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Consumers' Intention to Adopt Last-mile Drone Delivery Services: A Comparison Between US and Thai Consumers

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Abstract

This research explores factors influencing an intention to adopt last-mile drone delivery services in two groups of culturally different countries: Thailand and the USA. Despite the fact that drones raise privacy concerns among consumers, few research studies has investigated the interplay between perceived usefulness and perceived privacy risks and their effect on consumers' intentions to adopt last-mile drone delivery services. In addition, no prior research has compared the effect of privacy risks and usefulness on adoption intentions in different national cultures. An online survey was distributed to potential consumers of drone delivery services in both countries. PLS-SEM analysis was then conducted to understand the relationships among seven factors within the context of drone delivery service adoption. The results show that consumers from the two countries share similar perceptions of last-mile drone delivery. Perceived usefulness and trust were found to be the most influential factors in the intention to adopt last-mile drone delivery in both groups.

Keywords: Drone delivery service, Privacy calculus, Technology acceptance model, Behavioral intention

JEL Classifications: M15, M39, O14, O33

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1. Introduction

The emergence of Covid-19 has disrupted global and local supply chains. Many traditional retailers were forced to close due to the lockdown and other movement restrictions. The delivery was slow, and the uncertainty of receiving orders has caused customer anxiety and dissatisfaction during the pandemic (Yaprak et al., 2021). Drone delivery services (DDS) are one of the viable options to overcome the current challenges in last-mile delivery during the pandemic (Euchi, 2021).

DDS can reduce man-to-man interaction and thus lessen the chance of the virus spreading. It enables faster delivery times and lower distribution costs and allows commercial providers to access rural areas more easily with less environmental impact (Joerss et al., 2016). However, drones are notorious for their privacy issues. DDS without proper regulation can be intrusive, as drones can be equipped with facial recognition software, speakers, and a small camera that can record the surroundings (Damiani & Ivkovic, 2020). While past studies (e.g., Chang et al., 2017) reported high privacy concerns about drone delivery, none have investigated whether the usefulness of DDS could alleviate the perceived privacy risks.

Additionally, previous research (Yoo et al., 2018) confirmed that determinants of drone delivery adoption differ according to the customer's area of residence. National cultures were also found to impact technology adoption (Trepte et al., 2017). Therefore, this paper argues that users from different regions and national cultures could react differently to the adoption of last-mile DDS.

This study sets two main objectives. First, it seeks to understand whether the perceived usefulness of the DDS could reduce the perceived privacy risks. Few papers, to date, have examined the interplay of perceived benefits and privacy concerns driving consumer decisions to adopt last-mile DDS. Privacy calculus theory provides a basis for this investigation, as it is commonly used to examine the dual impact of perceived benefits and privacy threats on adopting new technology (Laufer & Wolfe, 1977). Second, this study compares the tradeoff between perceived usefulness and privacy risks and its influence on the intention to adopt DDS between that of U.S. consumers and Thai consumers. Previous research in other contexts, such as social network sites and mobile application adoption, confirmed that national culture affected how consumers perceive benefits and privacy risks (Li et al., 2022; Trepte et al., 2017; Pentina, 2016). In the context of DDS adoption, previous studies in developed countries, such as the USA (Yoo et al., 2018), Germany (Lydinia et al., 2017), and South Korea (Hwang & Choe, 2019), found that regulations and perceived privacy risks are critical barriers to the implementation of drones in the logistics sector. Few studies (e.g., Khan et al., 2019; Mathew et al., 2021) investigated the relationship between perceived privacy risks and the intention to adopt DDS in developing countries. To our best knowledge, no prior research has compared the effects of privacy risks and usefulness that could be different due to the context of developed and developing countries, which have different national cultures. This study, therefore, addresses this research gap.

For comparison purposes, Thailand is chosen as it is considered a decent representative for studying different aspects of new technology to enable a thriving e-commerce market in an emerging market (Chiu, 2019). Bloomberg Business News has named Thailand the top emerging market for 2021 (OECD, 2021). Thailand has one of the largest Foreign Direct Investment (FDI) and a very robust e-commerce market worth more than $27.7 billion in 2020, and the growth is expected to rise by about 8% until

2023. Its e-commerce market is the second largest, following only Indonesia within the ASEAN region. In addition, Thailand has just launched its first DDS in Phuket to deliver goods from a local supermarket to a nearby residential area (Suksawat, 2023), leaving a lot of room for DDS providers to explore and grow.

Among developed countries, the USA is one of the first adopters exploring the benefits and implementation of DDS for e-commerce. Amazon, UPS, and Domino's, for example, have attempted to use drones to deliver packages to local residences (Iranmanesh et al., 2019). In 2022, North America was reported as part of the largest drone package delivery market in the world (Globenewswire.com, 2023); several types of packages, including food, medicines, groceries, and other homecare products, had been delivered in the USA (Vazhavelil & Sonowal, 2021). Therefore, the USA is deemed appropriate for a comparison study on the intention to adopt DDS.

The insights from this study can provide several managerial and theoretical contributions to the current literature on DDS. Theoretically, it extends the last-mile drone delivery research by examining the comparative influence of privacy and usefulness on consumers' intentions to adopt drone DDS in two different cultures. Practically, the study offers insights that retailers and delivery companies can apply to increase consumers' intentions to adopt DDS.

2. Literature review

Privacy calculus and the adoption of last-mile DDS

Previous studies explored the intention to adopt drone delivery in several countries, for example, the USA (Yoo et al., 2018; Leon et al., 2021), South Korea (Hwang et al., 2019), European countries (Osakwe et al., 2022), Pakistan (Khan et al., 2019), Iran (Ganjipour & Edrisi, 2022), and Singapore (Tan et al., 2021). Perceived usefulness and privacy were found, in these studies, as key factors influencing the intention to adopt DDS; however, none of them has attempted to understand if the perceived usefulness can reduce the negative impact that perceived privacy risks could have on the adoption intention in the context of DDS.

Privacy calculus theory is commonly used to examine the dual impact of perceived usefulness and privacy threats on adopting new technology (Laufer & Wolfe, 1977). The theory asserts that users exhibit the "calculus of behavior" when deciding how much personal information to disclose (Li, 2012). Behavior is a process of weighing situational constraints, anticipated benefits, and perceived risks before a user decides what and how much information to disclose (Min & Kim, 2015). The application of privacy calculus theory to investigate the adoption of innovative technologies includes e-commerce, social networking services, mobile commerce services, and IoT services (Dienlin & Metzger, 2016; Li et al., 2016).

For DDS adoption, users could struggle with the trade-off between perceived benefits and risks of the new technological service. DDS poses many benefits to users. The services offer a less expensive delivery option, faster delivery times, and are better for the environment compared to traditional delivery modes. On the other hand, users could feel confused or intimidated by the complexity, safety, and privacy risks. Therefore, privacy calculus could provide a basis for this study.

The technology acceptance model and last-mile DDS adoption

The technology acceptance model (TAM) is a widely used framework to provide information on the contextual factors of new technology adoption. The theory asserts that

external factors, attitudes, and perceptions of usefulness and ease of use, can influence the behavioral intention of adopting an innovative technology (Davis et al., 1989). Many studies have extended TAM to incorporate additional constructs to improve the model's predictive power for user attitudes and behavioral intentions (Venkatesh & Bala, 2008). Trust and perceived risks are two notable determinants for new technologies, such as online banking, telemedicine, and autonomous vehicles (Zhang et al., 2019). Following the prior studies, we adopted TAM with an extension of trust and perceived privacy risks and combined it with privacy calculus theory to provide a basis for our research model.

2.1 Hypothesis development

2.1.1 The relationship between privacy disposition and privacy concerns related to DDS.

Privacy disposition is a personality attribute that reflects an individual's need to maintain boundaries, in which a person feels comfortable, for their personal information space (Xu et al., 2011). Before crossing the boundary and releasing personal information, users will assess the consequences of information disclosure and form their privacy concerns (Xu et al., 2008). Thus, disposition to privacy positively impacts privacy concerns when users engage in various information activities, including e-commerce, social networking, mobile finance, and telemedicine (Li, 2012). In the context of DDS, privacy disposition and concerns are critical to adopting DDS because users can potentially compromise their sensitive and confidential information, including their place of residence, social activities, and personal lifestyle. Therefore, we propose:

H1. In the commercial drone delivery context, privacy disposition has a positive impact on privacy concerns for consumers.

2.1.2 The relationship between privacy concerns and privacy risks related to DDS.

According to Barth and de Jong (2017), privacy concern is an attitude towards information disclosure that could shape the context of how people trade-off between benefits and risks concerning privacy, including how they perceive relevant privacy risks. DDS raises privacy concerns for consumers, because they could, without consent, fly over homes and collect information about residential areas (Luppicini & So, 2016). Users with high privacy concerns were found to also have high perceived privacy risks in the context of facial recognition check-in technology adoption (Boo & Chua, 2022). Therefore, we propose:

H2. In the commercial drone delivery context, privacy concerns have a positive impact on perceived privacy risks for consumers.

2.1.3 The relationship between drone legislative protection and privacy risks related to DDS.

When evaluating the potential benefits and risks of DDS, users will take legislative drone protection into consideration if they are aware of its existence. This regulatory influence has been proven to be a critical driver in lowering the perceived privacy risks of adopting innovative technologies such as RFID, GPS, healthcare wearable devices, and mobile payment services (Xu et al., 2012; Yang et al., 2015). Therefore, we propose:

H3. In the commercial drone delivery context, drone legislative protection has a negative effect on perceived privacy risks for consumers.

2.1.4 The relationship between perceived usefulness and privacy risks related to DSS.

When deciding whether to embrace new technology, users often adopt the privacy calculus lens to examine its perceived benefits and risks. It would benefit the service providers if the usefulness of DDS perceived by consumers could reduce their perception of DSS privacy risks. Such a negative association between perceived usefulness and privacy risks exists in varying IT adoption contexts, including smartphones, healthcare wearable devices, and IoT (Li et al., 2016; Dinev et al., 2013; Kehr et al., 2015). Therefore, we propose:

H4. In the context of commercial drone delivery, perceived usefulness has a negative effect on perceived privacy risk for consumers.

2.1.5 The relationship between perceived usefulness and intention to adopt DDS.

According to Venkatesh et al. (2003), perceived usefulness is the most vital determinant for using an information system. The positive impact of perceived usefulness on behavioral intention is evident in previous studies on e-commerce (Faqih, 2013), mobile applications (Leon, 2018), healthcare wearable devices (Huarng et al., 2022), and mobile payment (Ibrahim et al., 2022), to name a few. In the context of DDS, consumers' perceived usefulness of drone delivery would include the relative advantages of speed, cost, and environmental friendliness (Yoo et al., 2018). When consumers perceive that the services are useful, they are more likely to adopt the services. Thus, we propose:

H5. In the commercial drone delivery context, perceived usefulness has a positive effect on consumers' intentions to adopt DDS.

2.1.6 The relationship between perceived privacy risks and intention to adopt DDS.

DDS poses uncertainty about how the innovative technology could impact personal information privacy. The literature on technology adoption shows that perceived risks concerning technological innovation can decrease intention to adopt Internet banking (Kesharwani & Bisht, 2012), chatbot services (Song et al., 2022), and cashless payment systems (Namahoot & Jantasri, 2022). The negative correlation between perceived privacy risks and the intention to adopt innovative technologies has also been evident in DDS (Ramadan et al., 2017). Thus, we propose:

H6. In the context of commercial drone delivery, perceived privacy risk has a negative impact on consumers' intention to adopt DDS.

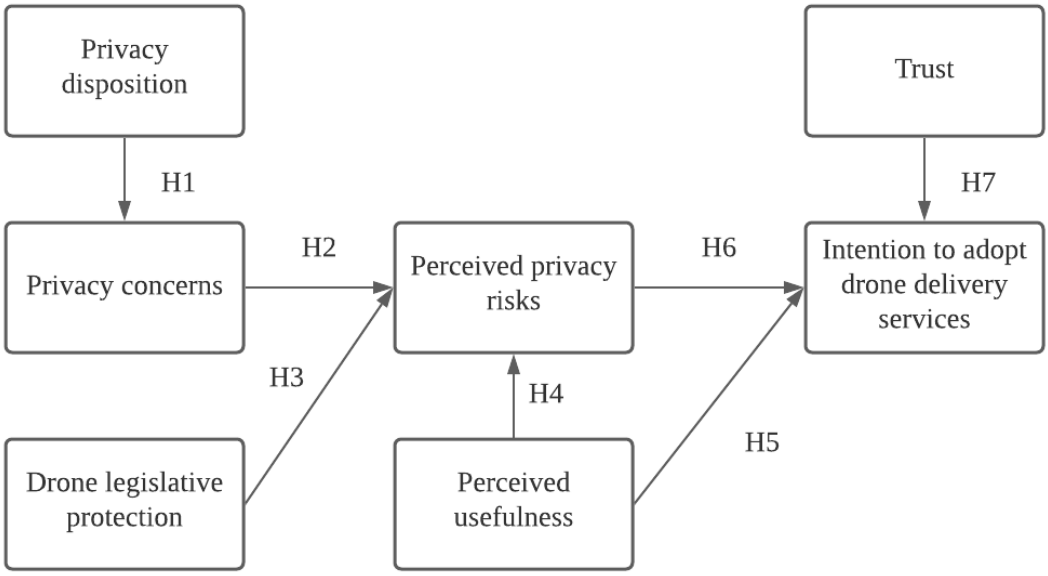
2.1.7 The relationship between trust and intention to adopt DDS.

Trust plays a vital role in users' acceptance of varying information technologies, such as electronic healthcare systems (Egea & González, 2011) and autonomous vehicles (Zhang et al., 2019). A higher level of trust can lead to a higher willingness among users to provide personal information and engage in online activities. Delivery drones flying high in the sky create a significant distance between them and their customers. This lack of physical interaction and communication with shippers can result in a higher degree of distrust for drone deliveries among users. Therefore, establishing a high level of trust with service providers is critical to the acceptance of DDS. Thus, we propose:

H7. In the context of commercial drone delivery, trust has a positive influence on consumers' intentions to adopt DDS.

The above discussion leads to the development of the research model (Figure 1) for this study.

Figure 1. Research Model



Source: Own work.

Privacy calculus and the effect of national culture on perceived privacy risks and adoption intention

As privacy is considered a psychological state which could impact technology adoption decisions (Barth & de Jong, 2017), it could be differently perceived by those with different national cultures. Therefore, a comparison between two countries is attempted to understand whether the perceived privacy risk and perceived usefulness would vary depending on the intention to adopt DDS. National culture has been proposed as an important factor moderating the willingness of people to disclose information when dealing with online sites (Wu et al., 2012). A person's cultural background can influence his or her beliefs and, thus, the perceived privacy risks (Trepte et al., 2017).

Hofstede (2011) classified national culture into six dimensions: power distance, individualism, masculinity, uncertainty avoidance, long-term orientation, and indulgence. Some of these dimensions can influence the intention to adopt new technology. The dichotomy of individualism versus collectivism has been used by the majority of cross-cultural studies (Li et al., 2022). Users in individualistic countries appeared to have higher levels of privacy concerns than those in collectivistic countries (Wang et al., 2011). As they are more self-concerned, they generally feel more in control over privacy disclosure (Li et al., 2022). According to Hofestede's insights (2021), American culture favors high individualism (91/100) and low uncertainty avoidance (46/100). In contrast, Thai culture favors low individualism (20/100) and high uncertainty avoidance (64/100). Therefore, we expect that Thai and American consumers would differently approach the trade-offs between perceived usefulness and perceived privacy risks concerning the adoption of last-mile DDS. However, due to a lack of empirical findings in this area, we have not tried to advance specific hypotheses, particularly the direction of the relationship between specific cultural traits and perceived privacy risk and usefulness. Rather, we aim to compare the results from the two countries, which have distinctly different national cultures. From the initial comparison in this study, we hope that it provides a basis for future studies on the impacts of national culture on DDS adoption.

3. Research Methodology

This research adopted a quantitative approach, using an online survey as a data collection instrument and Partial Least Squares – Structural Equation model (PLS-SEM) as a method to evaluate the measurement and test the hypothesized relationships proposed in Figure 1. The next two subsections explain how we designed the data collection instrument and how we collected data.

3.1 Data collection instrument

The survey was developed to minimize common method variance (CMV), a variance error that could affect the reliability and validity of the empirical results, by following the recommendations from Podsakoff et al. (2003). The recommendation was to proximally and methodologically separate the measurement of the predictor and criterion variables. The second recommendation included an assurance that respondents' answers would be anonymous. The third recommendation was to place a statement in the survey directions stating that honest answers were very much appreciated. The last recommendation was to use previously validated measurement items, reducing ambiguity, avoiding vague concepts, and keeping questions simple, specific, and concise. Finally, Harman's single-factor procedure was accomplished, and it was found that a single factor accounts for less than the majority of the variance. Therefore, it is unlikely that CMV influenced the results of the study.

The measurement items were adapted from previous studies related to the Privacy Calculus and TAM and modified to fit the context of drone service delivery (Table 1). The items in this study were constructed as closely as possible to the validated items from previous studies. Multi-item scales were used to increase validity and reliability (Peter, 1979). Five-point Likert scales were used to collect item responses anchored by 1 = "strongly disagree" and 5 = "strongly agree." The survey instruction stated that the survey was anonymous, and respondents were asked to provide honest answers.

Table 1: Constructs, Measurement Items, and Sources

Construct	Measurement Item	Source
Privacy Disposition (PD)	Privacy is a serious concern for me. It is important for me to control the amount of access that government agencies have to my personal data. I am not willing to share my personal information with companies. It is important for me to control the amount of access that commercial businesses have to my personal data. I am reluctant to share my personal information with companies.	Hossain and Dwivedi (2014)
Privacy Concern (PC)	I am concerned that delivery drones will collect personal information for other purposes without my authorization.	Dinev & Hart (2006); Lankton et al. (2017); Roca et al. (2009)

Construct	Measurement Item	Source
	I am concerned that delivery drones will collect personal information and share it with other entities without my permission. I think that too much of my personal information will be collected by delivery drones. I am concerned about my privacy during the delivery transaction. I am concerned that delivery drones will collect personal information and use it in a way I did not foresee.	
Drone Legislative Protection (DLP)	When enacted, I believe the legislation protecting personal privacy from drone delivery services will be: Serious enough to prevent the misuse of drones to collect personal information about me. Serious enough to prevent the unauthorized invasion of privacy.	Hossain & Dwivedi (2014)
Perceived Privacy Risk (PPR)	Privacy would be at risk when drones are used for delivery services. There would be a high potential for privacy loss associated with using drones for delivery service. There would be too much privacy uncertainty associated with using drones for delivery service.	Choi et al. (2018)
Perceived Usefulness (PU)	I would find that a drone delivery service would be useful in my daily life. Using a drone delivery service would make my lifestyle more convenient. Using a drone delivery service would save me time. Using a drone delivery service would make my life easier.	Roca et al. (2009); Leon (2018)
Trust (TST)	Companies that use drones for delivery are trustworthy. Companies that use drones for delivery are competent to protect my privacy. Companies that use drones for delivery are truthful. Companies that use drones for delivery are honest. I trust that companies that use drones for delivery will not invade my privacy.	McKnight et al. (2002); Roca et al. (2009)
Intention (INT)	If given a chance, I plan to use the drone delivery service frequently.	Roca et al. (2009); Leon (2018)

Construct	Measurement Item	Source
	I predict I will use a drone delivery service regularly.	
	I intend to use a drone delivery service in the future.	
	If given a chance, I will allow drones to deliver products to me.	

Source: Own work

3.2 Data collection

The online questionnaire was developed based on the above constructs and measurement items. It was distributed separately in the two countries, namely the USA and Thailand. Respondents were recruited based on their online shopping experience and their use of delivery services. The respondents must be 18 years of age or older and used to do any online shopping transaction or use any type of delivery service. Such experience would allow them to better relate to DDS. Besides, since this study also aimed to compare the effect of different national cultures on the intention to adopt last-mile DDS, participants needed to reside in Thailand to be eligible as Thai and in the USA to be eligible as American. In the USA, the data were collected from Amazon Mechanical Turk (MTurk). In Thailand, since the MTurk was not available, the online survey was distributed through popular Thai e-commerce related social media outlets and web forums.

A total of 1,077 subjects, after screening according to the recruiting criteria, completed the surveys, with 390 from Thailand and 687 from the USA (Table 2). 96.7% of Thai and 100% of American respondents had shopped online. The profiles of the respondents from Thailand and the USA were similar, indicating both groups as potential users of last-mile DDS.

Table 2: Demographical Analysis

Questions	Variables	THAILAND		USA	
		Frequency	Percent	Frequency	Percent
Gender	Male	109	27.9	288	41.9
	Female	281	72.1	399	58.1
How many times per month do you shop online?	Never	13	3.3	0	0.0
	1-5 times	286	73.3	285	41.5
	6-10 times	55	14.1	215	31.3
	More than 10 times	36	9.2	187	27.2
Do you have access to reliable and timely transportation?	No	35	9.0	70	10.2
	Yes	355	91.0	617	89.8
Have you ever been in close proximity to a flying drone?	No	154	39.5	264	38.4
	Yes	236	60.5	423	61.6

Source: Own work

3.3 Path and model estimation

PLS-SEM using SmartPLS3 (Ringle et al., 2015) was used to test the hypotheses, assess internal consistency and reliability, and estimate the model's path coefficients. PLS-SEM is an accepted technique for examining complex causal relationships (Henseler et al., 2009) and is suitable for exploratory studies (Hair et al., 2013). PLS is a preferred analysis method when formatively measured latent variables are adopted in the research model (Ringle et al., 2012). Moreover, it is less restrictive in its assumptions for sample sizes, measurement scales, and residual distribution (Chin, 1998) and less likely to lead to estimation problems (Goh & Sun, 2014).

4. Data analysis and results

4.1 Measurement model

The measurement model was tested for internal consistency and for convergent and discriminant validity. The measurement items showed high levels of internal reliability, with Cronbach's alpha values ranging from 0.849 to 0.926 for the data from Thailand and from 0.840 to 0.958 for the data from the USA (Table 3), which were above the recommended minimum value of 0.70 (Hair et al., 2006). Convergent validity was evaluated by examining composite reliability and the average variance extracted (Chin, 1998) for the sample data from both countries. Composite reliability values exceeded the threshold value of 0.70, and each of the lowest average variance extracted (AVE) values was 0.665 and 0.604 for the sample data from Thailand and the USA. These values were all above the recommended minimum threshold of 0.50 (Fornell & Larcker, 1981).

Table 3: Construct and Measurement Quality Indicators

Constructs	**Mean**		**Standard Deviation**		**Cronbach's Alpha**		**Composite Reliability**		**AVE**	
Country	TH*	USA	TH	USA	TH	USA	TH	USA	TH	USA
INT	3.451	3.575	1.058	1.012	0.849	0.914	0.898	0.939	0.688	0.794
DLP	3.158	3.654	1.119	1.025	0.926	0.879	0.964	0.940	0.931	0.887
PC	2.984	3.169	1.138	1.193	0.887	0.958	0.917	0.967	0.690	0.856
PD	3.884	3.901	0.797	0.794	0.874	0.840	0.908	0.884	0.665	0.604
PPR	3.182	3.067	1.075	1.178	0.873	0.928	0.922	0.954	0.798	0.873
PU	3.807	3.738	1.016	0.920	0.863	0.924	0.907	0.946	0.710	0.815
TST	3.616	3.416	0.826	0.853	0.903	0.923	0.928	0.942	0.721	0.765

Source: Own work

*Note: * TH = Thailand; AVE is average variance extracted*

The loadings and cross-loadings of factor analysis show that each item loads highly within its corresponding latent constructs, showing sufficient discriminant validity. Indicator reliability can be assumed if all indicator loadings are above the threshold value of 0.70 (Chin, 2010). The square root of the AVE for each construct was also greater than the correlations between the constructs and all other constructs (Table 4), indicating that the constructs have discriminant validity (Fornell & Larcker, 1981). For example, the square root of the AVE values for INT (0.8296) and DLP (0.9650) was greater than the inter-correlation (0.1449) between INT and DLP for the data collected from Thailand. In comparison, the square root of the AVE values for INT (0.8912) and DLP (0.9416) was greater than the inter-correlation (0.3824) between INT and DLP for the USA sample data. Thus, high discriminant validity is evident in the proposed research model for data sets from both countries.

Table 4: Correlations and Discriminant Validity Test Results

	INT	DLP	PC	PD	PPR	TST	PU
INT	**0.8296*** **(0.8912)**						
DLP	0.1449 (0.3824)	**0.9650** **(0.9416)**					
PC	0.0624 (-0.082)	0.2428 (-0.0876)	**0.8304** **(0.9251)**				
PD	0.1164 (-0.0659)	0.2269 (0.0553)	0.4625 (0.4255)	**0.8154** **(0.7774)**			
PPR	0.0530 (-0.1143)	0.1740 (-0.0855)	0.5827 (0.8788)	0.3879 (0.4177)	**0.8930** **(0.9346)**		
TST	0.3190 (0.6368)	0.2577 (0.4947)	0.0711 (-0.2361)	0.1034 (-0.0581)	0.0274 (-0.2181)	**0.8492** **(0.8748)**	
PU	0.6118 (0.7387)	0.1965 (0.4236)	0.0548 (-0.088)	0.1661 (-0.0193)	0.0232 (-0.0894)	0.272 (0.6354)	**0.8423** **(0.9025)**

Source: Own work

*Note: Square root of AVE appears on the diagonal in bold; *data from Thailand; () data from the USA*

4.2 Structural model and hypothesis testing

The research model was evaluated using a non-parametric multi-group analysis (MGA) procedure and its bootstrapping procedure in SmartPLS3. The procedure was used to test whether the path coefficients of the two groups differ significantly from each other. MGA (Henseler et al., 2009) uses the bootstrap outcomes of each group to test their significance. This bootstrapping method is not inhibited by distribution assumptions and is preferred to the t-test procedure when conducting PLS-SEM path modeling.

The path analysis result showed that 57.9% (the USA) and 40.1% (Thailand) of the variation in intention to adopt DDS was explained by the model's constructs. Four out of seven hypotheses are supported by both American and Thai samples. Surprisingly, perceived usefulness did not have a significant impact on the perceived privacy risk for both Thai (β[1] = -0.016; t = 0.407) and American (β = -0.010; t = 0.410) consumers. Besides, perceived privacy risk did not have a significant negative impact on the intention to adopt DDS for Thai (β = 0.035; t = 1.021) and American (β = -0.003; t = 0.125) consumers. The similarity in the comparative analysis results indicates that the Thai drone users may respond to the DDS in the same manner as the American users and warrant further analysis of each hypothesis test result from a cross-cultural perspective (Table 5).

Comparatively, Thai and US consumers seemed to perceive the usefulness of the DDS equally, and PU appeared to have an equal effect on adoption intention in both Thai and American consumers. The effect of PD on PC and that of DLP on PPR appeared to be stronger in Thai consumers than in American consumers. For the other tested relationships, path coefficients from the American samples appeared to be higher than those from the Thai samples.

[1] β is path coefficient beta value, indicating the strength of relationship between independent value and dependent value.

Table 5: Comparative Structural Equation Model Test Results between the USA and Thailand?

Hypothesized Paths	Thailand (TH)		USA			TH vs. USA
	Path Coefficients	T-statistics	Path Coefficients	T-statistics	Hypothesis test results	Path Coefficient Comparison
H1. PD → PC	0.462	10.903***	0.426	12.550***	Supported	TH (0.462) > USA (0.426)
H2. PC → PPR	0.574	12.439***	0.877	55.820***	Supported	TH (0.574) < USA (0.877)
H3. DLP → PPR	0.038	0.889	-0.004	0.148	Rejected	TH (0.038) > USA (-0.004)
H4. PU → PPR (TH > USA)	-0.016	0.407	-0.010	0.410	Rejected	TH (-0.016) < USA (-0.010)
H5. PU → INT	0.566	15.039***	0.561	15.022***	Supported	TH (0.566) = USA (0.561)
H6. PPR → INT	0.035	1.021	-0.003	0.125	Rejected	USA (-0.003) < TH (0.035)
H7. TST→ INT	0.164	3.713***	0.280	7.396***	Supported	TH (0.164) < USA (0.280)

Source: Own work

5. Discussion and Conclusion

5.1 Discussion

This study integrated the privacy calculus theory into TAM to explore the roles of perceived usefulness, perceived privacy risks, and trust in the intention to adopt DDS in two countries, namely the USA and Thailand. The results showed that perceived usefulness and trust were the most influential factors in the intention to adopt DDS by both Thai and US consumers. However, the perceived usefulness did not significantly reduce the privacy risk perceived by Thai and US consumers, and perceived privacy risks did not affect adoption intentions in both countries. Drone legislative protection was also found to be insignificantly reducing the degree of perceived privacy risk for both Thai and American customers. This indicated that the delivery service providers will need to better highlight and promote the advantages of the DDS. Relevant stakeholders may need to work harder on the presence of DDS regulation to make consumers perceive that the regulation is serious enough.

Considering the potential differences due to national culture, we found that perceived usefulness was not affected by national culture. The relationship between privacy disposition and privacy concern in the Thailand group was found to be more positive than the relationship in the USA group. This is consistent with the past study (Trepte et al., 2017), which found that users with high uncertainty avoidance and low individualism (Thailand in this study) have a higher concern for privacy risks than users with low uncertainty avoidance and high individualism (the USA in this study).

The relationship between privacy concern and perceived privacy risks and the relationship between trust and DSS adoption intention appeared to be stronger in the US culture than in the Thai culture. However, prior literature found that consumers with a higher level of individualism place less emphasis on privacy risks (Trepte et al., 2017), and individuals from high uncertainty avoidance cultures place a higher emphasis on trust when deciding to adopt new technology (Zhang et al., 2018).

Key similarities and differences in the findings between these two countries can be highlighted as follows:

Similarities in the findings:

1. Influential Factors: In both the United States and Thailand, perceived usefulness and trust were identified as the most influential factors driving the intention to adopt DDS among consumers. This suggests that regardless of national culture, individuals in both countries value the practical benefits and trustworthiness of DDS when considering adoption.

2. National Culture and Privacy Disposition: The study found that perceived usefulness was not significantly affected by national culture, indicating that the perceived practicality of DDS transcends cultural differences.

Differences in the findings:

1. Privacy Concern and Privacy Risks: While perceived privacy risks did not significantly impact the adoption intention in either country, there was a notable difference in the relationship between privacy concern and perceived privacy risks. In the Thai group, the relationship between these variables was more positive compared to the USA group. This suggests that consumers in Thailand, a culture characterized by higher uncertainty avoidance, may place a greater emphasis on privacy concerns when assessing privacy risks.

2. Trust and Adoption Intention: The relationship between trust and the intention to adopt DDS appeared to be stronger in the US culture than in the Thai culture. This contrast is interesting, as previous research had suggested that individuals from cultures with high uncertainty avoidance, such as Thailand, would prioritize trust when considering new technology adoption. However, the findings here suggest a nuanced relationship between trust and adoption intention, influenced by cultural factors.

3. Drone Legislative Protection: The study revealed that drone legislative protection did not significantly reduce the perceived privacy risk for Thai or American consumers. This indicates that, regardless of cultural context, consumers may not view legislative protections as effective in mitigating privacy concerns associated with DDS.

In conclusion, this study underscores the significance of perceived usefulness and trust as universal drivers of DDS adoption intention in both the United States and Thailand. However, differences in the relationships between privacy-related variables and adoption intention highlight the importance of considering cultural nuances when designing marketing strategies and regulatory frameworks for DDS. Stakeholders may need to emphasize different aspects of DDS benefits and address privacy concerns in culturally tailored ways to maximize adoption rates in these two countries.

5.2 Conclusion

This study examined factors influencing the intention to adopt DDS in Thailand and the USA, through a combined lens of privacy calculus and TAM. The adoption intention was found to increase if the consumers perceived DDS to be useful and trusted the DDS provider. Therefore, DDS providers should clearly communicate the potential benefits of drone delivery to their customers and find out what benefits are expected by consumers and would help reduce their perceived privacy risks. DDS providers should also pay attention to building trust with consumers to help them commit to the acceptance of DDS. This could be done by developing explicit policies and demonstrating adherence to them (Ayagma et al., 2021) and promoting transparency, frequent communication, social presence, and reputation (Wu & Zhang, 2017). Establishing policies related to data and imagery privacy, safety measures, security, and environmental and noise impacts may encourage trust in adopting DDS. Specific policies may entail limiting data collection and ensuring data is handled responsibly, ensuring

personal data from delivered packages is secure from intruders, implementing collision avoidance systems, and applying noise monitoring systems. Transparency may also build trust in DDS by providing clear and frequent information about data collection, safety precautions, and environmental initiatives. Frequent communication can be done through social media, placed on the company's website, as short communications alongside customer electronic invoices and receipts, or as paper inserts inside delivered packages.

Comparatively, the perception and adoption intention of the Thai and American consumers in this study appeared to be similar. This study presented a contradictory finding to previous literature (e.g., Özbilen, 2017; Trepte et al., 2017), which found national culture affecting consumers' perceptions and behaviors. Future research may investigate this further. There might be other cultural dimensions, apart from uncertainty avoidance and individualism, that could affect consumers' perceptions and intentions to adopt DDS. In addition, demographic factors, such as age and occupation, may affect the intention. Future research may investigate the moderating effect of demographic factors.

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