbreak of COVID-19		After the outbreak of COVID-19		Constrained model	Tests of moderator	
Path	β	t-value	β	t-value	$\Delta\chi^2$ (248) = 623.488	χ^2 difference	Hypotheses
H6a F → A	.221	3.872*	.457	6.913*	$\Delta\chi^2$ (347) = 627.392	$\Delta\chi^2(1) = 3.904$	Supported
H6b H → A	.401	5.857*	.182	3.212*	$\Delta\chi^2$ (347) = 627.293	$\Delta\chi^2(1) = 3.805$	Not supported
H6c C → A	.027	.459 ^{ns}	.095	1.531 ^{ns}	-	-	Not supported
H6d S → A	.193	2.697*	.196	2.992*	$\Delta\chi^2$ (347) = 623.499	$\Delta\chi^2(1) = .011$	Not supported

F = Functional motivation, H = Hedonic motivation, C = Cognitive motivation, S = Social motivation, and A = Attitude
^{ns} = not significant
*$p < .05$
$_{\Delta}\chi^2(1) = 3.84$, $p < .05$

results are illustrated in Figure 2. The overall evaluation of the model fit indicated a satisfactory fit of the model to the data (χ^2 = 492.724, df = 124, χ^2/df = 3.974, $p < .001$, NFI = .966, CFI = .974, TLI = .968, and RMSEA = .068). Of the first five hypotheses, four were statistically supported at $p < .05$. More specifically, the respondents' attitude was affected by functional, hedonic, and social motivations, thus supporting Hypothesis 1, Hypothesis 2, and Hypothesis 4. However, cognitive motivation did not affect the respondents' attitude, so Hypothesis 3 was not supported. Finally, attitude played an important role in the formation of the respondents' intentions to use drone food delivery services. Therefore, Hypothesis 5 was supported.

The moderating role of the outbreak of COVID-19

This study performed multiple-group analyses in order check the moderating role of the outbreak of COVID-19, and those results are presented in Table 5. First, the data analyses indicated that the outbreak of COVID-19 moderated the relationship between the respondents' functional motivation and their attitude ($\Delta\chi^2$ = 3.904 > χ^2 = .5(1) = 3.84, and df = 1), which supported Hypothesis 6a. More specifically, the path coefficient for the group after the outbreak of COVID-19 (β = .457 and t = 6.913*) was higher than that for the group before the outbreak (β = .221 and t = 3.872*). However, the data did not support Hypotheses 6b ($\Delta\chi^2$ = 3.805 < χ^2 = .5(1) = 3.84 and df = 1) and 6d ($\Delta\chi^2$ = .011 < χ^2 = .5(1) = 3.84 and df = 1).

Discussion and implications

The purpose of this study was to examine the effects that the MCI had on consumers' attitudes toward drone food delivery services and their intentions to use such services. Moreover, the moderating effect of the COVID-19 outbreak was evaluated. The results point to a number of factors that should be taken into account by food service companies and the restaurant industry when considering the application of drone technology during a pandemic and after it. The most important finding was that functional motivation was more influential in generating a positive attitude toward drone food delivery services after the outbreak of COVID-19 than before it. In addition, we found that functional, hedonic, and social motivations all positively affected the respondents' attitude toward drone food delivery services. Accordingly, to generate a positive attitude among consumers, food service companies and the restaurant industry need to identify the specific aspects of motivated consumer innovativeness that are likely to be effective with their consumers. Based on the empirical analyses, the findings of the study are discussed below.

First, it was found that functional motivation significantly influenced attitude, meaning that if respondents considered drone food delivery to be efficient, convenient, and beneficial in terms of saving time, that assessment motivated them to have a positive attitude toward drone food delivery services. This is in line with the findings from previous studies (Lyu et al., 2017; Saeed et al., 2014), which determined that functional motivations were important in affecting the adoption of a new technology. The results of the current study also indicated that consumers who were motivated to use drone food delivery services because of the functional aspects of the technology showed more favorable attitudes toward that new technology.

Second, this study confirmed the positive relationship between the hedonic motivation dimension of the MCI and individuals' attitudes toward drone food delivery services. In other words, the more consumers thought that utilizing drone food delivery services was exciting, fun, and enjoyable, the more they evaluated those services positively. The role of the hedonic motivation in affecting consumers' evaluation of a hospitality and tourism product has also been demonstrated by the previous studies (Kim & Hall, 2019; Yüksel, 2007). Contemporary consumers are seeking excitement, pleasure, and fun when they purchase a service product.

Likewise, the activity of trying a new technology, including one such as drone food delivery services, reflects symbolic aspects. The current study clarified that the hedonic motivation mattered when using drone food delivery services. Thus, it is important for food service companies and restaurant industry personnel to keep this point in mind.

Third, we found that a cognitive motivation did not significantly affect the respondents' attitude toward drone food delivery services. That finding is somewhat different from those in previous studies (Lyu et al., 2017), which indicated that a cognitive motivation enhanced the users' positive attitude toward a new technology. In contrast, the results of the current study showed that consumers may not necessarily think logically or compare all of the advantages and disadvantages of using drone food delivery services. Vandecasteele and Geuens (2010) mentioned that consumers welcomed novel technologies to a greater extent when their intellectual creativity became stronger. However, that relationship may not apply in the context of drone food delivery services.

Fourth, our results showed that people who are socially motivated tend to generate favorable attitudes toward drone food delivery services. This result is consistent with previous studies (Hwang, Kim et al., 2019; Saeed et al., 2014), which discovered a positive relationship between social motivation and attitude toward a new technology. Consumers who are motivated to use drone food delivery services to impress others or enhance their social status by adopting a new technology are more likely to have a positive attitude toward drone food delivery services.

Fifth, the respondents' attitude toward drone food delivery services was positively related to a high level of intention to use it. This result is also in line with the findings of previous studies (Kim & Hwang, 2020; Lee et al., 2020), which confirmed a positive relationship between attitude toward a service product and the intention to use that product. Thus, individuals who favorably evaluate drone food delivery services would be more willing to order their meals using drone technology.

Sixth, the moderating effect of the COVID-19 outbreak was demonstrated in this study by the relationship between the respondents' functional motivation and their attitude toward drone food delivery services, which means that the consumers paid more attention to the functional aspects of drone food delivery services and were more likely to be motivated to use them because of the services' convenience and efficiency, particularly after the outbreak of COVID-19. This confirms our notion that has been discussed previously and demonstrates the fact that the consumers' perception of drone food delivery services has changed since the onset of the COVID-19 pandemic. It is interesting to note that the moderating effect of the COVID-19 outbreak was not significantly influential between the respondents' hedonic, cognitive, or social motivation and their attitude toward drone food delivery services. These findings provide an important clue for restaurants and food delivery companies who have been placed under pressure to redesign their services by incorporating innovative technologies that minimize human contacts as a result of the pandemic.

Seventh, we proposed that hedonic and social motivated consumer innovativeness toward drone food delivery services will have more positive influence on attitude before COVID-19 than after COVID-19. However, these hypotheses were not supported. The results show that hedonic and social motivated consumer innovativeness are important for both before and after COVID-19. These findings provide an important clue for restaurants and food delivery companies that the role of hedonic and social motivated consumer innovativeness toward drone food delivery services are important and will be continuously critical in the long term.

Last, we proposed that cognitive consumer innovativeness toward drone food delivery services will have more positive influence on attitude after COVID-19 than before. However, this was not supported. As the relationship between cognitive consumer innovativeness on attitude toward drone food delivery services was not significant for both before and after COVID-19, the effect of cognitive motivated consumer innovativeness on attitude on drone food delivery services needs further examination.

Theoretical implications

This study provides several important academic implications. First, we proposed a conceptual model of the MCI in the context of drone food delivery services and empirically tested it. Few other studies have applied the MCI as a salient factor behind consumers' attitudes and intentions to use a service product, particularly in the context of drone food delivery services. The study's model proves that the MCI can be effective in explaining consumer adoption in the domain of drone food delivery services. Therefore, the model should benefit future studies that aim to focus on the role of the MCI in regard to other service products that involve a high level of innovative technology.

Second, this study's findings support the original idea of the theory of planned behavior and demonstrate the positive relationship between consumers' attitudes and their intentions to use drone food delivery services. This study strengthens the findings of previous studies that had determined positive relationships between attitude and intention to use a service product. This strong relationship also applies in the context of drone food

delivery services, which are considered to be innovative technology-based services.

Third, our findings regarding the moderating role of the COVID-19 are in line with studies conducted by Foroudi et al. (2021) and Shin and Kang (2020) that explained consumers' behavioral change through the risk perception theory in the hospitality setting during a global pandemic. As our daily lives during the pandemic have increased the demand for contactless food services, particular attention has been given to how consumers' perceptions have been changed regarding innovative technology that involves contactless food services since the outbreak of COVID-19. However, to the best of our knowledge, few longitudinal studies have tested a comprehensive model before and again after the outbreak of COVID-19. Therefore, this study broadens the range of studies regarding the moderating effect that the onset of the COVID-19 pandemic has had on consumer adoption of a new technology.

Practical implications

The current study provides insights into what the management and marketing strategies should be for food service companies and practitioners in the restaurant industry who wish to apply drone technology to deliver food to their customers. First, practitioners should focus on consumers' functional motivation in order to inspire a positive consumer attitude toward drone food delivery services. Such an effort has become particularly important since the outbreak of COVID-19, and we encourage food service companies to emphasize to their customers the functional utilities of drone food delivery services. For example, it is important to inform potential customers in detail about total flight ranges and the actual speed of drone delivery services. How the drone is designed to perform delivery services efficiently and how useful it is during a pandemic should be emphasized in newly created promotional videos and marketing materials for drone food delivery services.

When consumers are particularly interested in the functional aspects of drone food delivery services, restaurant managers will need to cooperate very closely with the distributors of the drones that are designed particularly for food delivery services, because restaurant managers are not likely to be experts on the drone technology itself. Restaurant managers should constantly communicate well with their drone vendors, so that the vendors can reflect the wants and the needs of the consumers when they update or design new functional aspects of drone technology.

Second, knowing that hedonic motivation is also an important MCI facet that affects people's attitude toward drone food delivery services, we recommend that restaurant practitioners emphasize for consumers the fact that using drone food delivery services can generate excitement, pleasure, fun, and positive feelings. Emphasizing these hedonic aspects of drone food delivery services is not something that has to be conducted under special circumstances such as pandemic since the moderation effect of hedonic motivation on attitude before and after COVID-19 was not significant. Rather, restaurant managers and marketers should continuously keep in their mind about the significance of hedonic motivation of drone food delivery services regardless of pandemic situation.

Third, food service companies and restaurant practitioners can encourage social motivation through marketing messages emphasizing that using drone food delivery services is special and that consumers can boast that they are early adopters of the latest technology. Restaurant managers can point out, through social networking sites and other forms of media, that trying drone food delivery services can enhance consumers' self-expression. Restaurants can employ specific social media marketing strategies, such as offering rewards to customers who post about how their positive experiences with ordering meals delivered by drone food delivery services enable them to express themselves favorably to others. Again, the findings of this study suggested that social motivation is influential on attitude toward the drone food delivery services both before and after COVID-19.

Fourth, we found that the consumers who developed positive attitudes toward drone food delivery services showed a high level of willingness to use those services when ordering food in the future, meaning that restaurant practitioners need to understand the antecedents of consumer attitudes toward such delivery services. Specifically, this study found that functional, hedonic, and social motivations were effective in influencing consumer attitudes. Moreover, we found that in developing a positive attitude, consumers may not necessarily be motivated to think logically or to critically consider the various points regarding drone food delivery services. Therefore, rather than appealing to a person's desire for intellectual confirmation, any focus on the critical points for consumers––that is, on their functional, hedonic, and social motivations– – should be effective in stimulating consumer approval.

Limitations and future research

This study has several important theoretical and practical implications, which are discussed above, but it also had limitations. First, because the data were collected in South Korea, applying the results of this study to other regions will be somewhat difficult. In particular, the consumer attitudes toward new technology-based services vary with cultural differences (Kumar, 2014), so we recommend that future studies collect data from other regions.

Furthermore, demographic profiles such as age and gender are often discussed as important moderators in accepting technology mediated services (Hwang et al., 2019). Thus, studies in future are suggested to take demographic characteristics into consideration in explaining consumer behavior. Second, drone food delivery services are not commercialized in South Korea, so this study showed a video in order to enhance the respondents' understanding of the services. However, in future research it would be meaningful to investigate customers who have actually used drone food delivery services. Third, the COVID-19 pandemic was in progress at the time of this study, so our findings about consumer behavior toward drone food delivery services may be different from people's behavior after the pandemic is over. Therefore, it will be important for future research to study consumer behavior toward drone food delivery services after the coronavirus pandemic has ended. Lastly, this study measured independent and dependent variables at the same time, which can lead common method bias. Thus, in order to measure independent and dependent variables, it is recommended to collect data at a distance of time (Podsakoff et al., 2003).

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Jinsoo Hwang http://orcid.org/0000-0001-6243-8524
Jinkyung Jenny Kim http://orcid.org/0000-0002-1704-3272

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APPENDIX

Source: Yogiyo (2018)