

International Journal of Business Performance and Supply Chain Modelling

ISSN online: 1758-941X - ISSN print: 1758-9401

<https://www.inderscience.com/ijbpscm>

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DOI: [10.1504/IJBPSM.2025.10070266](https://doi.org/10.1504/IJBPSM.2025.10070266)

Article History:

Received:	27 June 2023
Last revised:	03 November 2024
Accepted:	25 January 2025
Published online:	10 July 2025

The factors influencing the acceptance of drones as delivery option for young consumers

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Abstract: This study aimed to examine the influence of predictors of drone delivery on young consumers' intention to adopt drones as a medium of delivery in the Indian context. The theoretical framework was developed using a combination of diffusion of innovation theory and perceived risk theory. 230 respondents aged 18–34 years were considered usable for this study. Principal component analysis and multiple regression analyses were used for the analysis. The results showed that relative speed advantage (RSA), performance risk, and delivery risk positively influence the intention to adopt drone delivery, whereas green image negatively influences drone delivery adoption. The limitations of this study are discussed. The present study is one of the first attempts to understand the factors influencing the acceptance of drone delivery in India, which will help to understand the importance of environment-friendly deliveries.

Keywords: diffusion of innovation; drone delivery; perceived risk; privacy; performance risk; delivery risk; innovativeness; speedy delivery; environment friendliness.

Reference to this paper should be made as follows: Misra, V. and Shukla, S. (2025) 'The factors influencing the acceptance of drones as delivery option for young consumers', *Int. J. Business Performance and Supply Chain Modelling*, Vol. 15, No. 3, pp.231–254.

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1 Introduction

Research on drone delivery in today's era is becoming a point of attraction for researchers, as it provides certain advantages to organisations, consumers, and society. The first advantage of drones is not influenced by traffic, so they deliver the package speedily despite location constraints (Hwang et al., 2019; Yoo et al., 2018). Previous researchers have considered environmental friendliness as the second advantage of drone delivery. Researchers have concluded that delivery through drones reduces CO₂ emissions and energy consumption (Kim and Hwang, 2020; Goodchild and Toy, 2018; Figliozzi, 2017). Furthermore, some studies have found that delivery using drones can decrease the rate of accidents and prevent casualties (Asia Economy 2017).

The concept of drone delivery became more popular during the lockdown period and was practiced at various locations in India. According to a media report by the Times News Network, the Ahmedabad city administration used drones to deliver medicines. In another report, the Indore Municipal Corporation used drones to disinfect contaminated areas in the city (Yadav, 2020). During and after the lockdown, Uber Eats India, Swiggy, and Zomato were prominent names that utilised drone delivery in India. In the pandemic time, this 'touch me not' environment, drone delivery is emerging as a saviour for businesses to enhance their market spread with increased profits.

The Directorate General of Civil Aviation (DGCA) has permitted Zomato, Swiggy, and Google-backed Dunzo to be among the 13 organisations to conduct tests and trials of drone deliveries in India in June 2020 under the observation of a surveillance team (Gadgets 360°, 2020). Further, in June 2021, the Directorate General of Civil Aviation (DGCA) approved an ANRA Technologies-led consortium, of which Swiggy is a part to conduct the trial for Beyond Visual Line of Sight (BVLOS) functioning in India (The Economic Times, June 2021; India Today, June 2021). Hence, the importance of drone delivery can be realised from reports published by newspapers and magazines. In light of this, the reason for considering this domain for the study could be understood.

In this study, authors have created a theoretical framework based on the combination of diffusion of innovation theory and perceived risk theory to evaluate the influence of innovativeness, relative speed advantage (RSA), green image, performance risk, delivery risk, and privacy concerns on Indian young consumers' intention to adopt drone as a medium of delivery. Drone delivery has been the subject of numerous studies by researchers throughout the world, but only a small number of those studies have focused

on drone delivery in India. Furthermore, the adoption of drone deliveries by young consumers has not been addressed in previous studies, so we emphasise these two research gaps identified in previous studies. Therefore, we tried to address the research question- which are the predictors those significantly influences the young consumers intention to adopt drones as medium of delivery of packages. Our study is based on the intentions of young Indian consumers to use drones as a delivery method.

Our study significantly contributes to society by proposing that the awareness about the environmental issues should be included at every societal levels through various environment programs in India. This will help the societal well-being to understand the importance of environmental balancing, and may simultaneously help the societal well-being to adopt eco-friendly technology in their daily life.

Although many studies in past have studied the various factors influencing drone deliveries across the world. These past studies showed that the drone delivery is widely accepted by the consumers in developed geographies, which in turn means that the people of developed economies are early adopters of technology. A very few studies were commenced in developing countries regarding acceptance of drone deliveries by the consumers. Hence, we conducted this study in India to represent the opinion of developing countries regarding the acceptance of drone delivery by consumers. India is considered for this study because firstly, India is a developing country, secondly, India has vast population base and extensive markets. Indian market is one of the biggest markets in the world (The Times of India, 2021).

1.1 Research objectives

The main aim of this study was to examine the influence of predictors of drone delivery on young consumers' intention to adopt drones as the medium of delivery in the Indian context.

2 Literature review

A thorough literature review was conducted to understand the association between technology and innovation. It also aimed to extract the factors that convinced young consumers in favour of drone delivery.

2.1 Theoretical framework

2.1.1 Diffusion of innovation theory

Rogers (1962) proposed the diffusion of innovation theory, which is widely used by researchers, as it is acknowledged as a percipient theory because it streamlines the process of an individual's acceptance of any new idea, product, behaviour, etc. The five attributes of the diffusion of innovation theory—relative advantage, compatibility, complexity, observability, and trialability—may influence individuals' innovation adoption (Rogers, 1983). Researchers have discovered that relative advantage, compatibility, and complexity are the three attributes associated with innovation

acceptance (Agarwal and Prasad, 1998; Kang et al., 2015). Relative advantage refers to “the degree to which an innovation is perceived as being better than its precursor”, and compatibility is defined as the “degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters”, and complexity can be referred to as “the degree to which an innovation is perceived as being difficult to use” (Rogers, 1983).

Most past research on the diffusion of innovation has concentrated on how consumers’ perceptions influence the adoption of innovation. A few of the previous researches focused on the use of diffusion of innovation theory in various domains such as the adoption of internet banking (Giovanis et al., 2012), healthcare technology products (Karahoca et al., 2018), drone delivery (Yaprak et al., 2021; Yoo et al., 2018), etc.

2.1.2 *Perceived risk theory*

The theory of perceived risk has been enlightening about consumer behaviour since 1960 (Bauer, 1960; Lee, 2009; Featherman and Pavlou, 2003). The theory describes how consumers recognise risk and endeavour to prevent adverse outcomes in their purchasing decisions (Bauer, 1960). Perceived risk is referred to as “the nature and amount of risk perceived by a consumer in contemplating a particular purchase decision” (Cox and Rich, 1964). Due to perceived risk, consumers’ intention or willingness to buy a product declines (Choi et al., 1976, 2013). Researchers have explored social, financial, time, privacy, performance, and physical risks in their studies (Lee, 2009; Featherman and Pavlou, 2003; Jacoby and Kaplan, 1972).

Many studies in the past have focused on perceived risk as a crucial determinant of technology adoption (Yang et al., 2015; Wu et al., 2017). Yang et al. (2015) studied perceived risk as a hindrance to mobile payment adoption (Wu et al., 2017). However, some researchers explored the influence of perceived risk on mobile shopping (Marriott and Williams, 2018; Chopdar et al., 2018; Madan and Yadav, 2018). In the same context as the adoption of technology innovation, some studies have been carried out on drone delivery adoption using perceived risk theory. These researchers considered performance, delivery, and privacy risks as part of their study (Choe et al., 2021; Mathew et al., 2021; Yaprak et al., 2021; Hwang and Choe, 2019; Khan et al., 2019; Yoo et al., 2018).

However, some previous studies have also combined the diffusion of innovation theory and perceived risk theory to explore the influence on drone delivery (Yaprak et al., 2021; Yoo et al., 2018). Our study also used a combination of the diffusion of innovation theory and perceived risk theory. Perceived innovativeness has been widely used as a determinant of the diffusion of innovation. We considered perceived innovativeness (PI) as individual characteristics, RSA, and green image (GI) from relative advantage as the determinant from the diffusion of innovation theory and performance risk (PR), delivery risk (DR), and privacy concern (PC) from perceived risk theory.

Table 1, represents the difference between this study and the studies carried out by the scholars in the past.

Table 1 Difference between present and past studies

<i>Present study</i>	<i>Past study</i>
Our study focused on the theoretical framework based on Diffusion of Innovation and Perceived Risk Theory, which is not been considered by the past scholars. We tried this theoretical combination as perceived risk is equally important as other factors then acceptance or use of innovation is considered	Past scholars have not focused on the combination of Diffusion of Innovation and Perceived Risk Theory. They have used Diffusion of Innovation theory, TAM, perceived risk theories or their combinations in their work. Yoo et al. (2018) had used the combination of Diffusion of Innovation and Technology Acceptance Model to build their theoretical framework. Similarly, Hwang and Choe (2019) just focused on Perceived Risk Theory in their theoretical framework.
Our study is carried out in India, which is a developed country, hence, our study tried to explore the opinion about technology acceptance of the people of developing countries	There are many other researchers who had built up their theoretical framework using one or combination of different theories Most of the past studies were carried out in developed countries. The people of developed countries are more inclined towards the acceptance of technology

3 Conceptual model and hypotheses development

3.1 Innovativeness

Individuals' attitudes regarding a certain product or service are based on their knowledge and understanding of the competence of the product/service (Oliver et al., 1997). Innovativeness is one of the key indicators of a technical product's or service's originality, and Kim et al. (2021) highlighted the significant impact of perceived innovation in forming consumers' attitudes toward drone food delivery services. The Hwang et al. (2019) study supported the favourable influence of innovation on the intention to use drone delivery (Edrisi and Ganjipour, 2022; Hwang et al., 2021). Several researchers have also investigated how innovation affects drone delivery, and their findings are consistent with those of earlier studies (Mathew et al., 2021; Yoo et al., 2018).

H1: Innovativeness has a significant positive effect on the intention to adopt drone delivery.

3.2 Green image

According to the study by Kim and Hwang (2020), Figliozi (2017), and Goodchild and Toy (2018), Drone delivery facilitates lowering energy consumption and CO₂ emissions. Moreover, it also reduced greenhouse gas emissions (hereafter GHG) (Stolaroff et al., 2018). As per Yoo et al. (2018), adopting drone delivery is influenced by environmental friendliness (Mathew et al., 2021; Hwang and Kim, 2019; Yoo et al., 2018). Several previous studies and surveys have analysed that delivery speed and environmental

protection are two major benefits of drone delivery, which also affect its adoption by users (Xie et al., 2022).

H2: Green image has a significant positive influence on the intention to adopt drones as a medium of delivery.

3.3 Relative speed advantage

Although the privacy risks associated with drone delivery services, many consumers are attracted to them because of the relative speed and environmental benefits they offer. Consumers believe that the biggest benefit of drone delivery is that it is faster than traditional truck delivery since drones fly the best route and are not impacted by poor road conditions or heavy traffic (Xie et al., 2022). Previous studies have stated that there is the influence of RSA on attitude towards drone delivery, which further influences the adoption of deliveries using the drone, as consumers think that delivery through drones is faster as compared to traditional methods of delivery (Yoo et al., 2018; Joerss et al., 2016). Therefore, this study makes the case that consumers will switch from traditional truck services to drone delivery due to its perceived benefits of speed.

H3: The relative speed advantage has a significant positive impact on the intention to adopt delivery through drones.

3.4 Perceived risk

According to recent research, public concern over the safety and security risks of drone delivery is rising. Before opting for novelty services, people will probably weigh the privacy risks and relative advantages of drone delivery services. Numerous risks kinds are included in perceived risk, which affects consumer acceptance of new goods and services (Featherman and Pavlou, 2003). Each sort of risk, according to Lee (2009), affects the acceptance of innovations. Like in earlier research, we looked at how performance, delivery, and privacy threats may affect the adoption of drone delivery in this one (Yoo et al., 2018; Lee et al., 2016; Soffronoff et al., 2016). It was addressed that consumer acceptance of drone delivery is largely impacted by attitude and perceived risk where risk has been found to be negatively associated with consumers' intention to adopt drone delivery (Koh et al., 2023; Liu et al., 2020). The major concern about drone use is the invasion of privacy as a perceived risk. It has a negative impact because consumers' behaviour intention is relatively low when they perceive the high risk of drone delivery services (Leon et al., 2023).

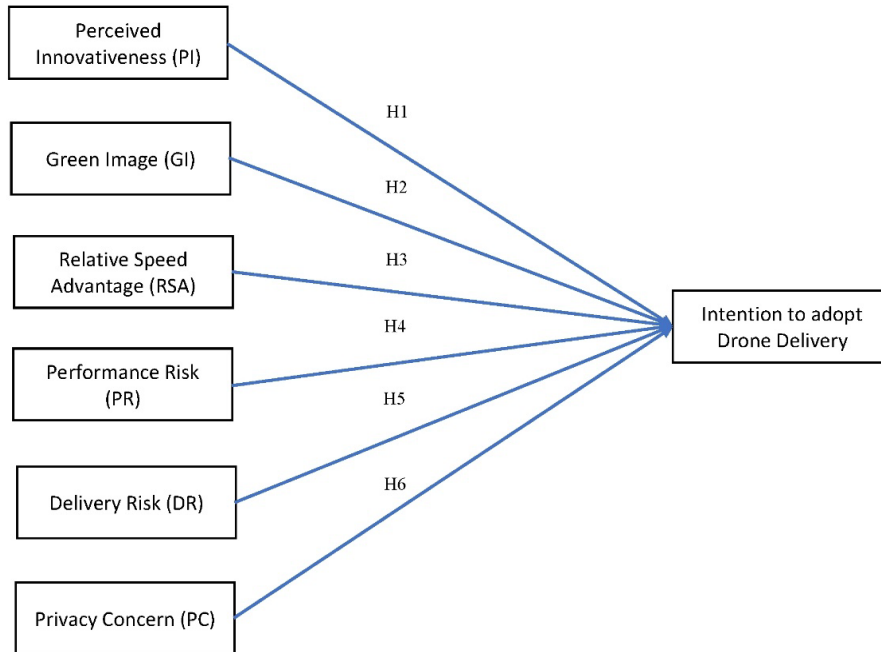
Yoo et al. (2018) found that performance risk and privacy concerns significantly affect drone delivery adoption (Mathew et al., 2021). However, Hwang and Choe (2019) find that performance risk has an adverse impact on the intention to adopt drone delivery. The findings of Hwang and Choe (2019) are supported by those of Choe et al. (2021). Mathew et al. (2021) also found no significant effects of performance, delivery risk, or privacy risk on drone delivery. Khan et al. (2019) explored privacy concerns as the primary concern in drone delivery (Alrawad et al., 2023). However, both studies investigated privacy concerns in different geographies.

H4: Performance risk has a significant association with consumers' intention to adopt drone delivery.

H5: Delivery risk influences the intention to adopt drone delivery.

H6: Privacy concerns have a significant association with the intention to adopt drone delivery.

Figure 1 Conceptual model (see online version for colours)



The foundation of this research was laid on an in-depth literature review and thus, major factors extracted from the detailed literature review for the study are environmentally friendly (green image), privacy concerns, risks involved, and RSA as major factors to work on and accordingly hypotheses were postulated. Very few studies have been carried out on drone delivery adoption in India, and yet no study has focused on the intentions of young consumers to adopt drones as a medium of delivery. We will investigate the influence of innovativeness, green image, and RSA as the determinants of relative advantage studied in the diffusion of innovation theory, and performance risk, delivery risk, and privacy concerns as predictors of perceived risk drawn from perceived risk theory. The model represents a combination of the diffusion of innovation and perceived risk theories (Figure 1).

4 Research methodology

4.1 Procedure

We used a descriptive research design as our study was based on a deductive research approach. We used the deductive research approach because we examined the influence of predictors used in past research in the context of young Indian consumers. According

to Singhi et al. (2017), the population below the age of 35 years is considered young (Nielsen, 2018); therefore, we targeted the population falling in the age group of 18–34 years. We carried out this study among young consumers as young consumers are more interested and inclined to adopt latest technology (The Times of India, 2021), hence referred as early adopters of technology (Sapry binti Azuwalri, 2022; Osakwe et al., 2022; Alexander and Kent, 2022; Thusi and Maduku, 2020; Leon, 2018). Aggarwal et al. (2023) states that the young people are frequently users of different technologies in their daily life. Considering young consumers early adopters and their role important and significant in technology adoption, we carried out this study on the young consumers.

The sample size determined was 384 using the formula given by Israel (1992). However, the completely filled forms were collected from 230 respondents pursuing graduation, post-graduation, and PhD. All the respondents considered for the study were non-working. Memon et al. (2020) suggested that the sample size above 150 respondents is sufficient if selected carefully. Hence, based on the suggestion of Memon et al. (2020) and the proposed sample size formula of Israel (1992), we consider the determined sample size of 384 and received 230 complete questionnaires sufficient for the study. The target sample was distributed as a ratio of the number of students enrolled in the courses. Convenience sampling was used to collect responses. The data were collected from respondents residing in the states of Uttar Pradesh, Uttarakhand, Rajasthan, Delhi, and Madhya Pradesh in India. The data was collected through email, the emails of the students were collected from the Dean Student Affair's office, Coaching Institutes, Public Libraries, and Training Institutes.

A structured questionnaire was developed consisting of single-choice, dichotomous, and Likert-scale questions. The questionnaire was created using Google Forms and circulated via email. The questionnaire was divided into three sections:

Section 1 included questions related to the demographic profile of the respondents. These questions were dichotomous and single-choice questions.

Section 2 involved questions regarding awareness of and attitude toward drone delivery. This section contained questions that were dichotomous and Likert-scale-based.

Section 3 consists of questions based on a Likert-type scale. These questions represent the influence of various factors on drone delivery acceptance.

However, past literature was collected through different web portals. These web portals include Google Scholar, Google, Emerald, ScienceDirect.com, and EBSCO.

4.2 Measures

Elements that had been verified as reliable and valid in previous studies were used for each notion. All components in this study were measured using a five-point Likert scale ranging from 1 to 5, where 1 = strongly disagree and 5 = strongly agree. We calculated the composite scores of the constructs to conduct a multiple regression analysis to test the hypotheses stating the influence of the predictors on young consumers' intention to adopt drones as the medium of delivery. The reliability of the questionnaire was assessed using Cronbach's alpha. We used SPSS 22.0 for data analysis.

Table 2 provides insights into the various constructs (elements) and factors adopted by different authors. Constructs related to relative speed delivery were adopted from Yoo et al. (2018) and Tan and Teo (2000). We used three constructs representing the green image used by Yoo et al. (2018) and Tan and Teo (2000), whereas the other three constructs were taken from Hwang and Kim (2019), Martínez (2015), and Cretu and

Brodie (2007). Perceived risk is divided into two parts: performance and delivery risks. The constructs related to performance risk were obtained from Yoo et al. (2018) and Soffronoff et al. (2016). However, we used the constructs regarding delivery risk proposed by Yoo et al. (2018), Soffronoff et al. (2016), and Lopez-Nicolas and Molina-Castillo (2008). The privacy factor was analysed using three constructs derived from the studies conducted by Yoo et al. (2018), Soffronoff et al. (2016), and Featherman and Pavlou (2003).

Table 2 Elements of study

<i>S. No.</i>	<i>Construct</i>	<i>Factors</i>	<i>Authors (Year)</i>
1	The drone delivers the package promptly	Relative Speed Advantage	Tan and Teo (2000), Yoo et al. (2018)
2	Drone delivery permits to accept a package quickly		
3	The drone helps get a package delivered fast	Green Image (Environment Friendly)	Tan and Teo (2000), Yoo et al. (2018)
4	Drone delivery is an ecological method of getting the package delivered		
5	Drone delivery permits me to collect the package in a more environmentally friendly way		
6	Drone delivery releases less carbon dioxide during delivery		
7	Drone delivery services protect the environment		
8	Drone food delivery services are more likely to be well-established in ecological concerns	Performance risk	Cretu and Brodie (2007) Hwang and Kim (2019) Martínez (2015)
9	Drone food delivery services are more likely to have a considerably high ecological reput		
10	The drone might fail and harm the package it's carrying		
11	The drone might fail and harm the property or injure someone		
12	The drone might deliver my parcel to some other address		
13	The parcel that the drone is carrying might be stolen	Delivery risk	Lopez-Nicolas and Molina-Castillo (2008) Soffronoff et al. (2016) Yoo et al. (2018)
14	The package the drone is carrying might get spoiled by someone		
15	Product delivery may delay or incomplete		

Table 2 Elements of study (continued)

<i>S. No.</i>	<i>Construct</i>	<i>Factors</i>	<i>Authors (Year)</i>
16	Drone delivery will lose my privacy	Privacy	Featherman and Pavlou (2003) Soffronoff et al. (2016) Yoo et al. (2018)
17	Drone delivery may lead to a loss of privacy for me		
18	Drone delivery might not be used in such a way that regards my privacy		
19	If I heard about innovation, I would look for ways to test it	Innovativeness	Jackson et al. (2013) Yoo et al. (2018) Fu and Elliott (2013) Hwang et al. (2019) Watchravesringkan et al. (2010)
20	Among my colleagues, I am usually the first to try out innovations		
21	I like to investigate new information innovations		
22	Drone delivery services seem unique		
23	Drone delivery services seem innovative		
24	Drone delivery services seem creative		
25	If given a chance, I plan to use the drone delivery service frequently	Intention to Adopt	Roca et al. (2009) Leon (2018)
26	I predict I will use a drone delivery service regularly		
27	I intend to use a drone delivery service in the future		
28	If given a chance, I will allow drones to deliver products to me		

The three constructs of innovativeness were procured from Yoo et al. (2018) and Jackson et al. (2013). The other three constructs were extracted from Hwang et al. (2019), Fu and Elliott (2013) and Watchravesringkan et al. (2010). The constructs representing the intention to adopt were obtained from Roca et al. (2009) and Leon (2018).

5 Results and discussion

5.1 Participants profile

330 questionnaires were distributed to the prospective respondents; however, we received 280 questionnaires in return. Of these, we used only 230 questionnaires after cleaning of data. Among the respondents, 138 (60%) were male and 92 (40.0%) were females. The

number of respondents enrolled in graduation was 133 (57.8%), 63 (27.4%) in post-graduation, and 34 (14.8%) in a PhD. Considering the age-demographics, there were 69 (30.0%) respondents in the age group of 18 years to 22 years, 139 (60.4%) respondents were between 22 to 26 years, and in the 26 years to 30 years group, there were 14 (6.1%) respondents, the remaining 8 (3.5%) respondents were between 30 years to 34 years of age. The data collected from five states in India. It was found that the majority of responses were received from Delhi 72 (31.3%), followed by the respondents residing in Uttar Pradesh 54 (23.5%), Madhya Pradesh 52 (22.6%), Uttarakhand 32 (13.9%), and Rajasthan 20 (8.7%). Table 3 represents an overview of the socio-demographic profile of the study respondents.

Table 3 Participant's profile

	<i>Demographics</i>	<i>Number of responses</i>	<i>Percentage (%)</i>
Age	18 years to 22 years	69	30.0%
	22 years to 26 years	139	60.4%
	26 years to 30 years	14	6.1%
	30 years to 34 years	8	3.5%
Gender	Male	138	60.0%
	Female	92	40.0%
Education	Graduation	133	57.8%
	Post-Graduation	63	27.4%
	PhD	34	14.8%
State Living In	Uttar Pradesh	54	23.5%
	Uttarakhand	32	13.9%
	Rajasthan	20	8.7%
	Delhi	72	31.3%
	Madhya Pradesh	52	22.6%

5.2 Reliability statistics

The overall Cronbach's alpha value for the 28 items assessed in this study was 0.861 indicating higher reliability of the items. The literature has shown that value of Cronbach's alpha higher than 0.65 is considered acceptable for reliability (Green et al., 1977; Spector, 1992; Vaske et al., 2017). From Table 4, it is evident that all predictors, including RSA, green image, perceived risk, privacy concern, innovativeness, and intention to adopt, surpassed the threshold of 0.65, thus demonstrating satisfactory reliability for each construct assessed in the study.

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy as shown in Table 5, reported a value of 0.803, greater than the recommended threshold of 0.60 suggested by prior scholars (Hair et al., 2018; Anthoine et al., 2014; Hutcheson and Sofroniou, 1999). Additionally, the Bartlett's Test of sphericity was significant at the 5% level of significance ($\chi^2 = 4256.714$, $p < 0.05$), further supporting the suitability of the data for exploratory factor analysis. Furthermore, communalities, which should ideally be higher

than or equal to 0.40, ranged from 0.493 to 0.924 for all variables, meeting the criterion for continuing with exploratory factor analysis.

Table 4 Reliability statistics

<i>S. No.</i>	<i>Determinants</i>	<i>Cronbach's alpha value</i>	<i>Items</i>
1	Relative speed advantage	0.752	3
2	Green image	0.920	6
3	Perceived risk	0.727	6
4	Privacy concern	0.891	3
5	Innovativeness	0.895	6
6	Intention to adopt	0.885	4
Overall Cronbach's alpha value		0.861	28

Table 5 KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.803
Bartlett's Test of Sphericity	Approx. Chi-Square	4256.714
	df	378
	Sig.	0.000

Table 6 presents the factors extracted from the exploratory factor analysis, along with their respective factor loadings, average variance extracted (AVE), composite reliability, and Cronbach's alpha values. The identified factors include green image, innovativeness, intention to adopt, privacy concern, performance risk, delivery risk, and RSA. Each factor comprises various items, and their factor loadings indicate the strength of association between the items and their respective factors. For instance, the factor loadings for the constructs of green image range from 0.782 to 0.884, representing a strong relationship with the green image factor. Similarly, innovativeness items exhibit factor loadings between 0.719 and 0.945, indicating their strong association with the innovativeness factor. The factor loadings for items of intention to adopt ranged from 0.773 to 0.853, while privacy concern, performance risk, delivery risk, and RSA items exhibit factor loadings between 0.651 and 0.923, emphasising their respective relationships with their corresponding factors.

Moreover, Cronbach's alpha values, which assess the reliability of the constructs, ranged from 0.752 to 0.920, indicating high reliability. Additionally, composite reliability values, which measure the extent to which the indicators represent their respective constructs, fall between 0.831 and 0.930, surpassing the recommended threshold of 0.65 as suggested by past scholars (Hair et al., 2021; Gu et al., 2019). These high values suggest strong reliability and consistency among the items within each factor.

The AVE for the green image is 0.690, innovativeness is 0.641, intention to adopt is 0.672, privacy concern is 0.812, performance risk is 0.657, the delivery risk is 0.673, and RSA is 0.625, which is higher than the desired threshold value of 0.50. These results indicate that a substantial proportion of the variance in each factor is explained by its concerned items, demonstrating good convergent validity. Overall, the findings suggest that the factors extracted from the exploratory factor analysis exhibit strong internal

consistency, reliability, and convergent validity, thus providing a robust framework for further analysis in the study.

Table 6 Reliability values, average variance extracted and total variance explained

<i>Factor name</i>	<i>Variable</i>	<i>Factor loadings</i>	<i>AVE</i>	<i>CR</i>	<i>CA</i>
Green image	Drone delivery permits me to collect the package in a more environmentally friendly way	0.884	0.690	0.930	0.920
	Drone delivery releases less carbon dioxide during delivery	0.859			
	Drone food delivery services are more likely to be well-established in ecological concerns	0.844			
	Drone delivery services protect the environment	0.818			
	Drone food delivery services are more likely to have a considerably high ecological reput	0.792			
	Drone delivery is an ecological method of getting the package delivered	0.782			
Innovativeness	Drone delivery services seem creative	0.945	0.641	0.914	0.895
	Drone delivery services seem innovative	0.844			
	Among my colleagues, I am usually the first to try out innovations	0.797			
	I like to investigate new information innovations	0.753			
	Drone delivery services seem unique	0.722			
	If I heard about innovation, I would look for ways to test it	0.719			
Intention to adopt	If given a chance, I plan to use the drone delivery service frequently	0.853	0.672	0.891	0.885
	If given a chance, I will allow drones to deliver products to me	0.830			
	I intend to use a drone delivery service in the future	0.821			
	I predict I will use a drone delivery service regularly	0.773			
Privacy concern	Drone delivery will lose my privacy	0.923	0.812	0.928	0.891
	Drone delivery may lead to a loss of privacy for me	0.912			
	Drone delivery might not be used in such a way that regards my privacy	0.867			

Table 6 Reliability values, average variance extracted and total variance explained (continued)

<i>Factor name</i>	<i>Variable</i>	<i>Factor loadings</i>	<i>AVE</i>	<i>CR</i>	<i>CA</i>
Performance risk	The drone might deliver my parcel to some other address	0.850	0.657	0.851	0.832
	The drone might fail and harm the property or injure someone	0.824			
	The drone might fail and harm the package it's carrying	0.754			
Delivery risk	The package the drone is carrying might get spoiled by someone	0.896	0.673	0.860	0.825
	Product delivery may delay or incomplete	0.807			
	The parcel that the drone is carrying might be stolen	0.752			
Related speed advantage	The drone delivers the package promptly	0.878	0.625	0.831	0.752
	The drone helps get a package delivered fast	0.825			
	Drone delivery permits to accept a package quickly	0.651			

Total Variance Explained = 74.023%.

AVE = Average Variance Extracted; CR = Composite Reliability; CA = Cronbach's Alpha.

Some past scholars proposed Fornell-Larcker criterion for checking the discriminant validity (Baah et al., 2021; Pratono, 2018; Ab Hamid et al., 2017). The criterion states that the square root of the AVE is compared with the correlation of the latent elements. The present study exhibits that the correlation value is lower than the square root of the AVE. The AVE square root ranged between 0.791 and 0.901 (Table 7); however, the correlation value ranged between -0.104 and 0.428 (Table 7); hence, discriminant validity was established, and the proposed model was considered to be reliable.

Subsequently, after assessing the measurement model, we proceeded to test the hypotheses utilising multiple regression analysis employing the enter method. This approach involves entering all predictor variables into the regression model simultaneously to examine their collective impact on the outcome variable. By utilising this method, in this study, we aimed to assess the individual contributions of factors innovativeness (Innov), green image (GI), RSA, performance risk (PR), delivery risk (DR), and privacy concern (PC) as predictors influencing the intention to adopt drone delivery.

The multiple regression model found an overall fit for the study, as shown in Table 8, with an R^2 value of 0.252, which means the independent variables in this study (RSA, green image, performance risk, delivery risk, privacy concern, and innovativeness) explained 25.2% of the variation in the dependent variable intention to adopt drones as a medium of delivery. The adjusted R^2 is 0.232 which is very close to R^2 . This indicates the goodness of fit for the model. The value of the Durbin-Watson test is 2.023, which states the assumption that the residual values are independent has been fulfilled. Therefore, we have deemed the model fit for this study.

Table 7 Discriminant validity

	<i>GI</i>	<i>Innov</i>	<i>ITA</i>	<i>PC</i>	<i>PR</i>	<i>DR</i>	<i>RSA</i>
<i>GI</i>	0.831						
<i>Innov</i>	0.255	0.801					
<i>ITA</i>	0.028	0.115	0.820				
<i>PC</i>	-0.020	-0.104	0.115	0.901			
<i>PR</i>	0.254	0.162	0.428	0.021	0.811		
<i>DR</i>	0.332	0.271	0.161	-0.006	0.080	0.820	
<i>RSA</i>	0.030	0.011	0.265	0.075	0.241	0.052	0.791

GI = Green Image; **Innov** = Innovativeness; **ITA** = Intention to Adopt; **PC** = Privacy Concern; **PR** = Performance Risk; **DR** = Delivery Risk; **RSA** = Relative Speed Advantage.

Table 8 Model summary and coefficients

<i>Model</i>	<i>Variable</i>	<i>Standardised Beta (β)</i>	<i>Std. Error</i>	<i>t</i>	<i>Sig.</i>	<i>Collinearity statistics</i>	
						<i>Tolerance</i>	<i>VIF</i>
1	(Constant)	1.251	0.392	3.191	0.002		
	Relative speed advantage	0.174	0.067	2.610	0.010	0.934	1.071
	Green image	-0.134	0.061	-2.212	0.028	0.817	1.224
	Performance risk	0.356	0.055	6.497	0.000	0.869	1.150
	Delivery risk	0.152	0.062	2.459	0.015	0.849	1.177
	Privacy concern	0.083	0.049	1.686	0.093	0.983	1.018
	Innovativeness	0.056	0.067	0.841	0.401	0.875	1.143

Model Summary: $R = 0.502$; $R^2 = 0.252$; Adjusted $R^2 = 0.232$; Durbin-Watson = 2.023

Dependent Variable: Intention to Adopt.

We conducted a multicollinearity test for the predictor variables to ensure the reliability of our regression model. Following the criteria suggested by Salmerón et al. (2018) and Daoud (2017), we deemed the model acceptable as all variance inflation factor (VIF) values were below 5, and tolerance values were above 0.2, indicating the absence of multicollinearity issues. This assessment provides confidence in the independence of the predictor variables within our proposed model. With no multicollinearity concerns identified, we can proceed with the multiple regression analysis. Table 8 provides the statistics of collinearity.

The results of multiple regression analysis revealed some important facets. We administered the analysis on six variables out of which RSA, green image performance risk, and delivery risk are the variables found to be significant at a 5% level of significance. In Table 8, the Standardised Beta (β) coefficients stipulate that the RSA ($\beta = 0.174$, $t = 2.610$, $p < 0.05$), performance risk ($\beta = 0.356$, $t = 6.497$, $p < 0.05$), and delivery risk ($\beta = 0.152$, $t = 2.459$, $p < 0.05$) are the significant influencing predictors of young consumers' intention to adopt drones as a delivery medium. The regression analysis revealed that green image significantly influences young consumers' intention to

adopt drones as a delivery medium in India, with a negative impact ($\beta = -0.134$, $t = -2.212$, $p < 0.05$). This suggests that a positive perception of environmental friendliness or sustainability associated with drone delivery services may not necessarily enhance adoption intentions among Indian young consumers. Further, privacy concern ($\beta = 0.083$, $t = 1.686$, $p > 0.05$) and innovativeness ($\beta = 0.056$, $t = 0.841$, $p > 0.05$) were found to have no significant impact on the intention to adopt drones among Indian young consumers.

The results of the multiple regression analysis suggest that privacy concerns and perceived innovativeness of drone delivery services do not significantly impact the adoption intentions of young consumers in India. However, the study confirms that RSA, performance risk, and delivery risk are significant predictors influencing the intention to adopt drones as a delivery medium among Indian young consumers. These findings align with previous research (Yoo et al., 2018; Joerss et al., 2016; Mathew et al., 2021), supporting hypotheses H3, H4, and H5. Therefore, it can be concluded that results of the present study are consistent with past findings, reinforcing the importance of factors like RSA, performance risk, and delivery risk in shaping the adoption intentions of young consumers regarding drone delivery services.

The green image found to have significant impact; however, this impact was negative with adoption of drones as the delivery medium by young consumers in India. Thus, we do not accept the hypothesis H2. Past scholars found a significant positive influence of green image on drone delivery adoption (Mathew et al., 2021; Hwang and Kim, 2019; Yoo et al., 2018). The findings of this study contradict these studies as we do not find the positive association. One possible explanation could be a perception of green initiatives as incompatible with the use of drones for delivery due to concerns related to noise pollution, airspace congestion, or even potential harm to wildlife. While environmental concern is increasingly valued worldwide, it may not necessarily convert directly into acceptance of drone for delivery purposes in India, where concerns about job displacement and privacy might offset the perceived environmental benefits. Therefore, the negative association between the green image and drone delivery adoption among young Indian consumers highlights the importance of considering diverse socio-cultural contexts.

The study conducted by Mathew et al. (2021) in the Indian context and other global research by scholars such as Hwang et al. (2021), Kim et al. (2021), and Yoo et al. (2018) found a significant positive association between innovativeness and the intention to adopt drone delivery. However, our findings regarding innovativeness do not support these past studies. It is possible that demographic or geographic differences among the targeted consumers in our study compared to those in previous research may account for this disparity. As it is considered that population in developing countries like India are not widely aware of the innovation and they are certainly late adopters of innovation. Additionally, the marketing strategies employed by companies presenting drone delivery services in India may not effectively communicate the innovative features of the technology or may fail to relate with the target population. Without proper awareness and understanding of the potential benefits of drone delivery, consumers may not observe innovativeness as a compelling factor in their adoption decisions. Consequently, we do not accept hypothesis H1, as our results indicate that innovativeness is not a significant predictor of young Indian consumers' intention to adopt drone delivery.

Similarly, our study does not find support for the influence of privacy concerns on the intention to adopt drone delivery among young Indian consumers, contrary to findings

from previous research conducted by Mathew et al. (2021) and Khan et al. (2019). Despite their significant association in past studies, privacy concerns do not emerge as significant predictors in our analysis. Therefore, hypothesis H6 is not accepted in our study.

Furthermore, the ANOVA results shown in Table 9 validates that the regression model significantly predicts the dependent variable (intention to adopt drones) at a 5% level of significance. This indicates that the predictors included in the model collectively contribute to explaining the variation in young consumers' intention to adopt drone delivery in India.

Table 9 ANOVA

<i>Model</i>		<i>Sum of squares</i>	<i>Df</i>	<i>Mean square</i>	<i>F</i>	<i>Sig</i>
1	Regression	49.329	6	8.222	12.544	0.000
	Residual	146.153	223	0.655		
	Total	195.483	229			

6 Conclusion

The study was conducted to examine the influence of the factors of drone delivery on young consumers' intention to adopt drones as the medium of delivery in the Indian context. We combined the diffusion of innovation and perceived risk theory in this study. To meet the objective six research hypotheses consisting of the predictors-innovativeness, green image, RSA, performance risk, delivery risk, and privacy concern were developed and tested.

We conclude that the RSA, performance risk, and delivery risk have a significant positive influence on young consumers' intention to adopt delivery using drones. Whereas; we also conclude that the green image has a negative influence on the intention to adopt drone delivery to young consumers in India. Further, the innovativeness and privacy concerns do not have a significant influence on young consumers' drone delivery adoption intention.

6.1 Implications of this study

Very few studies were conducted stating the utilisation of drones for commercial deliveries. Drones have emerged as an innovative way of delivering packages. In India, permission for testing the delivery through drones was sanctioned in June 2020 (Gadgets 360°, 2020). Although drone delivery is commenced for public use in many countries, and is still in the testing phase. There is a huge scope for innovation and technology companies to contribute their efforts in deliveries through drones. We addressed the various determinants of drone delivery acceptance; these determinants might help companies encounter young consumer issues regarding drone deliveries. The study may help companies in framing drone delivery policies.

The researchers can explore more on the deliveries through drones in India, as it is in the testing phase, the researchers can explore customer satisfaction regarding this

innovative delivery method. As we commenced this study in the early phase of drone delivery, we were not able to identify customer satisfaction. Once drone delivery is allowed for public use post-testing, the researchers may have a lot of scopes to provide input in this field. We considered the technology acceptance model with this study; however, researchers may explore some more theories and models to contribute to this field.

6.2 Contribution to society

The study makes several substantial contributions to society, particularly in the context of environmental concern and technological innovation. Firstly, by emphasising on the potential of drone delivery as an innovative method for commercial deliveries, the research sheds light on a possible ground for reducing carbon emissions. Drones release less carbon dioxide compared to traditional delivery vehicles, making them environmentally friendly and contributing to efforts aimed at battling climate change. Secondly, the study emphasises the role of drone delivery in facilitating safe and contactless delivery methods, particularly relevant in the context of public health concerns such as the COVID-19 pandemic. By minimising physical contact during the delivery process, drones offer a safer alternative for both delivery workers and receivers, reducing the risk of transmission of infectious diseases. This aspect of drone delivery aligns with broader efforts to promote public health and safety, thus enhancing societal well-being. However, this study also reveals a potential difference between societal perceptions of environmental friendliness and the adoption of drone delivery. Despite the environmental benefits of drone delivery, the research suggests that there may be a lack of awareness or understanding among the general public regarding the importance of environmental safety. This highlights the need for educational campaigns and initiatives aimed at raising awareness about environmental issues and promoting sustainable behaviours. The importance of environmental safety should also be included in the courses taught to the young generation.

6.3 Theoretical contribution

The study has explored the combination of Diffusion of Innovation and perceived risk theory as basis for development of theoretical framework. We found that RSA, performance risk and delivery risk do influence the young consumers intention to adopt drone delivery. This combination improves our understanding of the adoption process by highlighting the interplay between perceived risks associated with adopting new technologies and the innovative features that drive adoption. The identification of RSA highlights the importance of technological advancements in influencing adoption decisions, while the recognition of performance and delivery risks acknowledges the potential concerns and uncertainties that consumers may have regarding the reliability and safety of drone delivery services. The researchers can further study the influence of such factors using the same or different combination in their future studies. Our study found that the combination of perceived risk theory and diffusion of innovation provides theoretical foundation and contribute the importance of factors of perceived risk and innovation for further research.

7 Limitations of the study

Some of the limitations of our study are- Firstly, our study was geographically restricted to a few of the states in India due to constraints related to cost and time. Researchers may conduct studies in different locations across the world. They may conduct a comparative study to analyse the behaviour of consumers in different locations and environments. Secondly, a multi-dimensional cross-cultural study is also proposed for the future on the attitude of consumers toward drone delivery. Thirdly, we used convenience sampling due to the pandemic. Else, the use of some other sampling technique would have been considered. Fourthly, in this study, we targeted young consumers only. However, further studies may focus on other age groups, they may conduct this study on generation X, Z, or baby boomers, or the population as a whole.

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