

Why Would Customers Engage in Drone Deliveries?

Full Paper

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Abstract

Modern technologies, such as autonomously flying vehicles respectively drones, have won attention and are on the edge to change incumbent industries. Whereas drones are currently used in a variety of industry landscapes, such as filmmaking and agriculture, we focus particularly on the shipping industry. In this paper, we take the customers' perspective and evaluate why customers would engage in drone deliveries. We investigate the influence of trust, perceived risk, and motivational factors and propose a research model that seeks to explain the customers' intention. This study uses survey data ($n = 116$) and structural equation modeling. Our results provide empirical evidence that trust and perceived risk, as well as specific motivational factors influence the customers' intention to engage in drone deliveries. Further, our paper encourages researchers, designers, and developers to build the respective IS including the expectations of future drone users. Therefore, academic and practical implications are discussed.

Keywords

Autonomously Flying Vehicles, Drones, Delivery, Customer Perspective.

Introduction

Innovative unmanned aerial vehicles, commonly known as drones, are about to change incumbent industries (Manjoo 2016). Drones have been around for quite a while and are progressively used in industry landscapes, ranging from agriculture, military to filmmaking (Michał et al. 2016). Nowadays, firms realize a potential commercial use of the fully or intermittently autonomously flying vehicles. In other words, drones have won attention from investors and manufacturers alike, with the latter working on an array of commercial applications. Particularly the shipping industry assigns a huge potential and future competitive advantage to drone deliveries (Floreano and Wood 2015). Contemporary businesses incorporating drones as a tool for deliveries are expected to disintermediate the traditional standard delivery methods (Chalupníčková et al. 2014). A recent study by PwC estimated the potential market value of drone powered solutions at over \$127bn (Michał et al. 2016). In this regard, various shipping firms, such as UPS or DHL, and e-commerce retailers, such as Amazon, are currently testing and fostering drone deliveries (Chalupníčková et al. 2014). The vision of their drone projects is not only to fly to remote locations to deliver emergency supplies, but to substitute the traditional standard delivery at some indefinite future date and therefore reshape the entire delivery industry. According to PwC, the transportation industry will turn to drones for their speed, convenience, accessibility, and low operating costs compared with other means of transportation that require human labor (Michał et al. 2016). Whereas these advantages seem perspicuous for the transportation industry, they also seem advantageous to the final customers, who might benefit from lower prices, faster deliveries, and even protect the environment when requesting ecologically compatible low-emission drone deliveries. In this regard, especially young individuals of the millennials generation seem to be the predominant user group

respectively earlier adopters of drone technology. In our study, we want to understand how the customers acknowledge the new technology respectively what would drive them to engage in future drone deliveries. Therefore, our research question is: RQ: What drives customers to engage in future drone deliveries?

In our study, we propose a research model, which investigates the effect of trust, risk, convenience, time-saving, environmental cautiousness, financial motives, and personal innovativeness on the customers' intention to engage in drone deliveries. In this regard, existing literature, such as Koufaris and Hampton-Sosa (2004) and McKnight et al. (1998, 2002), identified trust as a critical factor of the customers' intention to engage in new technologies. Trust, as an influential factor of the intentions has long been empirically validated in online businesses, such as in the e-commerce industry. For example, Jarvenpaa et al. (1999) assessed that high levels of trust encourage online engagement intentions, whereas Hoffman et al. (1999) showed that the lack of trust is one of the main reasons why people do not engage in new technologies. Based on this logic, fellow researchers identified perceived risk as a discouraging factor of costumers' intentions (Kim et al. 2008). Motivational factors, on the other hand, are in addition identified as potential drivers of user behavior. In this regard, various research streams theorize economic, environmental, and social motives as influential factors on user behavior (Lewis and Weigert 1985; Zaleskiewicz 2001)

Hence, in our study we contribute to literature and point out practical implications. First and foremost, we contribute to the field of IS by complementing the theory of trust and risk-based decision-making regarding modern technologies that foster a technological shift (Gefen 2000; Kim et al. 2008). In other words, by incorporating trust and perceived risk in our study, we shed light on distinct antecedents of user intentions regarding the engagement of drone deliveries. Second, we add to the understanding of the transportation service industry by evaluating the costumers' perspective on drone deliveries (Chalupníčková et al. 2014; Floreano and Wood 2015). Finally, by incorporating personal attributes, such as perceived convenience, time-saving, environmental cautiousness, financial motives, and personal innovativeness, we also contribute to adoption theory by reevaluating the given antecedents in a real-world context (Straub 2009).

The remainder of this study is organized as follows: In Section 2, we present the related work on motivational factors, including trust and perceived risk, and state our research hypotheses. In Section 3, we outline our research design and propose our research model. In Section 4, we present our research methodology. In Section 5, we assess the measurement model, perform structural equation modeling, and present our study results. Section 6, determines our study by discussing possible implications of our findings.

Literature Review and Hypotheses Development

Drone Deliveries

A large variety of different flying machines exist, such as airplanes, helicopters, and lately – drones. Firms like Amazon, UPS, or DHL see huge benefits in using unmanned flying drones to deliver goods to their customers. In 2016, the first package was delivered to a customer via Amazon drone delivery (Chalupníčková et al. 2014; Manjoo 2016). While the technology is still at an early stage, researchers and analysts believe that it is only a matter of time until drones will frequently deliver packages to customers in an environmental friendly, quick, and riskless manner (Cohan 2016; Manjoo 2016).

Trust and Perceived Risk

Research in the information systems (IS) field has identified trust as a primary predictor of technology usage and a fundamental concept for understanding user perceptions of modern technology (Li et al. 2008). Overall, trust is one of the most contradictory, complex, and confusing concepts (McKnight and Chervany 2001; Shapiro 1987) that has been studied incessantly from different perspectives in numerous disciplinary fields, such as psychology (Geyskens et al. 1996), sociology (Luhmann 1979; Rousseau et al. 1998), philosophy (Hosmer 1995; Porter 1996), and economics (Fehr 2009). Irrespective of the field, researchers state that trust is multi-faceted, context-dependent, and has several connotations (Gefen and Straub 2004; McKnight et al. 1998). However, there is no consensus definition of trust in the context of new technologies. Nowadays, in IS research, scholars are rethinking how the rapid progress of technology

has affected concepts such as trust. In consensus, researchers find that the need for trust increases with the rising dependency on other entities, such as new technologies, due to higher transaction complexity and uncertainties. In this regard, users must overcome perceptions of risk and uncertainty before using a novel technology. For the purpose of this paper, we follow the definition of McKnight et al. (1998, 2002) regarding initial trust as trust in an unfamiliar entity. In other words, we understand trust as the willingness to be vulnerable to the actions and respective consequences of new technology. In this regard, we hypothesize:

H1: Increased degrees of trust in drone deliveries will increase the customers' intention to engage in drone deliveries.

H2: Increased degrees of trust in drone deliveries will decrease the customers' perceived risk of drone deliveries.

Nicolaou and McKnight (2006) define perceived risk as the extent to which one believes uncertainty exists about whether desirable outcomes will occur. We adopt this definition and understand perceived risk as users' belief about potential negative outcomes from using modern technology. Consequently, this definition includes a part of Sitkin and Pablo's (1992) broader perceived risk concept, which is formed by outcome expectations, outcome uncertainty, and outcome potential. Negative outcomes that might occur by using drones as a delivery method could be delivery failures due to technology malfunctioning, hacking, or theft, as well as delays due to bad weather conditions or airspace restrictions. In general, perceived risk is an important barrier for unfamiliar customers who are considering the usage of new technology (Jarvenpaa et al. 1999; Pavlou 2001). Prior research and the peculiarities of modern shipping methods encouraged us to investigate the implications of trust and perceived risk on the customers' intention to engage in drone deliveries. In this regard, we hypothesize:

H3: Increased degrees of perceived risk of drone deliveries will decrease the customers' intention to engage in drone deliveries.

Financial Motivation

One can argue that cost savings account for an individual's self-benefit and might therefore be an important determinant of new technologies (Möhlmann 2015). In fact, many research contributions have been addressing the adoption of new technology predominantly due to economic reasons respectively to save money compared to using outdated technologies (Palmer et al. 1995; Reinganum 1981). In other words, people would opt for automated drone deliveries in order to save money compared to traditional delivery methods that still require human capital to be executed (Cohan 2016). In this regard, analysts argue that delivery automation, using drones and robots, presents the "biggest cost reduction" opportunity for popular retailers, such as Amazon (Cohan 2016), with an estimated 80% cost savings coming to last-mile shipping, or the shipment between the final storage hub and the customers' homes – shipping costs might decrease accordingly (Manjoo 2016). In this regard, we hypothesize:

H4: Increased degrees of financial motivation will increase the customers' intention to engage in drone deliveries.

Environmental and Convenience Motivation

Environmental motivation is likely to be a potential driver of user behavior concerning new technologies (Hungerford and Volk 1990; Michał et al. 2016). In this regard, fostering environmental motivation to perform pro-environmental behaviors is an implicit goal of many environmental programs and new technologies that have been studied for many years by fellow researchers, such as Hungerford and Volk (1990), Shrivastava (1995). Especially in times of growing pollution and disputable sustainable technologies, alternative forms of green, economical or sustainable technologies become increasingly important (Lin and Ho 2017). Indeed, electrically powered drone solutions are argued to have a positive environmental impact compared to traditional shipping methods that still heavily rely on delivery trucks for the last mile (Craig et al. 2007). Drone delivery, however, could replace daily shopping of groceries and therefore save the customers' time. In addition, besides reducing the customers' need to continuously drive to the grocery store, drone deliveries are reducing carbon emission, as battery-powered drones do not emit diesel pollution. Another convenience respectively environmental advantage is relief of

congestion on already crowded roads by substituting delivery trucks with drones. Lastly, the sheer convenience of drone-enabled online shipping without any additional effort might encourage customers to buy more and therefore boost the economy. As a result, many customers are in favor of sustainable technologies that can simplify their lives and in addition are good for the environment. In this regard, we hypothesize:

H5: Increased degrees of environmental motivation will increase the customers’ intention to engage in drone deliveries.

H7: Increased degrees of convenience motivation will increase the customers’ intention to engage in drone deliveries.

Time-saving Motivation

Literature has identified potential time-savings as a factor that influences customers’ online shopping behavior (Jarvenpaa and Todd 1997). Overby and Lee (2006) stated in their study about online shopping behavior that time-saving as a utilitarian value is a factor that influences the preference and intention to use a new technology. Their findings can be adapted to our research setting that investigates the future use of a new technology. Featherman and Pavlou (2003) focused on the perceived time risk of e-services and defined it as the potential time loss if customers make bad purchasing decisions. Contrary, drone deliveries will save time by reducing the delivery time between the actual order and final delivery of the product (Michał et al. 2016). Therefore, we hypothesize:

H6: Increased degrees of time-saving motivation will increase the customers’ intention to engage in drone deliveries.

Personal Innovativeness in IT

Personal innovativeness stems from the diffusion of innovations research and describes individuals which are early to adopt an innovation (Rogers 1995). Agarwal and Prasad (1998) applied and specified this personality trait to the domain of IT and conceptualized it as the willingness to try out and experiment with any new technology (Agarwal and Prasad 1998). As delivery with drones is not yet commonly established and considering the aforementioned definition of innovativeness, we argue that individuals who have the innate propensity to be innovative (Agarwal and Karahanna 2000) are more likely to engage in drone deliveries. In this regard, we hypothesize:

H8: Increased degrees of personal innovativeness in IT will increase the customers’ intention to engage in drone deliveries.

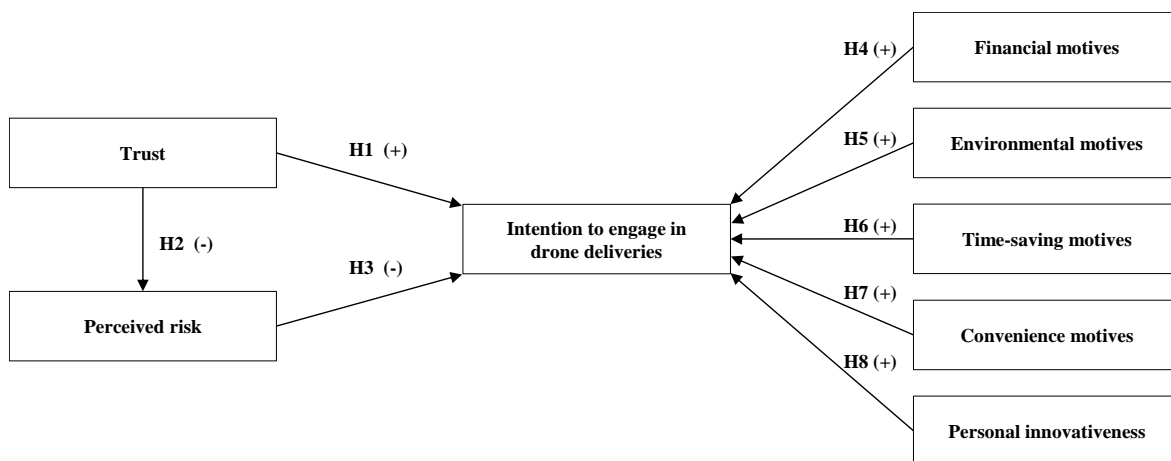


Figure 1. Proposed Research Model

Finally, after we developed our hypotheses based on our literature review, we propose our research model. Figure 1 gives an overview of all constructs, hypotheses, and relationships used in our study.

Methodology

Measurement Development and Data Collection

We designed an online survey to assess the drivers of the customers' intention to engage in drone deliveries. In order to gather appropriate data, we decided to use the survey method as it is an established tool to adequately assess personal attitudes and beliefs. Moreover, the applied survey method builds a great foundation for an extended research on the topic, for example, controlled laboratory and contextual field studies with behavioural measures (Fang et al. 2014). Our online survey contained 51 questions, covering eight constructs, controls, and demographic data. Previous research recommends including control variables regarding financial attributes (e.g., income, profession), social attributes (e.g., marital status), experience-based attributes (e.g., age), the intention to engage in new technologies (Fang et al. 2014), and personality-orientated attributes (e.g., education, gender), which could theoretically bias the users' intention regarding the engagement of new technologies (Kim et al. 2008).

	Count	%		Count	%
Age			Marital status		
16 to 20 years	16	13.79	Single	101	87.07
21 to 25 years	64	55.17	Married	11	9.48
26 to 30 years	17	14.66	Separated	2	1.72
31 to 35 years	19	16.38	Divorced	2	1.72
Income			Profession		
less than US\$20,000	67	57.76	Student	70	60.34
between US\$20,000 and US\$29,999	13	11.21	Employed for wages	24	20.69
between US\$30,000 and US\$39,999	11	9.48	Self-employed	12	10.34
between US\$40,000 and US\$49,999	3	2.59	Out of work	10	8.62
between US\$50,000 and US\$59,999	7	6.03	Retired		
between US\$60,000 and US\$69,999	3	2.59	Education		
between US\$70,000 and US\$79,999	1	0.86	Less than high school	2	1.72
between US\$80,000 and US\$89,999	6	5.17	High school graduate	63	54.31
between US\$90,000 and US\$99,999	1	0.86	Associate degree	18	15.52
above US\$100,000	4	3.45	Bachelor's degree	30	25.86
Gender			Master's degree	2	1.72
Male	60	51.72	Doctorate degree	1	0.86
Female	56	48.28			

Table 1. Participants Characteristics (N = 116)

The survey used a standardized response format – 7-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (7). Table A1 in the Appendix displays the full item catalogue, including the constructs, the loadings, the corresponding item codes, as well as the respective references. The study was conducted in early 2017, utilizing the knowledge of the crowd while targeting millennials on *Clickworker* (Buhrmester et al. 2011). By the due date, 116 participants completed the survey – see Table 1.

Measurement Model

To evaluate the reliability of our measurement model, we analyzed the factor structure of our dataset (N = 116). We evaluated the validity and reliability of our eight constructs by following the recommendations from Hair et al. (2014) to determine internal consistency.

	CoMo	EnMo	FiMo	Int	PIIT	PR	TiMo	Tr
Cronbach's Alpha	0.786	0.873	0.937	0.950	0.868	0.874	0.917	0.920
rho_A	0.838	1.071	1.023	0.954	0.883	0.889	0.926	0.928
Composite Reliability	0.871	0.914	0.958	0.968	0.919	0.908	0.947	0.941
Note: Tr = Trust in drone deliveries, PR = Perceived risk of drone delivery, FiMo = Financial motives, CoMo = Convenience motives, PIIT = Personal innovativeness, Int = Intention to engage in drone deliveries, EnMo = Environmental motives.								

Table 2. Descriptive Statistics and Reliability Index

In this regard, we found sufficient reliability for all our constructs, as the calculated Cronbach's Alpha, rho_A, and Composite Reliability scores are all above the threshold of 0.70 (Fornell and Larcker 1982).

In addition, we assessed construct validity by calculating convergent validity and discriminant validity (O’Leary-Kelly and J. Vokurka 1998). Discriminant validity is defined as the degree to which measures of different latent variables are unique (O’Leary-Kelly and J. Vokurka 1998). In this regard, discriminant validity is considered acceptable when the square roots of the AVE are greater than the correlations among the research constructs (Fornell and Larcker 1982). Furthermore, the variance explained by each construct is greater than the measurement error variance.

	AVE	CoMo	EnMo	FiMo	Int	PIIT	PR	TiMo	Tr
CoMo	0.694	0.833							
EnMo	0.780	0.278	0.883						
FiMo	0.885	0.214	0.481	0.941					
Int	0.909	0.646	0.322	0.214	0.954				
PIIT	0.792	0.365	0.170	0.117	0.537	0.890			
PR	0.665	-0.392	-0.098	-0.047	-0.574	-0.390	0.816		
TiMo	0.857	0.437	0.318	0.140	0.445	0.254	-0.265	0.926	
Tr	0.761	0.649	0.268	0.234	0.718	0.454	-0.581	0.395	0.872

Note: AVE = Average Variance Extracted. Diagonal elements of the last eight columns represent the square root of the AVE. Off diagonal elements are the correlations among latent constructs.

Table 3. Convergent and Discriminant Validity Coefficients

Convergent validity, on the other hand, is the extent to which the measures for an item act as if they are measuring the underlying theoretical construct because they share variance (McKnight et al. 2002). Accordingly, convergent validity is considered acceptable when the Average Variance Extracted (AVE) is greater than 0.50 for all constructs (Fornell and Larcker 1982). The results of our study indicate that there is strong evidence of construct validity in our dataset. Table 3 demonstrates that there are no discriminant validity concerns in our data. Finally, we checked for common method bias (CMB) using SPSS. We used the Harman's single factor test to confirm that no single component explains more than 50% of the total variance (Harman's single factor test of our dataset: 34.28%). Based on the SPSS analysis, we find that CMB is unlikely a potential concern in our data.

Structural Model Assessment

The major goal of this study was to identify the drivers of the customers’ intention to engage in drone deliveries. Therefore, after we confirmed the factor structure of our dataset, we conducted PLS-SEM to analyze both measurement and structural relationships in our research model (Gefen et al. 2011). Our analysis confirms that the collected data adequately fits our research model. The given items share only little residual variance and indicate unidimensionality of the SEM approach. The results of the SEM are presented in Table 4 and visually summarized in Figure 2. The explanatory power of our research model was assessed by examining the significance levels of the corresponding path coefficients. The results show support for five hypotheses.

Hypothesis	Path	Path coefficient	Sample Mean	T Statistics	p-value
H1	0.312	0.308	0.095	3.275	***
H2	-0.581	-0.586	0.061	9.471	***
H3	-0.157	-0.159	0.073	2.159	*
H4	0.020	0.020	0.072	0.282	0.778
H5	0.100	0.103	0.075	1.322	0.186
H6	0.067	0.063	0.060	1.123	0.261
H7	0.232	0.233	0.085	2.742	**
H8	0.187	0.188	0.068	2.733	**

Note: * significant at a .05 level, ** significant at a .01 level, *** significant at a .001 level

Table 4. Results of Path Coefficients

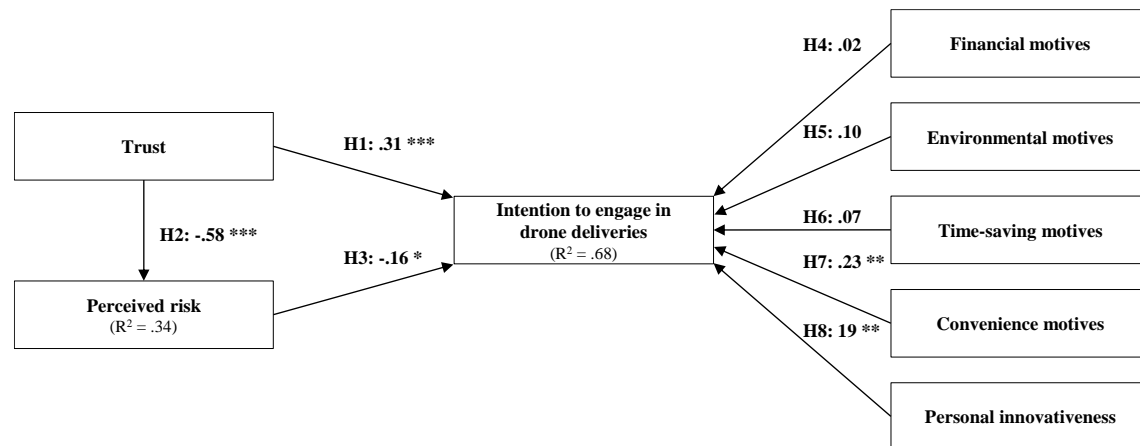


Figure 2. PLS Analysis with Standardized Path Coefficients

The construct of trust has the highest positive effect on the intention to engage in drone deliveries (H1). Further, trust has a direct negative effect on perceived risk (H2) and a significant indirect effect on the customers' intention ($p = 0.041^*$). Perceived risk has a negative effect on the intention (H3), while financial (H4), environmental (H5), and time-savings motives (H6) do not have a significant effect. However, the constructs of convenience (H7) and personal innovativeness (H8), as hypothesized do have a direct positive effect on the intention. For an overview of our research model with all path coefficients refer to Figure 2. Finally, our model explains 68.2% of the customers' intention to engage in drone deliveries.

Discussion, Conclusion, and Implications

The goal of this study was to investigate what motives customers to engage in drone deliveries. To our knowledge, this study is the first that examines the customers' intention to use drones in addition to standard delivery methods. We established and validated a research model based on existing literature and conducted a survey with 116 participants. The CFA validated our measurement models and showed an overall acceptable model. The PLS-SEM analysis outlined that five out of our eight hypotheses were supported.

Trust in drone deliveries has a significant effect on the intention to engage in drone deliveries. This is no surprise, as trust is a primary predictor for technology use. If customers do not trust the technology behind drone deliveries, they are less likely to use it and stick with the traditional standard delivery method. Therefore, high trust is essential for the engagement in drone deliveries. Further, the negative effects of risk partially mediates trust on the intention. Customers that see a risk of a potential loss or damage of their goods through the use of the technology, will refrain from using it. Interestingly, financial and time-saving motives do not have a significant effect on the decision to engage in drone deliveries. While one of the advertised advantages of drone deliveries is the short time interval between the actual order and delivery, our analysis showed no significant relationship between the constructs (Michał et al. 2016). Convenience motives have a positive effect on the intention. When customers believe that the new technology is convenient and reduces effort they are more likely to engage with it. As expected, personal innovativeness has a positive effect on the intention to engage in drone deliveries. This finding is in line with innovation and adoption literature (Agarwal and Karahanna 2000; Yi et al. 2006).

We provide both theoretical and practical contributions. First, we contribute to the theoretical topic of trust and risk in IS by establishing a research model that can be used to understand the customers' motivation behind drone deliveries. Second, firms that are already using or actively developing drone deliveries can use our findings to enrich their understanding in what customers perceive as critical factors. Advertisement campaigns, for example, should focus on increasing customers' trust in drone deliveries. If customers are afraid that drone deliveries pose a risk that their packages could be damaged or lost, they might not engage with this new technology. Even though our results showed no significant effect of environmental motives on the intention to use drone deliveries, customers just might not yet

realize those benefits. It might be a good strategy to outline the environmental benefits of drone deliveries in order to shape the perception of the firm towards being more environmental friendly.

This study contributes to the existing body of knowledge, but has also several limitations concerning generalizability. First, the majority of our sample were mostly young and highly educated people whose behavior could differ from the average population. Young people tend to be more innovative and are quicker in accepting and using new technologies such as drone deliveries. Second, all of our participants came from western countries, therefore, future research could focus on cultural differences and test different age groups. Lastly, drone deliveries are a phenomenon that is only available for customers in specific areas. None of the participants has yet engaged in an actual drone delivery. Therefore, we recommend to validate our findings in a field experiment with actual users of the technology.

REFERENCES

- Agarwal, R., and Karahanna, E. 2000. "Time Flies When You're Having Fun: Cognitive Absorption and Beliefs about Information Technology Usage," *MIS Quarterly* (24:4), pp. 665–694.
- Agarwal, R., and Prasad, J. 1998. "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology," *Information Systems Research* (9:2), pp. 204–215.
- Buhrmester, M., Kwang, T., and Gosling, S. D. 2011. "Amazon's Mechanical Turk: A New Source of Inexpensive, Yet High-Quality, Data?," *Perspectives on Psychological Science* (6:1), pp. 3–5.
- Chalupníčková, H., Bahenský, P., Sýkora, V., and Heralová, D. 2014. "The Use of Drones in Air Cargo Transportation," *Economy & Society & Environment* (4509), pp. 1–6.
- Cohan, P. 2016. "How Amazon's Investments Could Wipe Out Retail Stores," *Forbes.com*.
- Craig, L., Krewski, D., Samet, J., Shortreed, J., and van Bree, L. 2007. *Strategies for clean air and health Journal of toxicology and environmental health. Part A* (Vol. 70).
- Davis, F., Bagozzi, R., and Warshaw, P. 1989. "User acceptance of computer technology: a comparison of two theoretical models," *Management science* (35:8), pp. 982–1003.
- Fang, Y., Qureshi, I., Sus, H., Mccole, P., Ramsey, E., and Lim, K. H. 2014. "Trust, Satisfaction, and Online Repurchase Intention: The Moderating Role of Perceived Effectiveness of E-Commerce Institutional Mechanisms," *MIS Quarterly* (38:2), pp. 407–427.
- Featherman, M. S., and Pavlou, P. A. 2003. "Predicting e-services adoption: A perceived risk facets perspective," *International Journal of Human Computer Studies* (59:4), pp. 451–474.
- Fehr, E. 2009. "On the Economics and Biology of Trust," *Journal of the European Economic Association* (7:2–3), pp. 235–266.
- Floreano, D., and Wood, R. J. 2015. "Science, technology and the future of small autonomous drones," *Nature* (521:7553), pp. 460–466.
- Fornell, C., and Larcker, D. F. 1982. "Evaluation of structural equation models with unobservable variables and measurement error: Algebra and statistics," *A second generation of multivariate analysis* (2:3), pp. 382–388.
- Gefen, D. 2000. "E-commerce: the role of familiarity and trust," *Omega* (28:6), pp. 725–737.
- Gefen, D., Karahanna, E., and Straub, D. W. 2003. "Trust and TAM in Online Shopping: An Integrated Model," *MIS Quarterly* (27:1), pp. 51–90.
- Gefen, D., Rigdon, E. E., and Straub, D. W. 2011. "An Update and Extension to SEM Guidelines for Administrative and Social Science Research.," *MIS Quarterly* (35:2), pp. iii–xiv.
- Gefen, D., and Straub, D. W. 2004. "Consumer trust in B2C e-Commerce and the importance of social presence: Experiments in e-Products and e-Services," *Omega* (32:6), pp. 407–424.
- Geyskens, I., Steenkamp, J.-B. E. M., Scheer, L. K., and Kumar, N. 1996. "The effects of trust and interdependence on relationship commitment," *International Journal of Research in Marketing* (13:4), pp. 303–317.
- Hair, J. F., Black, W. C., Babin, B. J., and Anderson, R. E. 2014. *Multivariate Data Analysis*.
- Hosmer, L. T. 1995. "Trust: The Connecting Link between Organizational Theory and Philosophical Ethics," *The Academy of Management Review* (20:2), pp. 379–403.
- Hungerford, H. R., and Volk, T. L. 1990. "Changing Learner Behavior through Environmental Education," *Journal of Environmental Education*, pp. 8–21.
- Jarvenpaa, S. L., and Todd, P. A. 1997. "Consumer Reactions to Electronic Shopping on the World Wide Web," *International Journal of Electronic Commerce* (1:2), pp. 59–88.
- Jarvenpaa, S. L., Tractinsky, N., and Saarinen, L. 1999. "Consumer trust in an internet store: a cross

- culture validation," *Journal of Computer Mediated Communication* (5), pp. 1–35.
- Kim, D. J., Ferrin, D. L., and Rao, H. R. 2008. "A trust-based consumer decision-making model in electronic commerce: The role of trust, perceived risk, and their antecedents," *Decision Support Systems* (44:2), pp. 544–564.
- Koufaris, M., and Hampton-Sosa, W. 2004. "The development of initial trust in an online company by new customers," *Information & Management* (41:3), pp. 377–397.
- Lewis, D. J., and Weigert, A. 1985. "Trust as a Social Reality," *Social Forces* (63:4), pp. 967–985.
- Li, X., Hess, T. J., and Valacich, J. S. 2008. "Why do we trust new technology? A study of initial trust formation with organizational information systems," *Journal of Strategic Information Systems* (17:1), pp. 39–71.
- Lin, A. C., and Ho, Y. 2017. "Determinants of Green Practice Adoption for Logistics Companies in China," *Journal of Business Ethics* (98:1), pp. 67–83.
- Luhmann, N. 1979. *Trust and Power* (Vol. 23), John Wiley & Sons.
- Manjoo, F. 2016. "Think Amazon's drone delivery idea is a gimmick? Think again," *New York Times*, pp. 1–8.
- McKnight, D. H., and Chervany, N. L. 2001. "What Trust Means in E-Commerce Customer Relationships: An Interdisciplinary Conceptual Typology," *International Journal of Electronic Commerce* (6:2), pp. 35–59.
- McKnight, D. H., Choudhury, V., and Kacmar, C. 2002. "The impact of initial consumer trust on intentions to transact with a web site: A trust building model," *Journal of Strategic Information Systems* (11:3–4), pp. 297–323.
- McKnight, D. H., Cummings, L. L., and Chervany, N. L. 1998. "Initial Trust formation in new organizational relationships," *Academy of Management Review* (23:3), pp. 473–490.
- Michał, M., Wiśniewski, A., and McMillan, J. 2016. "Clarity from above," *PwC Drone Powered Solutions* (May), p. 38.
- Möhlmann, M. 2015. "Collaborative consumption: determinants of satisfaction and the likelihood of using a sharing economy option again," *Journal of Consumer Behaviour* (14:3), pp. 193–207.
- Nicolaou, A. I., and McKnight, D. H. 2006. "Perceived information quality in data exchanges: Effects on risk, trust, and intention to use," *Information Systems Research* (17:4), pp. 332–351.
- O'Leary-Kelly, S. W., and J. Vokurka, R. 1998. "The empirical assessment of construct validity," *Journal of Operations Management* (16:4), pp. 387–405.
- Overby, J. W., and Lee, E. J. 2006. "The effects of utilitarian and hedonic online shopping value on consumer preference and intentions," *Journal of Business Research* (59:10–11), pp. 1160–1166.
- Palmer, K., Oates, W. E., and Portney, P. R. 1995. "Tightening Environmental Standards: The Benefit-Cost or the No-Cost Paradigm?," *Journal of Economic Perspectives* (9:4), pp. 119–132.
- Pavlou, P. A. 2001. "Integrating Trust in Electronic Commerce with the Technology Acceptance Model: Model Development and Validation," in *AMCIS 2001*, pp. 816–822.
- Pavlou, P. A., and Gefen, D. 2004. "Building Effective Online Marketplaces with Institution-Based Trust," *Information Systems Research* (15:1), pp. 37–59.
- Porter, T. 1996. *Trust in numbers. The pursuit of objectivity in science and public life*.
- Reinganum, J. F. 1981. "Market structure and the diffusion of new technology," *The Bell Journal of Economics* (12:2), pp. 618–624.
- Rogers, E. M. 1995. *Diffusion of innovations* Newyork Free Press.
- Rousseau, D. M., Sitkin, S. B., Burt, R. S., and Camerer, C. 1998. "Not so different after all: A cross-discipline view of trust," *Academy of Management Review* (23:3), pp. 393–404.
- Shapiro, S. P. 1987. "The Social Control of Impersonal Trust," *American Journal of Sociology* (93:3), pp. 623–658.
- Shrivastava, P. 1995. "Environmental Technologies and Competitive Advantage," *Strategic Management Journal* (16), pp. 183–200.
- Sitkin, S. B., and Pablo, A. L. 1992. "Reconceptualizing the Determinants of Risk Behavior," *The Academy of Management Review* (17:1), pp. 9–38.
- Straub, E. T. 2009. "Understanding Technology Adoption: Theory and Future Directions for Informal Learning," *Review of Educational Research* (79:2), pp. 625–649.
- Yi, M. J., Fiedler, K. D., and Park, J. S. 2006. "Understanding the Role of Individual Innovativeness in the Acceptance ...," *Decision Sciences* (37:3), pp. 393–426.
- Zaleskiewicz, T. 2001. "Beyond risk seeking and risk aversion: personality and the dual nature of economic risk taking," *European Journal of Personality* (15:1), pp. 105–122.

Appendix

Construct	Code	Item	Loading	Reference
Trust in drones delivery (reflective)	Tr1	I believe that drone deliveries are trustworthy.	0.914	Items adapted and modified from: Gefen (2000), McKnight et al. (1998)
	Tr2	I trust drone deliveries.	0.915	
	Tr3	I feel that drone deliveries are reliable.	0.920	
	Tr4	Even if not monitored, I would trust drones to carry out an unobstructed delivery.	0.811	
	Tr5	I believe that drone deliveries are functioning.	0.791	
Perceived risk of drones delivery (reflective)	PR1	There is a considerable risk involved in requesting a drone delivery.	0.791	Items adapted and modified from: Pavlou and Gefen (2004), Zaleskiewicz (2001)
	PR2	There is a high potential for loss involved in using drone deliveries.	0.754	
	PR3	A decision to request drone delivery as a shipping option is risky.	0.895	
	PR4	It is likely that drone deliveries, as a shipping method, will fail to meet my expectations.	0.795	
	PR5	Requesting drone deliveries is unsafe.	0.836	
Personal innovativeness (reflective)	PI1	If I heard about a new information technology, I would look for ways to experiment with it.	0.915	Items from: Agarwal and Prasad (1998)
	PI2	Among my peers, I am usually the first to try out new information technologies.	0.924	
	PI3	I like to experiment with new information technologies.	0.828	
Financial motives (reflective)	FiMo1	I believe drone deliveries are cheap.	0.934	Items adapted and modified from: Bucher et al. (2016), Möhlmann (2015)
	FiMo2	I feel that choosing drone deliveries will save me money.	0.960	
	FiMo3	I believe drone deliveries have low shipping costs.	0.928	
Time-saving motives (reflective)	TiMo1	I believe drone deliveries are fast.	0.914	Self-developed
	TiMo2	I feel that using drone deliveries will save me time.	0.936	
	TiMo3	I believe drone deliveries fasten the shipping process.	0.927	
Convenience motives (reflective)	CoMo1	I believe drone deliveries are convenient and suitable to use.	0.893	Self-developed
	CoMo2	I feel that using drone deliveries reduces effort.	0.735	
	CoMo3	I believe drone deliveries are comfortable.	0.863	
Environmental motives (reflective)	EnMo1	I believe that drone delivery is better for my environment.	0.869	Items adapted and modified from: Möhlmann (2015)
	EnMo2	Drone delivery helps me to lower the ecological transportation costs.	0.858	
	EnMo3	I actively support the environment through drone deliveries.	0.922	
Intention to engage in drone deliveries (reflective)	Int1	I would not hesitate to use drones as a shipping option.	0.931	Items adapted and modified from: Davis et al. (1989), Gefen et al. (2003), Pavlou (2001)
	Int2	Given the chance, I would request drone delivery for my orders.	0.968	
	Int3	Given the opportunity, I intend to use drones as a delivery option.	0.962	

Table A1. Overview of Items after the Content Validity Assessment