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An Empirical Evaluation of Customers' Adoption of Drone Food Delivery Services: An Extended Technology Acceptance Model

Idrees Waris [1], Rashid Ali [2,3,*], Anand Nayyar [4,5,*], Mohammed Baz [6], Ran Liu [2] and Irfan Hameed [7]

1 Department of Management Sciences, University of Turbat, Turbat 92600, Pakistan; idress1988@gmail.com
2 School of Information Engineering, Southwest University of Science and Technology, Mianyang 621010, China; ran.liu.86@gmail.com
3 Department of Computer Science, University of Turbat, Turbat 92600, Pakistan
4 Graduate School, Duy Tan University, Da Nang 550000, Vietnam
5 Faculty of Information Technology, Duy Tan University, Da Nang 550000, Vietnam
6 Department of Computer Engineering, College of Computer and Information Technology, Taif University, P.O. Box 11099, Taif 21994, Saudi Arabia; mo.baz@tu.edu.sa
7 College of Business Management, Institute of Business Management Karachi, Karachi 75190, Pakistan; irfanhameed.iu@gmail.com
* Correspondence: alirashid@mails.swust.edu.cn (R.A.); anandnayyar@duytan.edu.vn (A.N.)

Abstract: A single technological advancement in the business sector tremendously changed customers' lifestyles and consumption behavior. Drone technology is one of the main revolutions that increase business efficiency at a lower cost. However, the acceptance of emerging technologies is not rapid in developing markets. Therefore, this study aims to evaluate customers' adoption of drone technology in the context of food delivery services. This study has used an extended technology acceptance model (TAM) to assess customers' behavior. Product processing innovativeness, information processing innovativeness, and subjective norms have been added as additional constructs into TAM. The data of 354 customers from five different cities of Pakistan have been collected and analyzed through partial least square structural equation modeling (PLS-SEM). The results of the study revealed that all proposed hypotheses, except the positive influence of perceived ease of use on perceived usefulness, were accepted. Further, the results depict that perceived usefulness, subjective norms, and attitude were the major predictors of customers' adoption of drone food delivery services. In addition to this, customers' word of mouth has a greater influence and reach than other forms of marketing communication. Therefore, practitioners and marketers may consider hosting competition programs to experiment with drone food delivery systems to enhance the acceptance of this technology among the masses.

Keywords: product processing innovativeness; information processing innovativeness; subjective norms; perceived ease of use; perceived usefulness

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1. Introduction

The ways of interaction between customers and retailers are changing due to technological advancements [1]. In recent times, retailers are adopting dynamic technologies to execute complex business operations [2]. This technological change has reduced employees' participation, and increased customers' involvement in the design and delivery of products and services, creating challenges and opportunities for businesses [3]. To compete with the globalized business world, companies must adopt advanced technology for efficient and seamless business processes [1]. In many countries, drone food delivery services are not commercialized due to legal constraints [4]. However, this technology has huge potential to fulfill customers' needs. Due to technological innovation in retail sectors, the relationship between customers and retailers has improved and ultimately increased customers' loyalty to particular retailers [4]. Particularly, drone technology has had a substantial impact on

food delivery services [2,5]. In addition, drones are an innovative solution to traditional food delivery services, such as cars and motorcycles, which contribute to traffic jams and environmental pollution [2].

The adoption of drone technologies has huge potential in the retail sector due to its vigorous service delivery system. In recent times, various chains such as YO! Sushi, a London-based chain restaurant, Francesco's Pizza in India, and Casa Madrona hotel in the U.S. have successfully implemented drones food delivery services to customers. UberEats is planning to launch a drone delivery service as it is more efficient than traditional food delivery through partners who use bikes and cars [4]. Foodpanda, a food delivery company in Pakistan is planning to launch drone food delivery services in the name of Pandafly. Pandafly will be the first Pakistani commercial drone to provide drone food delivery services in Pakistan. Flytrex, a company that develops drones stated that drones can cover a distance of three miles within 5 to 10 min. Further, they reported that drones are more efficient than humans as they make five deliveries within an hour compared to two to three deliveries [2]. In addition, a study indicated that the use of drone technology for food delivery would significantly reduce environmental pollution [5]. Researchers posited that the current food delivery system that is based on gasoline-powered vehicles such as car and motorcycles cause pollution to the environment. Contrary to this, drone-based food delivery services are environmentally friendly because they are operated by batteries that are charged with electricity [6]. Past empirical studies reported that drone food delivery services are environmentally friendly. For example, previous researchers highlighted that drone-based food delivery services have an advantage over motorcycle delivery services because they reduce global warming potential (GWP) [7]. Another study suggested that drone-based delivery services can reduce greenhouse gas emissions [8]. Climate change has made Pakistan a highly vulnerable country among the developing nations [9]. Therefore, the introduction of drone delivery services will help to reduce environmental pollution and thus protect the environment.

A comprehensive review of the literature reveals that drone food delivery services will not have an issue with commercialization in the coming years. However, academic literature is very scarce related to this emerging topic due to the newness of technology [4,7,10]. For example, a recent study has focused on technological and legal aspects of using drone delivery services, and failed to address consumer perception which is an essential element of technology adoption [11,12]. Further, some researchers highlighted the importance of improving the usage of drone food delivery services but they did not assess the usefulness of the technology from customers' perspectives [4,10]. Another study explored the association between eco-friendly drone technology and customer behavioral intention, failing to address customers' innovative traits [2]. Recently, researchers integrated the technology acceptance model (TAM) and theory of planned behavior (TPB) theories and studied the customers' intention to use drone delivery services [4]. They found that technology-related constructs and core constructs of TPB positively affect customers' intention to use drone delivery services. However, the moderating effect of product innovativeness was insignificant. Unlike a recent study that assessed only product innovativeness in the customers' adoption of drone food services [4]. To address this research gap, the current study has focused on both dimensions of customer innovativeness in the adoption of drone technology in the context of food delivery services. Particularly, the current study attempts (1) to explain customer innovativeness in the domain of drone delivery services, (2) to explore the ease and usefulness of drone delivery services, (3) to identify the importance of subjective norms in building attitude towards drone delivery services, and (4) to assess the relationship between attitude and sub-dimension of behavioral intention which includes word of mouth, willingness to pay more, and intention to use.

Thus, the current study integrated TAM with domain-specific innovativeness (product processing innovativeness and information processing innovativeness) and subjective norms in the context of drone food delivery services. Since the 1990s, the concept of innovativeness has gained momentum and become the center of attraction for marketers

and practitioners around the globe [4,13,14]. Extant literature reveals the importance of innovativeness in a specific domain to attain a competitive edge in the market and increase the probability of innovative product adoption [4,15]. In addition, subjective norms were found an important construct that informs about the use of technology, the person may believe that technology is beneficial which in turn leads to an intention to adopt it [16].

2. Theoretical Foundation: Technology Acceptance Model

Since TAM was introduced in academia, the theory has become very popular, supported by data, and being adaptable to predict the use of new technology [17]. The model focuses on how the characteristics of new technology affect consumers' perceptions and how the customers ultimately use that technology [16,18]. The main point of TAM is that usefulness and the ease of use perceived by consumers are linked to consumers' attitudes toward using new technology. Furthermore, the consumers' attitudes toward using new technology are critical to the use of new technology [19,20]. Past studies have proposed several modifications that were considered essential to improve the predictive power of the technology acceptance model [21,22]. Several studies attempted to develop extended TAM to predict individual intention to adopt technology [16,23]. Most of the past studies have been done in the context of IT-related technologies. However, some studies have been conducted on the use of non-IT technologies such as apparel shopping [4,24], bottled water usage [25], acceptance of electric vehicles [23], intention to use YouBike system [26], outsourcing in organizational decision making [27], and acceptance of sustainability labels [28]. Therefore, TAM is the most appropriate model to predict customers' intention to use drone delivery. The extended technology acceptance model is presented in Figure 1.

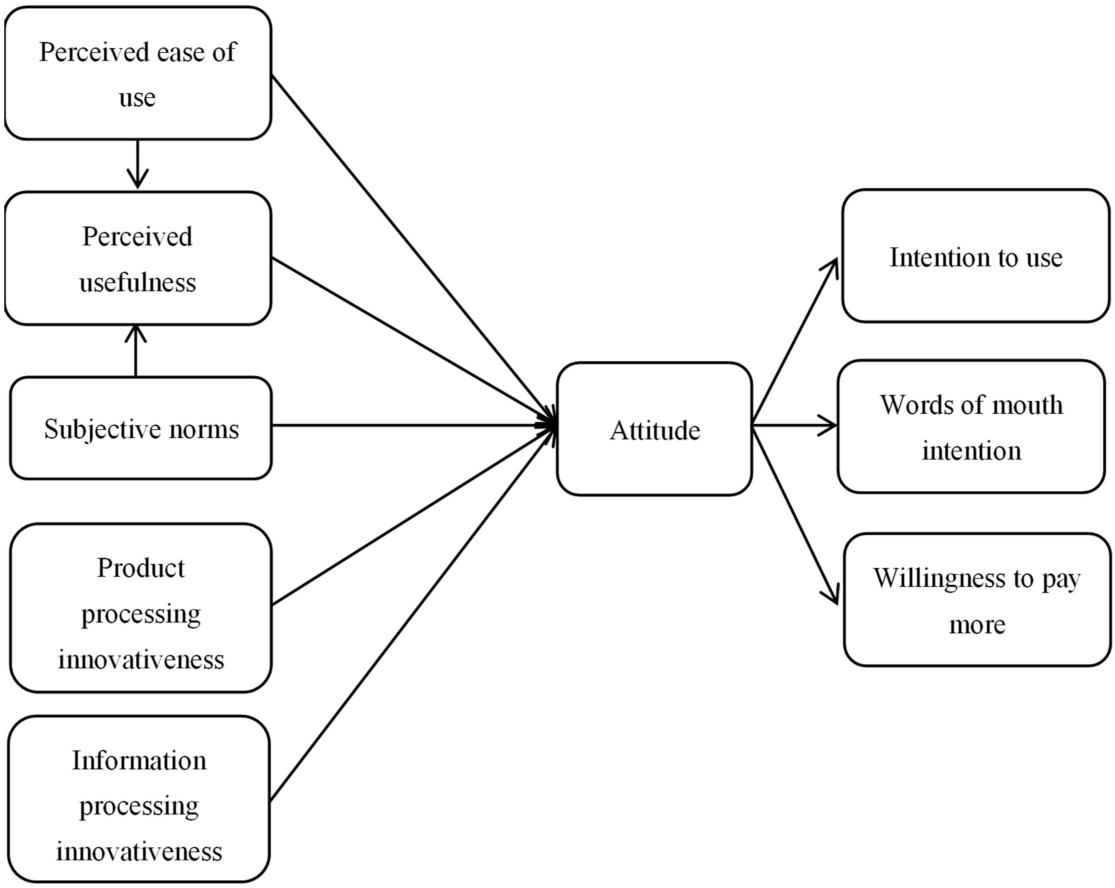

Figure 1. An extended technology acceptance model.

2.1. Perceived Ease of Use

Perceived ease of use–also known as 'complexity' in innovation diffusion theory [29]—has been described as a significant predictor of technology adoption. For example, one study found that poor interface systems led to poor user performance, resulting in the rejection of many technologies [30]. In the context of electronic commerce, the success was depending upon the customer service features, products, site designs, and navigation and entertainment features [31]. Prior studies have shown that sites designs include updated information, simple checkout procedures, good layout, transparent navigational structures, effective search engines, and user-friendly interfaces were important aspects of online shopping [32–34]. In line with this, researchers found that perceived ease of use has a positive influence on teachers' attitudes towards mobile learning at higher institutions [35]. In the context of drone delivery services, perceived ease of use positively influenced attitudes towards drone delivery services [4].

2.2. Perceived Usefulness

Perceived usefulness refers to an individual's belief that using a specific system will accelerate his or her performance [36]. Prior researchers argued that perceived usefulness is a primary construct in TAM that predicts consumer attitude towards the virtual store, and a crucial factor that determines the behavioral intention [37]. Similarly, another study revealed the positive influence of perceived usefulness on attitude and behavioral intention to use online retail stores [32]. In the context of online retail stores, researchers argued that perceived usefulness significantly enhanced consumers' attitudes and intention to use online retailers [38]. In line with this, researchers found that the perceived usefulness of mobile apps has a positive influence toward the adoption of the app in the medical education system [39]. Extant literature depicts that perceived usefulness is a significant factor in technology adoption. For example, studies showed that technology usefulness has positive a influence on the adoption of the Google Applications platform [40] and customers' online purchases [41].

Prior studies depict the significance of technology-related constructs in the adoption of technological products. Hence, we assume that perceived ease of use and perceived usefulness are significant predictors of drone-based delivery services. Thus, we propose the following hypotheses:

Hypothesis 1 (H1). *Perceived ease of using drone food delivery service has a positive influence on attitude towards drone-based delivery services.*

Hypothesis 2 (H2). *Perceived ease of using drone food delivery services has a positive influence on the perceived usefulness of drone-based delivery services.*

Hypothesis 3 (H3). *Perceived usefulness of using drone food delivery services has a positive influence on attitude towards drone-based delivery services.*

2.3. Subjective Norms

Subjective norms are an important antecedent influencing people's behavior. It is the perceived pressure of a person towards behaving in a certain manner. Researchers found that important referents such as family and friends affect consumers' belief in the use of technology [42]. Researchers found that the influence of subjective norms on an individual is due to internalization, which refers to incorporating a referent's belief about the usefulness of a system [16]. Past studies revealed that subjective norms have a positive influence on users' perceived usefulness of technology [43,44]. For example, a study conducted on the acceptance of mobile commerce (m-commerce) revealed that subjective norms positively influenced the usefulness and attitude towards the acceptance of m-commerce [45]. Another study on US consumers' use of mobile technology for shopping fashion goods revealed that subjective norms positively influenced the perceived usefulness of mobile technology for shopping [46]. Similarly, researchers revealed that

subjective norms positively influenced the attitude towards mobile payment-based hotel reservations [47]. Extant literature revealed the significant effect of subjective norms on attitudes towards using technology via perceived usefulness [48,49]. Based on prior studies results related to the significant role of subjective norms in the adoption of innovative products, we propose the following hypotheses:

Hypothesis 4 (H4). *Subjective norms positively influence the usefulness of drone food delivery services.*

Hypothesis 5 (H5). *Subjective norms positively influence attitudes towards drone food delivery services.*

2.4. Domain-Specific Innovativeness

Domain-specific innovativeness (DSI) is related to individual inclination towards the adoption of a product class and refers to the tendency of a person to learn about the products within the particular domain [50]. The concept of domain-specific innovativeness is first presented by Robertson [51]. He suggested that consumers can innovate in the particular product class or related product classes. Consumers who have a propensity in the specific domain would react more towards the innovation in that category [52]. For example, people who have expertise in the domain of automobiles would better evaluate the performance of the high-power engine. Experts in the cosmetic industry would better evaluate the positive and negative aspects of beauty cream. This perception is due to the individual innovativeness in the domain of a specific product class [50]. Further, DSI is a better predictor of consumer behavior than global innovativeness [50,53]. In the context of electronic commerce, domain-specific innovativeness positively influenced consumers' acquisition and adoption of new products [54].

Prior research showed that consumers at any time can be innovative in a specific category, and at the same time, they can be a laggard in other product categories [55], and the measurement is only possible through a domain-specific environment [50]. The usefulness of domain-specific innovativeness can be seen in the number of consumer behavior researches [56–58]. Past studies have applied domain-specific innovativeness (DSI) in different domains such as rock music [59], wine consumption [60], online shopping [61], tourism management [62], and information technology usage [63]. Although domain-specific innovation was proved to be an efficient predictor of consumers' product adoption, researchers found a weak relationship between domain-specific innovativeness and new products adoption [64]. Researchers indicated that the current scale for adaptive behavior is biased as it does not cover other aspects of innovativeness [65]. That is, past researchers measured the adoptive dimension of domain-specific innovativeness such as purchase experience and time of adoption. Thus, to overcome this issue, the current study has conceptualized domain-specific innovativeness into two dimensions: product processing innovativeness and information processing innovativeness. Product processing innovativeness focuses on the specification of the product class [53], and information processing innovativeness relates to the knowledge and novelty-seeking aspect of domain-specific innovation [56]. Recently, researchers found that consumer novelty seeking has a positive impact on attitudes towards drone food delivery services [66].

The extant literature on innovativeness reveals the significance of both dimensions of domain-specific innovativeness, that is, product processing innovativeness and information processing innovativeness in the adoption of technology. Therefore, we assume that product processing innovativeness and information processing will positively influence the attitude towards the adoption of drone-based delivery services. Hence, we propose the following hypotheses:

Hypothesis 6 (H6). *Product processing innovativeness will positively influence customers' attitudes towards drone food delivery services.*

Hypothesis 7 (H7). *Information processing innovativeness will positively influence customers' attitudes towards drone food delivery services.*

2.5. Impact of Attitude on Behavioral Intentions

This study proposes that attitudes towards drone delivery service have a positive influence on three dimensions, including word of mouth, willingness to pay more, and intention to use [4,67,68]. First, the intention is the individual degree of willingness to perform or not a particular behavior in the near future [10,69]. Researchers found that the intention to use products or services is based on a positive evaluation of using the product or services [67,70,71]. Second, word of mouth represents consumers' informal communication directed to other people about the characteristics of the consumed products or services [68,72]. The impact of word of mouth is greater than an advertisement as it is considered more reliable and imparts greater confidence to purchase the products and services [73,74]. The third dimension of behavioral intention is a willingness to pay more. It is defined as the customers' willingness to pay high prices for the purchase of products and services [75]. Extant literature found that attitude has a positive impact on behavioral intentions [4,66,71].

Researchers argued that the TAM supports the effect of attitude on behavioral intentions [16,76]. Several studies have found a positive influence of attitude on behavioral intention. For example, attitude positively affects behavioral intentions for the purchase of green products [77], and the intention to use drone food delivery services [1]. Similarly, in the context of using drone food delivery during COVID-19, scholars found that attitude has a positive influence on behavioral intention [2]. Previous researchers merged TPB and TAM and predicted that attitude has a positive influence on customer behavioral intention to use drone food delivery services [4]. Similarly, other researchers found that attitude positively influences intention to use technology. For example, a study on using robotic technology in restaurants confirmed the positive influence of consumers' attitudes towards robotics on three dimensions of behavioral intentions—intention to use, word of mouth, and willingness to pay more [67]. In the context of using drone food delivery, researchers found that attitude has a positive influence on intention to use, word of mouth, and willingness to pay more [68]. Prior studies empirical and theoretical backgrounds provide evidence that attitude has a significant impact on the behavioral intention of customers. Hence we propose the following hypotheses:

Hypothesis 8 (H8). *Attitude towards drone food delivery service has a positive influence on intention to use drone food delivery service.*

Hypothesis 9 (H9). *Attitude towards drone food delivery service has a positive influence on word of mouth.*

Hypothesis 10 (H10). *Attitude towards drone food delivery service has a positive influence on willingness to pay more.*

3. Methodology

3.1. Measurement

This study has adapted measurement scales from past studies. The items of perceived usefulness and perceived ease of use were adapted from the study of Choe et al. [4]. They adapted both scales from previous studies [69,78] and used them in the context of drone delivery services. Perugini and Bagozzi [79] items were used for the measurement of attitude towards drone delivery service and subjective norms. The measuring items for product processing innovativeness and information processing innovativeness were adapted from the studies of [44,80]. Hwang et al. [67] items were adapted for the measurement of three behavioral constructs: word of mouth, intention to use, and willingness to pay. A five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree was used for the measurement of constructs' items. The questionnaire for this study consists of two parts:

demographic information of the respondents and questions covering the constructs. The final questionnaire was evaluated by four academic experts from the field of marketing and management. They assessed the content, language, grammar, layout of the questionnaire and proposed minor changes in the wording to meet the purpose of the study. Then the items of the constructs were evaluated by conducting a pilot test on 50 respondents. The results of the pilot test were satisfactory as all factors loading met the minimum threshold value that is 0.70. The items of measuring constructs are given in Table A1.

3.2. Data Collection

The data of the respondents were collected in the restaurants of the five main cities of Pakistan (Karachi, Islamabad, Lahore, Hyderabad, and Quetta). The collection of data was done by the 22 students studying in the final years of MBA and MPhil programs. Before assigning the task of data collection, students were given an online demonstration explaining the process of data collection. Since drone delivery services are not fully commercialized in many countries, respondents, therefore, have little knowledge of drone delivery services. To overcome this problem, first, we asked respondents to watch a one-minute and 56-s video that illustrated food delivery through a drone service (see the link in Appendix A). Then we requested the respondents to fill out the questionnaire. The data collection was started soon after the government announcement of lifting Corona restrictions in the country. It was carried out between 2 August 2021 to 9 December 2021. A total of 672 questionnaires were distributed to the respondents of the study. However, respondents were reluctant to fill out the questionnaires due to their busy schedules and privacy issues. At the end of the survey, we received 383 responses. After discarding the incomplete questionnaires, 361 were validated for data analysis. The response rate was 53.72%.

4. Data Analysis

Statistical Package for Social Sciences (SPSS) and partial least square structural equation modeling (PLS-SEM) were used to analyze the data. We utilized SPSS for data purification and assessing common method bias, and PLS-SEM for the analysis of measurement and structural model.

4.1. Data Screening

Before conducting the final analysis, we applied the Mahalanobis distance technique for the identification of outliers in the data. There were seven outliers whose probability values were less than 0.001. Therefore, we excluded these multivariate outliers from our final analysis. This made our final sample size 354. Further, we performed Harman's [81] single factor test to assess whether common method bias was a threat or not. Common method bias occurs when the researchers use self-reported data and rely on a single source [82]. A substantial bias exists in the data if a single factor explains more than 50% variance [83]. The study result showed that a single factor explaining 28.32% variance in the data depicted that common method bias was not a threat to data credibility [83].

4.2. Participants' Profile

The study's participants belonged to five different cities in Pakistan. In terms of gender, 218 of the 354 participants were male, comprising 61.6% of the total sample. Married individuals were 203, accounting for 57.3 percent. In terms of qualifications, 146 individuals had bachelor's degrees, with a percentage of 41.2. One hundred and forty-six participants earned roughly 172 US dollars per month, making a 41.2% representation. In Pakistan, the average salary of a person is around 229 US dollars (PKR 40,000) per month. Table 1 shows the participants' information.

Table 1. Participants' Profile.

		Frequency	Percentage
Gender	Male	218	61.6%
	Female	136	38.4%
Marital Status	Unmarried	151	57.3%
	Married	203	42.7%
Qualification	Freshman	52	14.68%
	Bachelor	146	41.2%
	Master	144	40.7%
	Doctorate	12	3.4%
Household income	1 US$ to 172 US$	146	41.2%
	173 US$ to 344 US$	72	20.3%
	345 US$ to 515 US$	56	15.8%
	516 US$ to 688 US$	51	14.4%
	689 US$ or more	29	8.2%

4.3. Reliability and Convergent Validity

The internal consistency of the data is characterized as "reliability" [84]. Internal consistency was examined in this study using Cronbach's alpha (α) and composite reliability scores. The Cronbach's alpha (α) values greater than 0.60 suggest the internal consistency of the data. Cronbach's alpha (α) values between 0.70 and 0.80 are deemed credible. While the values between 0.80 and 0.90 are considered to be substantially reliable. The values of all constructions were more than 0.80, indicating internal consistency. Another way for establishing internal consistency is the composite reliability (CR) rating. Internal consistency is better measured by CR [85]. All constructions had CR values larger than 0.90, demonstrating internal consistency. The degree of resemblance of measurement constructs when assessed using diverse measuring methods is referred to as convergent validity [84]. We used three measures to determine convergent validity: composite reliability (CR), outer loadings, and average variance extracted (AVE). Table 2 shows that the values of CR ranged from 0.845 to 0.934, outer factor loadings values ranged between 0.696 to 0.933, and AVE values ranged from 0.646 to 0.826 confirming the presence of convergent validity [85,86]. Figure 2 shows the measurement model that depicts the strength of relationships (path coefficients) among the constructs.

4.4. Descriptive Statistics and Discriminant Validity

Descriptive statistics test was performed to assess the values of mean, median, mode and standard deviation as shown in Table 3. The degree to which measurement constructs differ from one another is referred to as discriminant validity [85]. The establishment of discriminant validity is required for the appropriateness of the statistical results [87]. The discriminant validity of this study was determined using two measures: the Fornell and Larcker criteria and the Heterotrait-Monotrait (HTMT) ratio. According to Fornell and Larcker's [86] criteria, a construct should have more variances with its components than other constructs [85]. As demonstrated in Table 3, the diagonal values, i.e., the square roots of AVE, were bigger than the inter-correlation among the constructs, indicating discriminant validity [88]. Second, the discriminant validity was determined using the HTMT ratio criteria. HTMT values less than 0.90 are required for the establishment of discriminant validity [87]. The HTMT value of all constructs shown in Table 4 was less than 0.90, confirming the discriminant validity.

4.5. Predictive Power of the Inner Model

In the study, model fit criteria were assessed through the values of coefficient of determination (R^2) and cross-validated redundancy (Q^2) [85,87]. The variance explained by the independent constructs on dependent constructs is represented by the value of (R^2). The value of (R^2) for endogenous constructs was 10.5%, 17.3%, and 18.9% for word of

mouth, intention to use, and willingness to pay more respectively, which moderated the predictive accuracy of the studied model. Next, we assessed the value of cross-validated redundancy (Q^2) through the blindfolding method. In this method, a (Q^2) value above zero indicates that the model has an adequate predictive relevance. The values of (Q^2) for word of mouth, intention to use, and willingness to pay were 6.6%, 10.9%, and 11.8% respectively, which showed that the model possessed an adequate predictive relevance.

Table 2. Reliability Testing and Convergent Validity.

Constructs	Items	Loading	Cronbach's Alpha	CR	AVE
Perceived ease of use	PEOU1	0.807	0.798	0.881	0.712
	PEOU2	0.859			
	PEOU3	0.864			
Perceived usefulness	PU1	0.725	0.761	0.860	0.674
	PU2	0.881			
	PU3	0.848			
Subjective norms	SN1	0.893	0.874	0.923	0.799
	SN2	0.908			
	SN3	0.880			
Product processing Innovation	PPI1	0.808	0.864	0.865	0.711
	PPI2	0.840			
	PP13	0.876			
	PPI4	0.847			
Information processing	IPI1	0.803	0.764	0.908	0.680
Innovation	IPI2	0.855			
	IPI3	0.814			
Attitude	ATD1	0.882	0.894	0.934	0.826
	ATD2	0.933			
	ATD3	0.910			
Intention to use	ITU1	0.859	0.723	0.844	0.646
	ITU2	0.698			
	ITU3	0.845			
Willingness to pay more	WTP1	0.900	0.768	0.861	0.676
	WTP2	0.856			
	WTP3	0.696			
Words of mouth	WOM1	0.824	0.723	0.845	0.647
	WOM2	0.870			
	WOM3	0.711			

Note: CR = Composite Reliability; AVE = Average Variance Extracted.

4.6. Hypothesis Testing

The results of the hypotheses testing are presented in Table 5. Hypothesis 1 suggests that perceived ease of use has a positive effect on attitude, which has been accepted ($\beta = 0.097$, $p = 0.038$) since the significant value was less than 0.05. Hypothesis 2 proposing the positive influence of perceived ease of use on perceived usefulness was rejected ($\beta = -0.096$, $p = 0.127$). The positive impact of perceived usefulness on attitude proposed in hypothesis 3 was supported ($\beta = 0.334$, $p = 0.000$). Subjective norms had a significant positive impact on the perceived usefulness (H4: $\beta = 0.274$, $p = 0.000$), and attitude (H5: $\beta = 0.275$, $p = 0.000$) was accepted. The results of hypotheses 6 and 7 revealed that product processing innovation (H6: $\beta = 0.147$, $p = 0.016$), and information processing innovation (H7: $\beta = 0.173$, $p = 0.001$) have a positive impact on attitude. Hypotheses 8 to 10 posits the positive influence of attitude on intention to use (H8: $\beta = 0.418$, $p = 0.000$), word of mouth (H9: $\beta = 0.327$, $p = 0.000$), and willingness to pay more (H10: $\beta = 0.437$, $p = 0.000$) respectively, which were accepted. Hence, it could be concluded that all of the proposed

hypotheses were accepted except hypothesis 2. The results of the structural model are shown in Figure 3.

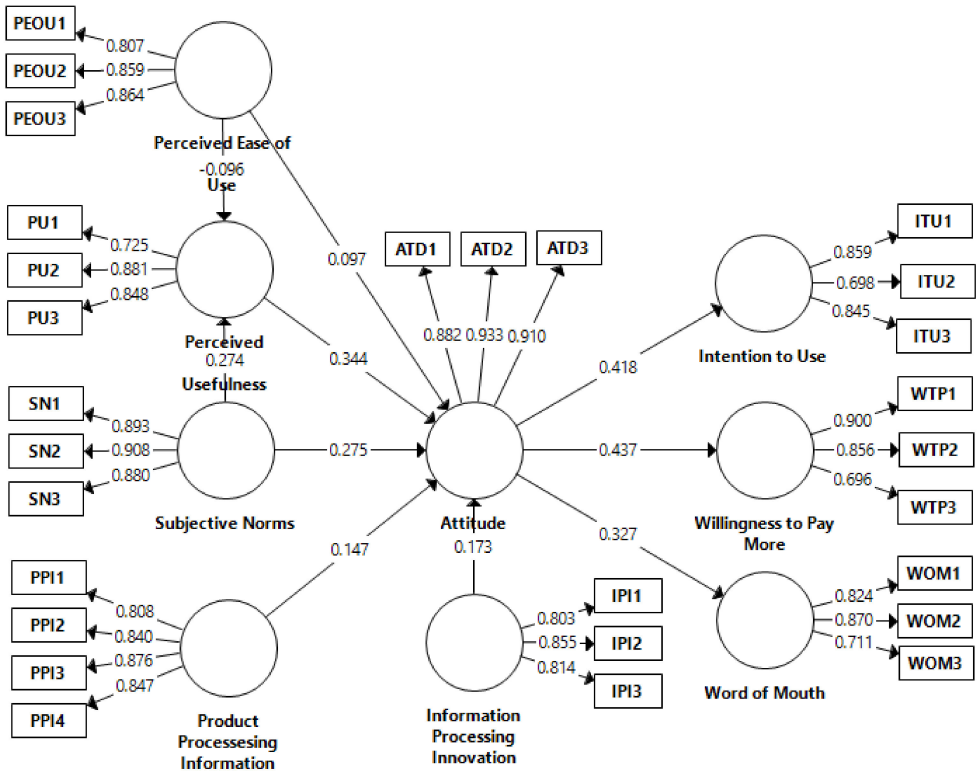

Figure 2. Measurement model.

Table 3. Descriptive Statistics and Discriminant Validity Analysis.

Latent Variables	Mean	Median	Mode	SD	1	2	3	4	5	6	7	8	9
Attitude	4.01	4.00	4.00	0.70	**0.909**								
Product Processing innovation	4.01	4.00	4.00	0.69	0.427	**0.824**							
Intention to use	4.13	4.00	4.00	0.66	0.418	0.357	**0.804**						
Perceived ease of use	4.20	4.00	5.00	0.68	0.286	0.332	0.555	**0.844**					
Perceived usefulness	3.52	3.66	4.00	0.84	0.497	0.154	0.193	−0.008	**0.821**				
Information processing innovation	4.07	4.00	4.00	0.73	0.544	0.343	0.320	0.313	0.411	**0.843**			
Subjective norms	4.26	4.00	4.00	0.65	0.553	0.429	0.279	0.321	0.244	0.605	**0.894**		
Willingness to pay	4.03	4.00	4.00	0.68	0.437	0.334	0.543	0.339	0.274	0.295	0.292	**0.822**	
Words of mouth	3.67	3.66	4.00	0.76	0.327	0.193	0.320	0.164	0.473	0.321	0.176	0.390	**0.804**

Notes: The bold diagonal values refer to the square root of the AVE of each construct. All correlations are statistically significant ($p < 0.01$). SD = Standard deviation.

Table 4. Heterotrait-Monotrait Ratio (HTMT) Results.

Latent Variables	1	2	3	4	5	6	7	8	9
Attitude									
Product Processing innovation	0.515								
Intention to use	0.517	0.485							
Perceived ease of use	0.338	0.425	0.740						

Table 4. *Cont.*

Latent Variables	1	2	3	4	5	6	7	8	9
Perceived usefulness	0.583	0.190	0.234	0.086					
Information processing innovation	0.612	0.419	0.398	0.368	0.492				
Subjective norms	0.624	0.528	0.359	0.383	0.278	0.688			
Willingness to pay	0.494	0.420	0.733	0.429	0.333	0.331	0.325		
Words of mouth	0.406	0.265	0.439	0.221	0.637	0.408	0.220	0.512	

Table 5. Hypotheses assessment summary.

Hypotheses	Beta	SE	*p*-Values	T-Values	Decision
H1: PEOU → ATD	0.097	0.098	0.038	2.058	Supported
H2: PEOU → PU	−0.096	−0.096	0.127	1.538	Not supported
H3: PU → ATD	0.344	0.345	0.000	7.346	Supported
H4: SN → PU	0.274	0.278	0.000	5.339	Supported
H5: SN → ATD	0.275	0.274	0.000	4.285	Supported
H6: PPI → ATD	0.147	0.146	0.016	2.392	Supported
H7: IPI → ATD	0.173	0.174	0.001	3.429	Supported
H8: ATD → ITU	0.418	0.419	0.000	7.369	Supported
H9: ATD → WOM	0.327	0.336	0.000	6.712	Supported
H10: ATD → WTP	0.437	0.441	0.000	9.769	Supported

Notes: Beta 5 standardized coefficient path, SE 5 standard error, path coefficient is significant if $p < 0.05$ for two-tailed tests. ATD = Attitude, IPI = information processing innovation, ITU = intention to use, PEOU = perceived ease of use, PU = perceived usefulness, PPI = product processing Innovation, SN = subjective norms, WTP = willingness to pay more, WOM = word of mouth.

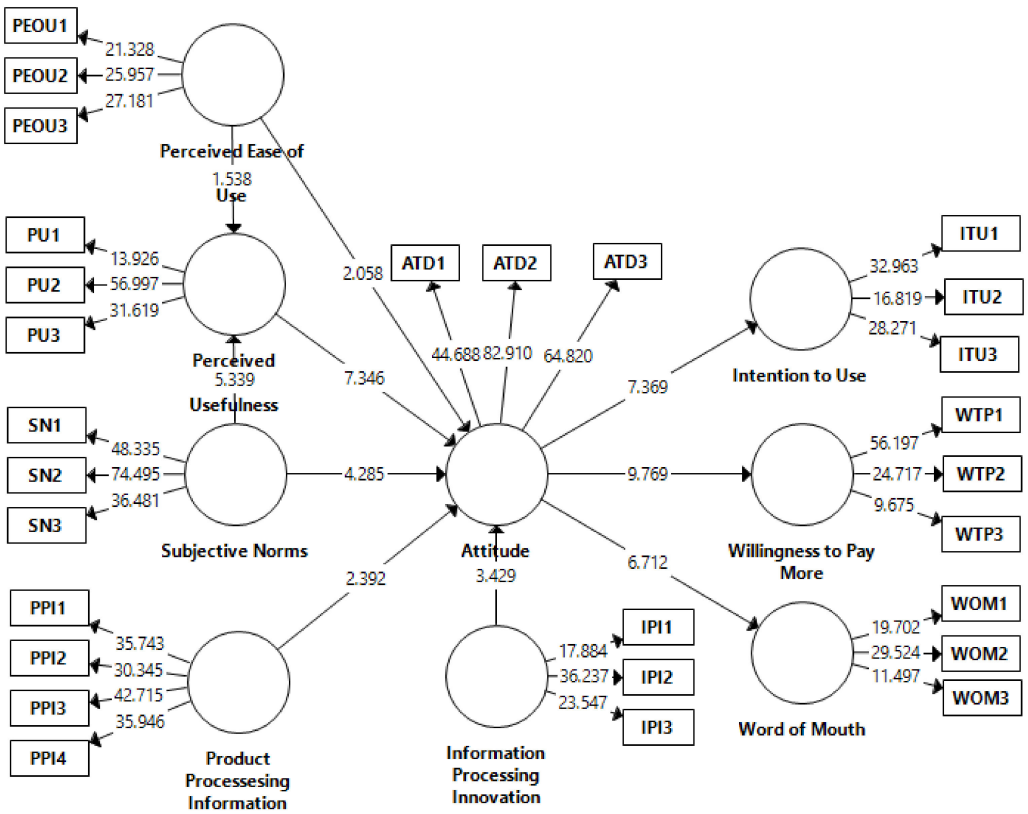

Figure 3. Structural model.

5. Discussions and Implications

The results revealed that perceived ease of use and perceived usefulness significantly affect customers' attitudes towards drone delivery services which is consistent with prior studies [4,21,76]. However, the positive influence of perceived ease of use on perceived usefulness was insignificant which matches with the findings of [89]. Customers' are unable to assess the practical impact of drone food delivery services because these services are not fully commercialized in developing nations. In the study of [49], they integrated subjective norms into TAM and found a significant and positive influence of subjective norms on the perceived usefulness of technology. The result of this study confirms that subjective norms have a positive influence on the perceived usefulness of drone food delivery services. Further, the study confirms the positive influence of subjective norms on attitude towards drone food delivery services which is consistent with the study of [90]. Further, the findings of the study revealed that product processing innovativeness and information processing have a significant impact on attitude towards drone food delivery services. These findings are consistent with prior studies which indicate the significant product processing innovative and information processing innovativeness on attitude towards emergent technologies [58,63,67]. Finally, the results depict that attitude towards drone food delivery services has a positive influence on three dimensions of behavioral intention: intention to use, word of mouth, and willingness to pay. These findings are consistent with previous studies that argued that customers with a positive attitude will say positive things about technology, use the technology, and pay extra money to avail the services of technology [4,67,68]. The results of the current study are in line with past studies except for the positive relationship between perceived ease of use and perceived usefulness. Further, unlike other studies, this study extends TAM by incorporating both constructs of domain-specific innovativeness that help to understand customers' acceptance of drone technology in the context of food delivery services.

Theoretically, this study has contributed to the TAM by confirming the significant impact of innovativeness in the adoption of drone technology [63,66]. Further, some studies found a weak and insignificant impact of domain-specific innovativeness on the adoption of novel technologies [64,91], particularly an insignificant effect of product processing innovativeness [56]. Further, the study also finds that subjective norms are significant predictors of attitudes in the adoption of drone technology in the context of food delivery services. Previous researchers also found that subjective norms have a significant effect on attitude towards the adoption of drone technology [42,49]. The addition of subjective norms in the context of drone food delivery services provides strong empirical evidence related to the significance of the construct. Hence the current research confirms the findings of previous studies and validated the significance of extended TAM in the context of drone food delivery services. Further, unlike previous studies in the context of drone food delivery services [1,2,4], the current study has extended TAM and assessed the behavioral intention into three dimensions (word of mouth, intention to use, and willingness to pay more). The results demonstrate that attitude significantly influenced the dimensions of behavioral intention.

There are several practical implications of this study. First, the marketing managers should extensively promote the usage of drone food delivery services since the results revealed the positive influence of perceived ease of use and perceived usefulness on attitude towards the drone food delivery service. In the context of developing markets such as Pakistan, the traditional food delivery system, which is normally operating through motorbikes and cars, has many issues due to heavy traffic jams and personnel management [4,10]. Therefore, the introduction of drone food delivery services improves the efficiency of the process and food delivery system. Further, the current delivery system is based on gasoline-powered vehicles (cars and motorcycles) causing environmental pollution. Therefore, marketers should focus on the environmentally friendly aspect of new technology to encourage the adoption of drone food delivery services. Secondly, the positive influence of product processing innovativeness and information processing innovativeness on attitude

denotes the significance of drone food delivery service technology. Therefore, it is suggested that marketers need to focus on the benefits of innovative technology to customers to build a positive image of drone foodservice technology. Additionally, the advertising should focus on cost-effective and efficient delivery services of the drone to customers to generate a positive perception regarding the adoption of innovative drone technology. Thirdly, the results of the study indicate the positive influence of subjective norms in the adoption of drone technology. In a collective society such as Pakistan, subjective norms have huge importance regarding the adoption of the technology [92], therefore, marketers should emphasize the attributes of drone delivery services that offer benefits to the extended family system in a collective culture. Fourthly, the results of the study depict that customer's attitude leads to three forms of behavioral intentions: word of mouth, intention to use, and willingness to pay more. Therefore, it is recommended that food delivery service providers should focus on the encouragement of word of mouth to promote the adoption of drone food delivery services [67,93]. They posited that potential customers' word of mouth has greater influence and reach than other forms of marketing communication. In this regard, practitioners and marketers may host several competition programs to experiment with the drone food delivery system that would eventually help the association between subjective norm and behavioral intention. Lastly, the positive relationship between attitude towards drone food delivery service and customers' willingness to pay more denote the acceptance of innovative technology. Therefore, marketers should start extensive advertisements to penetrate the market and increase customers' involvement in drone food delivery services [66].

6. Conclusions and Future Research Directions

The current study aims to examine customers' behavioral intentions related to drone-delivery food services. This study has integrated subjective norms and domain-specific innovativeness constructs: product processing innovativeness and information processing innovativeness into TAM to predict customers' behavioral intention. Further, this study assessed the impact of customers' attitudes on behavioral intention constructs: intention to use, word of mouth, and willingness to pay more. The cross-sectional data of 354 restaurants customers from five main cities of Pakistan has been collected for this study. The result of ten hypotheses indicates that the proposed theoretical model possesses adequate relevancy and predictive power in the context of drone delivery food services in the Pakistani market. Although the current study has several theoretical and managerial implications, it has some limitations that need careful consideration. First, the data of respondents were collected from a developing market context, therefore, generalizability would be an issue because the respondents of developed countries may have a different opinion regarding drone delivery services. Therefore, it is recommended for future research to collect data from advanced countries' customers and compare the findings with the developing countries for a comprehensive understanding of novel technology adoption. Second, this study has only used quantitative techniques to evaluate the behavioral intention of the respondents. The findings of the quantitative study can be generalized but it covers the specific dimensions under study. To comprehensively understand customers' perceptions regarding drone food delivery services, future researchers should conduct in-depth interviews with the respondents. Third, this study has used the purposive sampling technique for the collection of data that may result in biases in data. Future studies can use different types of sampling techniques to avoid biases in data. Fourth, the data of this study has been collected at the same time which may cause common methods. Therefore, Harman single factor was conducted to ensure that common method bias is not a threat. The result depicts that a single factor contributed very low variance [94]. Therefore, Podsakoff [83] suggested to collect data at different times to avoid common method bias issues.

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Appendix A

Table A1. Measurement items.

	Constructs and Measurement Items	Source(s)
	Perceived Ease of Use	Choe et al. [4]
PEOU1	Learning to use drone food delivery services seems to be easy to understand.	
PEOU2	It seems to be easy to use drone food delivery services when ordering food.	
PEOU3	It does not seem to be difficult to use drone food delivery services.	
	Perceived Usefulness	Choe et al. [4]
PU1	Drone food delivery services would enable me to receive food more quickly.	
PU2	Using drone food delivery services could make it easier for me to receive food.	
PU3	Using drone food delivery services seems to be convenient when receiving food.	
	Attitude	Perugini and Bagozzi [79]
ATD1	I have a favorable attitude towards the use of drone food delivery services.	
ATD2	Drone food delivery service is good.	
ATD3	I have a positive attitude towards the use of drone food delivery services.	
	Subjective norms	Perugini and Bagozzi [79]
SN1	Most people who are important to me think I should use drone food delivery services when ordering food.	
SN2	Most people who are important to me would want me to use drone food delivery services when ordering food.	
SN3	People whose opinions I value would prefer that I use drone food delivery services when ordering food.	
	Product Processing Innovativeness	Fu and Elliott [80]
PPI1	Drone food delivery service is one of the first products of its kind in the market.	
PPI2	Drone food delivery service is totally new to the market.	
PPI3	Drone food delivery service represents a new product/service category for customers.	
PPI4	Drone food delivery service is innovative.	
	Information Processing Innovativeness	Lu, Yao and Yu [44]
IPI1	If I heard about new technology, I would look for ways to experiment with it.	
IPI2	Among my peers, I am usually first to explore new technologies.	
IPI3	I like to experiment with new products and services.	

Table A1. *Cont.*

	Constructs and Measurement Items	Source(s)
	Intention to Use	Hwang et al. [67]
ITU1	I will use a drone food delivery service for dining.	
ITU2	I am willing to use a drone food delivery service for dining.	
ITU3	I am likely to use a drone food delivery service for dining.	
	Words of mouth	Hwang et al. [67]
WOM1	I am likely to say positive things about a drone food delivery service	
WOM2	I am likely to recommend a drone food delivery service.	
WOM3	I am likely to encourage others to use drone food delivery service.	
	Willingness to pay more	Hwang et al. [67]
WTP1	I am likely to pay more for drone food delivery service.	
WTP2	It is acceptable to pay more for a drone food delivery service.	
WTP3	I am likely to spend extra in order to use a drone food delivery service.	

Video link: https://www.youtube.com/watch?v=PA7NYuH0BlY&t=1s (accessed on 10 December 2021).

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