INFOGAIN PUBLICATION

International Journal of Advanced Engineering, Management and Science (IJAEMS)
Peer-Reviewed Journal
ISSN: 2454-1311 | Vol-9, Issue-9; Sep, 2023
Journal Home Page: https://ijaems.com/
Article DOI: https://dx.doi.org/10.22161/ijaems.99.9

Exploring the Purchase and Use of Drone Aerial Camera from the Viewpoint of Technological Theoretical Models That Influence Domestic Graphic Art Creators

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Received: 10 Aug 2023; Received in revised form: 13 Sep 2023; Accepted: 21 Sep 2023; Available online: 30 Sep 2023

Abstract— *The growth of Taiwan's camera drone, commonly used in today's film and media industries, has allowed more people to see the deeper beauty of Taiwan, and a wave of drone purchases and use has arisen in Taiwan. This is a business opportunity in the sky. While artists around the world have been widely using drone aerial cameras in their art creations, it is worthwhile to explore the willingness of domestic graphic artists to purchase and use drone aerial cameras. Therefore, this study attempts to use the "Task-Technology Fit Theory (TTF)" and the "Diffusion of Innovations (DOI)" as the theoretical basis for the empirical study. The study will be conducted using an online survey (online questionnaire) with a sample of 300 participants, and the hypotheses will be statistically analyzed through structural equation modeling using SmartPLS. The results of the study can be used by graphic artists as a reference for the use and purchase intentions of technological products and to enhance the presentation of high spatial aesthetics.*

Keywords— ***Drone Aerial Camera (DAC), Task-Technology Fit Theory (TTF), Diffusion of Innovations Theory (DOI), SmartPLS, Structural Equation Modeling (SEM)***

I. INTRODUCTION

The rapid development and popularization of technology is having a profound impact on various fields, including the field of art creation. As an emerging technological tool, unmanned aerial vehicles (UAV) (also known as drones or unmanned aerial vehicles) have been widely used in the fields of photography and film production. For creators of graphic arts, the drone may bring them new creative possibilities and visual effects, and at the same time, it may have an impact on their creative process and style.

While artists around the world have been widely using drone aerial photography in their art creations, it is worthwhile to explore the willingness of domestic graphic artists to purchase and use drone aerial photography. Therefore, this research paper adopts the "Task-Technology Fit (TTF)" theory and the Diffusion of Innovations (DOI) theory as the theoretical basis of the

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study and deduces the research framework, assumptions, and tests based on them. Since the development of drones, due to their high mobility, navigation system (GPS), flight control system open source, Wi-Fi and other wireless communications (5G), artificial intelligence, and other information technology products, the focus of the use of science and technology is that the user's attitude and beliefs can be predicted by the use of the information system's behavior.

The main theory is that some external factors will affect users' beliefs about usage behavior, and these beliefs will further affect attitudes, which in turn will affect usage willingness and actual usage behavior, thus applying the TTF theory proposed by Goodhue and Thompson in 1995. When the acceptance level of an innovation is low at the beginning and the number of users is small, the diffusion process will be relatively slow, and when the proportion of users reaches a critical value, the diffusion process of the innovation will increase rapidly. The researcher believes that the drone theme of this paper can be explored by applying these two theories. Product/service attributes are the main reason why people adopt and purchase these products or services. The relationship between product/service attributes and adoption behavior can also be explained by the Diffusion of Innovation (DOI) theory. Past studies have shown that the compatibility of an IT learning system will increase the users' learning performance and their willingness to adopt the system (Islam, 2016).

This study attempts to understand the factors behind domestic graphic arts creators' willingness to purchase and use unmanned aerial photography by using a theoretical model of technology. Such a study can help to understand the impact of technology on the field of art creation and, at the same time, provide valuable references and guidance for policymakers, the industry, and the creators themselves. Based on the background and purpose of the study, the research questions of this paper are as follows:

(1) Will the integration and utilization of Drone Aerial Camera (DAC) in graphic art creation increase the use of DAC by more art creation consumers?

(2) Will the TTF model affect the willingness of art creation consumers to purchase and use DAC?

(3) Does the willingness of art creation consumers to purchase and use DAC prove the applicability of the theory of DOI?

Based on the above research questions, this paper develops a research design, framework, and hypotheses and seeks to obtain the conclusions of this paper through a proper research methodology.

II. LITERATURE REVIEW

2.1 Artistic Creators

Art creators are those who create works of art in the fields of visual arts, performing arts, literature, music, and video. Through a variety of creative and expressive methods, they transform their ideas, feelings, and opinions into works of art in order to arouse resonance, inspire thinking, or foster emotional communication among audiences.

Creators of graphic arts are those who create works in the field of art that combine images and words. They usually utilize both graphic and textual elements, blending the two modes of expression to create works that are rich in meaning and emotion. This form of creation can be found in a variety of media, including illustrations, comics, book illustrations, posters, movie credits, visual essays, and more.

Graphic arts creators combine visual and textual elements, often not only for aesthetic reasons but also to convey a specific message, emotion, or story. This type of creation can create a unique visual and emotional experience through the interaction between images and words, which may lead the audience into deep thinking or evoke emotional resonance. The work of graphic arts creators is often visually and linguistically powerful, and

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they are able to explore and present complex subject matter in unique ways. They may work in a variety of fields, such as illustration and fiction, educational resources, social aspirations, etc., and provide audiences with multiple levels of thought and experience. In short, graphic artists are those who create works of art that combine images and words, combining visual and verbal elements to convey messages, emotions, and stories through their work.

2.2 Camera drone

A drone, also known as an unmanned vehicle, is a vehicle that carries no passengers. It is usually controlled by remote control, guidance, or autopilot. It can be used for scientific research, site exploration, military, and recreational purposes. At present, the most commercialized drone is the UAV. Aerial vehicles with built-in or external cameras or camcorders are often referred to as UAV. Aerial cameras allow people to enjoy the beauty of nature from a bird's-eye view. Many photographers and image creators have purchased aerial cameras to show their creative talents. Composition is not enough; in addition to proficient flight remote control technology, the operation of the aerial camera should know how to operate the camera shooting; otherwise, there are even better flying skills, such as not mastering the aerial shooting of the camera rhythm, and it is easy to degenerate into a record of the nature of the photo or video. It is precisely because the threshold for creating aerial photography is not low that the preciousness of beautiful images is emphasized. Artistic presentation of drone group flying performance is an integrated application of high technology. With the improvement of technology, there are more and more changes and possibilities, and the aesthetic part of the artistic presentation requires the input of more technological artists in order to design touching works so that the beauty of the group flying performance is deeply rooted in people's hearts, creating more eternal memories to be treasured in life. Therefore, the perfect combination of graphic arts creation tasks and technological innovation products will be more and more diversified and mass-produced.

2.3 Task-Technology Fit Theory (TTF)

Task-Technology Fit (TTF) theory was proposed by Goodhue and Thompson in 1995. This study has found that there are two main streams in exploring the relationship between IT usage and performance: the technology usage viewpoint and the technology fit viewpoint. The focus of the technology usage perspective is that user attitudes and beliefs can predict the usage behavior of an information system, and the main theory is that some external factors will affect the user's beliefs about the usage behavior, and these beliefs will in turn affect attitudes, which in turn will affect the willingness to use the system and the actual usage behavior. TTF is the degree to which technology is used to help the user accomplish a task/job. If the art-making consumer can accomplish the task through the features of the DAC and the task is compatible with the features of the DAC, then the art-making consumer will be more likely to purchase the DAC. The following is the correlation between the technology task adaptation theory and the DAC in art creation:

(1) Matching work demands and technology functions: The technology task adaptation theory states that when users choose and use technology tools, they will consider whether these tools can fulfill their work demands. For art creators, the unmanned aerial camera provides unique camera angles and scenes that can help them create more visually impactful works, thus adapting to their art creation needs.

(2) Ease of use and skill requirements: The technology task adaptation theory emphasize the effect of ease of use and skill requirements on the willingness and satisfaction of using technology tools. The operation of an unmanned aerial camera may require technical skills, but as technology advances and simplifies, it may become

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easier for users to master its operation, thus increasing willingness to use and satisfaction.

(3) Work effectiveness and efficiency: The TTF theory is concerned with whether the use of technological tools can improve work effectiveness and efficiency. In art creation, the DAC can help art creators capture specific scenes and viewpoints more quickly, which improves the efficiency of creation and also brings more creative possibilities to them.

(4) Cognitive and affective factors: The technology task adaptation theory considers the influence of users' cognitive and affective factors on the use of technology. Artists may be more willing to use the drone because of the visual surprise and emotional resonance it brings, and these factors may also affect their satisfaction with the drone.

2.4 Diffusion of Innovation (DOI) Theory

Diffusion of innovations (DOI) is the process of diffusion and adoption of something new, a theory derived from the American scholar Everett Rogers in 1962. The concept is a series of decision-making processes over time, defined by five successive stages of the concept: awareness, interest, evaluation, judgment, and adoption of the idea to decide whether to accept an innovation or not.

After linking the correlation between user traits and art creators' willingness to purchase a drone in innovation diffusion theory, different user traits reflect their acceptance and attitude towards new products or technologies, and these traits will affect art creators' willingness to purchase a drone as well as the reasons behind it. The following are the correlations between user characteristics and art creators' willingness to purchase CVRs:

(1) Innovators and Artists: Innovators are usually curious about new technologies and are the first to accept new products on the market. For art creators, if they have both artistic and technological innovation qualities, they may purchase a drone during the innovator phase to explore its application in their creation.

(2) Early Adopters and Art Creators: Early adopters are social leaders whose behavior and opinions may influence the decisions of others. For art creators, the influence of early adopters in their social networks may pique their interest in CVTs and may motivate them to purchase and use them.

(3) Early Majority and Art Creators: The Early Majority is a group of people who embrace new technologies after the first two stages and may be more risk-averse to the technology. Artists may begin to consider the use of CVRs at this stage, especially if there are enough success stories and examples of actual creations to prove the value of CVRs.

(4) Late Majority and Artistic Creators: The Late Majority may be a more conservative group, and they may need more concrete evidence and real-world results to convince them to adopt the new technology. For art creators, they may focus on the actual impact of unmanned aerial cameras on their creative outcomes and consider whether they can enhance their creative works by using unmanned aerial cameras.

(5) Conservatives and Art Creators: Conservatives are the last group to accept new technologies, and they may need more time to adapt and accept new technologies. For art creators, if they want to use unmanned aerial photography in their creations, they may need more publicity and education to convince the conservative group.

The user traits in the DOI theory can help us understand the differences in the willingness of different types of art creators to purchase a drone. Depending on their characteristics, art creators may exhibit different purchase intentions and motivations in the stages of Innovator, Early Adopter, Early Majority, Late Majority, and Conservative.

III. RESEARCH METHODOLOGIES

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3.1 Data Collection and Measurement Tools

This study will be conducted using an internet survey (online questionnaire). About 72% of internet users in Taiwan use mobile 4G and 5G internet. According to the 2018 survey, Taiwan has more than 16 million mobile phone users. In this study, e-gift cards will be offered as a raffle gift to attract potential respondents, and subjects' emails and IP addresses will be checked to avoid duplication. It is estimated that 300 samples will be taken. The questionnaire is adapted from previous studies to measure the conceptualization of the study. Experienced professionals will be invited to design appropriate questions from relevant literature. The wording of the project was adapted to fit the context of the study. Task-related and DOI-related projects were adapted and revised from Kim and Ammeter's (2014) project. The TTF project was adapted from Hsiao (2017). Value-related items were taken from Hsiao and Chen (2018). Perceived observability was adapted from Hsiao (2013), while purchase intentions were taken from Hsiao and Chen (2016).

3.2 Research Hypotheses

Based on the literature review and research design, the relevant research hypotheses (hypotheses) for this study are as follows:

H1: When work and tasks are facilitated by the functions of the DAC, the fit between tasks and technology will be enhanced.

H2: Consumers' willingness to purchase and use the DAC will be directly affected by the TTF.

H3: Task-technology fit is directly affected by perceptual compatibility.

H4: The willingness of art creation consumers to buy a drone will be directly affected by perceived compatibility.

H5: Task and technology suitability will be directly affected by perceived relative advantages.

H6: Consumers' willingness to purchase a drone will be directly affected by their perceived relative advantage.

H7: Artistic creation consumers' willingness to buy a drone will be directly influenced by its appearance and design.

H8: Artistic creation consumers' willingness to buy "drones" will be directly influenced by emotional values.

H9: Artistic creation consumers' willingness to buy "drones" will be directly influenced by the value of quality.

H10: Consumers' willingness to buy "drones" is directly influenced by the value of money.

3.3 Analysis Methods

This study anticipates the use of SmartPLS, a statistical analysis method for structural equation modeling (SEM), which is an analytical technique for probing or constructing predictive models, especially for causal modeling between latent variables, which is superior to general linear structural relationship models. SmartPLS is software with a graphical user interface for variance-based SEM using partial least squares (PLS) path modeling. Users can use basic PLS-SEM, Weighted PLS-SEM (WPLS), consistent PLS-SEM (PLSc-SEM), and sum regression algorithms to estimate the model and the data. SmartPLS is popular with managers because of its ability to analyze small samples and accurately estimate problems such as intermediation and interference, which helps the researcher automate and complete the statistical program quickly. Thus, SmartPLS is widely used by researchers in the fields of capital management, marketing, business, sports and leisure, health, and tourism, and has gradually become the mainstream analysis software in the social sciences.

SmartPLS 3 is a popular PLS tool that evaluates both measurement and structural models. PLS requires a relatively small sample size and does not restrict the distribution of variables. The collected respondents are divided into two groups based on their purchasing behavior. The sample size for the customer group is

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relatively small (Ncustomers = 100).The PLS approach requires a sample size that is at least ten times the maximum number of quotes or the maximum number of formative indicators that affect the dependent variable (Chin et al., 2003). Therefore, the sample size is relatively adequate for the PLS estimation program. In the context of this study, SmartPLS 3 was considered a suitable tool. Therefore, SmartPLS, as structural equation modeling software, can be used to explore the statistical methods of TTF theory and DOI theory on the willingness of art creators to purchase DAC. It is a suitable tool in the context of this study as it can provide a deeper understanding of the correlation between the factors and their influence on the behavior of art creators.

3.4 Subjects

This paper is based on the internet users in China as the research target. It is difficult to estimate the number of domestic users of unmanned aerial photography, but it is important and forward-looking data. The online questionnaire for this paper was distributed on the more popular online smart device communities and smart device social networking sites (Google, SurveyCake, and SurveyMonkey, 2019), and internet users through the communities and social networking sites were invited to fill out the questionnaire as a research sample. At the same time, the email and IP addresses of the respondents were verified and checked to avoid duplicate sampling. Respondents took about 8 minutes to complete the online survey. After the final screening, there were 249 valid questionnaires left. The sample size was relatively small because unmanned aerial photography is not yet mature and popular in China.

3.5 Questionnaire

The questionnaire was adapted from previous studies to measure the concept of the study. Three senior professionals were invited to develop appropriate questions from the relevant literature based on their understanding of the products, and other question wordings were modified to fit the context and content of this study. The questions related to TTF and DOI were revised based on Kim and Ammeter's (2014) questions, and the TTF items were adapted from Hsiao (2017). The 'value orientation-related' items were taken from Hsiao and Chen (2018). The item 'Appearance design' was adapted from Hsiao (2013), while the item 'Purchase intention' was taken from Hsiao and Chen (2016). A pre-test was first conducted by collecting questionnaire responses from experts and university students. Factor analysis was used to measure the factor loadings, and question items with factor loadings below 0.5 (Hair et al., 2009) were deleted from the study, and finally 33 question items were retained.

IV. RESULTS

4.1 Measurement Model

SmartPLS 3 provides Confirmatory Factor Analysis (CFA) to assess the reliability and validity of the constructs. In general, Cronbach's alpha and the critical ratio (CR) are the key indicators of the reliability and validity of the questionnaire. In this study, the CR values, Cronbach's alpha, and average variance extracted (AVE) for the two groups (artwork consumers and potential artwork consumers) are summarized for each construct. The CR and Cronbach's alpha values ranged from.86 to.95, which exceeds the acceptable threshold of .6. During the analysis of convergence, the reliability of the constructs must satisfy the following criteria: first, the factor loadings must be greater than 0.5; second, the CR must be greater than 0.6; and third, and the AVE must be greater than 0.5 (Hair et al., 2009).

The indicator factor loadings for all factors in this study exceeded the acceptable thresholds. The AVE values and all composite values also exceeded the thresholds. Therefore, all values meet the criteria for convergent validity. In addition, acceptable discriminant validity must be satisfied by the correlation coefficient being less than

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the square root of the AVE. After calculating the square root of AVE and correlation coefficients for each factor, the results showed that the scales were able to satisfy the requirements for discriminant validity. In addition, the coefficient of inflation (VIF) was used to detect the degree of multiple covariance in this study. The PLS statistics showed that the internal VIF values ranged from 1.171 to 2.340, which is much lower than the critical value of 3.3 (Lee and Xia, 2010).

The results indicate that there is no multicollinearity between the independent constitutive surfaces. The result shows that the mean value of 'Emotional Value' is the highest among the two groups. Meanwhile, the mean value of "price/price ratio" is the lowest, which means that customers agree that the drone can bring them emotional benefits. The results of the independent sample t-test showed that the majority mean of the "Creative Arts Consumers" group was significantly larger than the mean of the "Potential Creative Arts Consumers" group. The ratings for the drone were more pronounced in the "Creative Arts Consumers" group. The mean values of most of the components in the "Art Creation Consumers" group reached significance.

4.2 Structural Modeling

In the analysis of the structural model, the path coefficients and the determination coefficients (R2 values) were calculated by PLS (Chin et al., 2003). TTF can highly influence the respondent's "willingness to buy", therefore H1 is supported in this study (β = 0.62, p-value <0.001), and H2 is also supported by the fact that the unmanned aerial camera has a very high influence on this construct of TTF in this variable (β = 0.64, p-value <0.001). In the construct of the 'product' attribute, 'relative advantage' has a significant effect on TTF of the drone aerial camera (β=0.29, p-value <0.001); therefore, H5 is supported but H3 is not (β=-0.03, p-value <0.001). There was no significant effect of perceptual compatibility on the willingness of art creation consumers to purchase the unmanned aerial camera; therefore, H4 was not supported (β = -0.05, p-value <0.001). Whereas, having 'Relative Advantage' and 'Appearance Design' had a significant effect on respondents' 'Willingness to Buy' (β=0.31, p-value <0.01; β=0.11, p-value <0.05), and therefore H6 and H7 were supported.

In the 'Perceived Value' construct, 'Emotional Value' significantly affected 'Willingness to Buy' (β = 0.42, p-value <0.001), but the performance-related 'Value and monetary value' did not affect 'willingness to buy'. Therefore, H8 was supported, but H9 and H10 were not. None of the control variables had a significant effect on willingness to buy. Summarizing the above, the research framework's models for each pathway showed that the explanatory variance for TTF and 'willingness to buy' could reach 64% and 57%, respectively.

V. CONCLUSION

The research framework of this study has good explanatory power in exploring the willingness of art-creation consumers to purchase DAC. The components and factors presented in the study can explain more than 64% of the variance, which indicates a good predictive effect and an explanatory research framework. This study also explores the differences between the potential consumption group and the consumption group, which also provides deeper implications (Hsiao, 2017). Within the potential consumer group, the analysis confirms previous findings that factors such as 'product attributes', 'design', and 'relative advantage' have a significant impact on customers' 'purchase intention'. In particular, "emotional value" has the strongest effect in these two groups. The contributions of this study are summarized as follows:

First, it provides a reasonable explanation for the correlation among TTF factors, product attributes, perceived value, and purchase intention. In the past, few researchers have integrated TTF, DOI, and perceived value

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into the willingness of art-making consumers to purchase unmanned aerial photography.

Second, this study found that the effect of TTF on purchase intention is significant. It indicates that TTF has some explanatory power over the use of drone equipment. Although past related studies have found that the effect of TTF on general consumers' willingness to purchase and use is not significant across different groups (Hsiao, 2017), the target population of this study is art creation consumers, which will have a high degree of fit with the TTF theory based on the high need for quality, energy, and work tasks in art creation.

Third, this study validates and adds to our understanding of the differences in determinants affecting consumers' and potential consumers' purchase intentions. Two sets of hypotheses (RA→PI and DA→PI) were supported in the group of potential consumers but not in the group of consumers. Manufacturers of unmanned aerial photography machines should continue to develop newer usage features to increase the relative advantage of their products, and at the same time, manufacturers can offer product variety in design to fulfill consumers' needs to increase repurchase intention.

Fourth, older customers may have more repurchase intentions, so they can become a target group. Elderly customers may be more willing to use and purchase a drone; after all, the cost of purchasing a drone is not low, but there are more choices for artistic creation and excellent creative height, which will bring an extraordinary creative experience.

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