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The Stranger in My Pocket: A Research on the Intention to Use Digital Voice Assistants[1]

Cebimdeki YabancI: Dijital Sesli Asistanları Kullanma Niyeti Üzerine Bir Araştırma

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Abstract: Artificial intelligence-driven digital voice assistants (DVAs) collect, use, and store user data to optimize the user experience. This function of digital assistants leads to privacy concerns, whereas brand trust becomes a mitigating factor in accepting digital voice assistants. Therefore, this study utilizes Technology Acceptance Model (TAM) and extends the model by integrating privacy concern and brand trust. Data were collected from participants with tools integrated with DVAs and analyzed via structural equation modeling. Results demonstrate that privacy concern has a negative role, while perceived ease of use, brand trust, perceived usefulness, and attitude have positive roles in determining the usage intention of digital voice assistants. The findings also underline that privacy concern is the most important predictor of the intention to use DVAs and brand trust decreases privacy concern.

Keywords: Digital Voice Assistants, Privacy Concern, Brand Trust, Artificial Intelligence

JEL Classification: M31, M37, O33

Öz: Yapay zeka destekli dijital sesli asistanlar (DVA'lar), kullanıcı deneyimini iyileştirmek amacıyla veri toplama, kullanma ve depolama işlevlerine sahiptirler. Ancak bu işlevler, gizlilik endişelerini de beraberinde getirmektedir. Bu bağlamda marka güveni, kullanıcıların DVA'ları benimsemesinde dengeleyici bir rol oynamaktadır. Bu çalışmada, Teknoloji Kabul Modeli (TAM) temel alınmış; modele gizlilik endişesi ve marka güveni değişkenleri eklenerek genişletilmiştir. DVA entegre araçlarla katılımcılardan toplanan veriler, yapısal eşitlik modellemesi ile analiz edilmiştir. Sonuçlar, gizlilik endişesinin kullanım niyeti üzerinde olumsuz bir etki yarattığını; buna karşılık algılanan kullanım kolaylığı, marka güveni, algılanan fayda ve olumlu tutumun kullanım niyetini artırdığını ortaya koymaktadır. Ayrıca, gizlilik endişesinin DVA kullanım niyetinin en güçlü belirleyicisi olduğu, marka güveninin ise bu endişeyi azaltarak kabul sürecini kolaylaştırdığı tespit edilmiştir.

Anahtar Kelimeler: Dijital Sesli Asistanlar, Gizlilik Endişesi, Marka Güveni, Yapay Zeka

JEL Sınıflandırması: M31, M37, O33

1. Introduction

Digital technologies like service robots, artificial intelligence, and augmented reality transform the way of doing business and change the customer experience remarkably (Fernandes & Oliveira, 2021; Wirtx et al., 2018). As digital technologies, especially AI-based technologies, become more prevalent in recent years, machines and devices have constantly

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adapted to the environment by acting like humans to perform various tasks. In recent years, advanced AI technologies, like digital voice assistants (DVAs), have been integrated with electronic devices such as speakers, smart watches, TVs, and mobile devices (Kowalski, 2020). As a result of these developments and the harmonization achieved, some of the daily activities that people do have become faster and easier to perform, allowing people to better use their time and resources for other tasks. On the other hand, companies save billions of dollars owing to the efficiency of artificial intelligence and other technologies developed on this basis (Kim et al., 2021; Deloitte, 2017).

DVA, defined as software that uses automated voice recognition and understands human language using computers, carries out several everyday duties for users (Choi & Drumwright, 2021). It understands voice instructions to finish tasks by using artificial intelligence (AI) and machine learning to detect speech and complete human requests (Santander, 2022). Therefore, DVAs have become one of the most essential tools of artificial intelligence (AI) and electronic device integration (Guzman, 2018). DVAs are an advanced type that can conversationally handle more complex interactions. They provide interfaces that are speech-oriented and offer consumers the opportunity to interact with each other, other companies, or devices in a more convenient, fun, and productive way (Ewers et al., 2020). Interactions with mobile assistants can be developed according to users' habits and how they prefer communicating with the other party, rather than being limited to basic communication about a single pre-programmed function (Guzman, 2019). Hence, DVAs can improve their answers according to the feedback from users and provide personalized services by constantly improving themselves (Wollerton, 2019).

Previous research showed that although the popularity of DVAs is increasing, privacy and security concerns have become prominent barriers to the adaptation of those devices by more consumers (Shin, Zhong & Biocca, 2020). The main reasons for these concerns arise from the fact that digital assistants can collect private data about location history, calendar, voice inquiries, and purchase or search history (Gardiner, 2018). To date, research has investigated the attitude towards DVAs, purchase intention, and the barriers to the intention to use (Fowler, 2018; Ostrom, Fotheringham & Bitner, 2019), but little research exists on the impact regarding the adoption of DVAs (McLean & Osei-Frimpong, 2019; Vivalkumar et al., 2021; Al Shamsi et al., 2022). Thus, the main focus of this study is to fill this gap by extending the Technology Acceptance Model (TAM) by adapting privacy concerns and brand trust to reveal a holistic approach to understanding the constructs affecting the intention to use DVAs.

TAM is a widely recognized and frequently utilized theoretical framework for elucidating the technology adoption. Besides, the TAM and extended versions of the model were used in the relevant literature (Ewers & Baier, 2020; Schultz & Brüggemann, 2021) to describe technology adoption such as DVAs. The TAM comprises four factors named perceived ease of use (PEU), perceived usefulness (PU), attitude, and intention to use. PEU is the amount of work that a person thinks employing a certain system will require, whereas perceived usefulness is the degree to which a person feels that using a particular system would improve their performance (Davis, 1989). When discussing voice assistants, PU refers to how much the tool improves daily life and facilitates tasks, and perceived ease of use relates to how simple it would be for the user to utilize the tool (Buteau & Lee, 2021). Attitude toward usage refers to the evaluation of the system (Davis, 1989).

Privacy and trust are crucial factors to explore when examining the adoption and use of information technology, as they are closely tied to the sharing of personal information (Hasan, Shams & Rahman, 2020; Pal, Babakerkhell & Zhang, 2021). DVAs are private technologies with access to a wide range of potentially sensitive user data (Sharif & Tenbergen, 2020). This fact requires a more comprehensive view of privacy concerns and trust. Furthermore, little is known about how privacy concerns and brand trust can affect attitudes towards DVAs and intention to use them. Therefore, this study incorporates privacy concerns and trust variables into TAM. As consumers become more technology-driven, they will require more privacy and search for more credible alternatives when using DVAs. Thus, understanding the role of these variables in the process of consumer adoption becomes remarkable for both theory and practice. This study is unique in its exploration of two key factors that influence the use of DVAs. Privacy concern is considered a negative variable, while brand trust is recognized as a positive variable. In this way, this study not only extends TAM framework but also examines the simultaneous influence of two contrasting factors—one negative and one positive—that may significantly shape user behavior.

2. Literature Review

2.1.Digital Voice Assistants

Artificial intelligence refers to the information systems that can accomplish tasks normally associated with human intelligence (de Cosmo, Piper & Di Vittorio, 2021). This concept has tremendously changed the way people live and conduct business. One of the most popular artificial intelligence technologies is intelligent digital voice assistants.

Voice assistants are defined as artificial intelligence tools that assist individuals by performing tasks based on their directives (Hoy, 2018; Moussawi & Benbunan-Fich, 2021; Whang & Im, 2020). Voice assistants are different from other technologies since the main mode of interaction is voice (Guha et al., 2022) and they can perform like human assistants (Hernandez-Ortega & Ferreira, 2021). Therefore, it is critical to recognize that voice assistants Therefore, it is critical to recognize that voice assistants are not only a tool but also a company for interacting with people (Malodia et al., 2021). The DVAs in our pockets not only make it possible to interact easily with other consumers but also with other devices and firms (Ewers, Baier & Höhn, 2020).

2.2.Technology Acceptance Model

Advances in technology have enabled more research to explore why people choose to adopt or reject certain technologies. To comprehend customers' reactions and the factors influencing their intentions, the most widely used theories are the TAM developed by Davis et al. (1989) and its modified form, the Unified Theory of Acceptance and Usage of Technology (UTAUT) (Venkatesh, Thong & Xu, 2016). The primary framework used in this study to explain the intention to use digital voice assistants is TAM. DVAs are relatively novel technology, so it is fruitful to examine reasons for choosing to use them by utilizing and extending the technology acceptance model as also suggested by Buteau & Lee (2021).

The main aim of the technology acceptance model is to present a ground to seek the influence of external constructs on internal attitudes and intentions (Legris, John Ingham, Collerette, 2003). Perceived ease of use (PEU) perceived usefulness (PU) (King & He, 2006; Park & Park, 2020), and attitude toward behavior (Zaineldeen et al., 2020) are considered as the fundamental determinants of behavior in this model. On the other hand, UTAUT enhances TAM by adding social influence and facilitating conditions constructs (Moorthy & Vu, 2015).

PU is positively influenced by PEU, according to TAM (Moorthy & Vu, 2015; Schultz & Brüggemann, 2021; Yılmaz & Rızvanoğlu, 2021; Song, Yang & Cheng, 2022). Moslehpour et al. (2018) argue that when technologies are perceived as easy to use, they stimulate consumer behavior, such as online purchasing, by increasing the perceived usefulness of the technology. This is consistent with the idea that PEU improves PU since a satisfying user experience might increase understanding of the advantages of the technology. From a psychological perspective, the ease of use can decrease cognitive load so that consumers can concentrate on the technology's useful and functional features. Users are better able to recognize a system's value when they are not frustrated by its intricacies. The idea that PEU

positively influences PU is supported by the possibility that this cognitive ease will result in a more positive assessment of the technology's advantages. The findings from various studies, including those by Setiawati et al. (2019), indicate that perceived ease of use is a key determinant of technology acceptance. It can be argued that if a system is easier to use, it is more likely to be perceived as beneficial, thereby supporting the assumption that ease of use enhances perceived usefulness. As a result, the following hypothesis is formed.

H1: There is a positive and significant relationship between PEU and PU.

PEU is related to attitudes toward using artificial intelligence-based assistants (Pitardi & Marriott, 2021; Al Shamsi, Al-Emran, & Shaalan, 2022; Açıkgöz et al., 2023). These results laid the groundwork for the subsequent hypothesis.

H2: There is a positive and significant relationship between PEU and attitude.

PU is the degree to which a user feels that using a particular technology will enhance his or her performance (Davis, 1989; Chen, Li & Li, 2011). PU in this study relates to a person's belief that using voice-based digital assistants will help improve their performance. Recent studies examining voice assistants found some supporting evidence on the applicability of TAM in the context of DVAs (Balakrishnan et al., 2024; Zhong et al., 2024; Muñoz & Kremer, 2023). On the other hand, Buteau & Lee (2021) found a positive relationship between attitude, intention to use voice assistants and PU. Studies also found that PU of a voice assistant positively affects attitude (Kim, Merrill, & Collins, 2021; Hsieh & Lee, 2021; Balakrishnan et al., 2024). Thus, the following hypothesis is suggested.

H3: There is a positive and significant relationship between PU and attitude.

PEU is also a determinant of the behavioral intention of voice-based digital assistants (Vimalkumar et al., 2021; Song, Yang & Cheng, 2022). Users who find voice assistants easy to use are more likely to indicate that they would be willing to interact with them. Whang & Im (2020) examine how the human-like characteristics of voice assistants influence users' perceptions of them. They contend that people are more inclined to interact with voice assistants when they believe them to be more human-like and approachable. This implies that consumers' intention to use voice assistants is increased when they believe them to be easy to use and have anthropomorphic features. Ahn (2023) discusses how voice recognition technology is becoming more and more integrated into daily life and how this is affecting customer behavior. According to the study, consumers are more likely to use voice search technologies for information retrieval and task execution if they believe them to be user-friendly. This aligns with the hypothesis that PEU positively affects usage intention in the context of online voice assistants. Therefore, the following is hypothesized:

H4: There is a positive and significant relationship between PEU and usage intention.

Furthermore, Fernandes & Oliveira (2021) proved that perceived usefulness affects DVAs' acceptance while Vimalkumar et al. (2021) stated that perceived usefulness is a predictor of behavioral intention of voice-based digital assistants. Numerous studies have empirically validated the positive relationship between PU and usage intention across various contexts. Hsieh and Lee Hsieh & Lee (2021) investigated how usage intentions of AI assistant-enabled smart speakers were influenced by perceived socialness. They discovered that users' intents to interact with these technologies were significantly influenced by their perceived usefulness, supporting the idea that people are more willing to embrace voice assistants when they see their value. Calahorra-Candao (2024) created a theoretical framework integrating the Uses and Gratifications Theory and TAM to predict acceptance of voice shopping intentions in the context of online shopping using voice assistants. The study highlighted the function of voice assistants in promoting online purchases by emphasizing how perceived usefulness greatly impacts behavioral intentions. This is consistent with the extended version of TAM where perceived usefulness is a critical determinant of technology adoption. Therefore, it is expected that,

H5: There is a positive and significant association between PU and usage intention.

TAM suggests that intention to use is predicted by attitude (Davis & Venkatesh, 1996; Lunney et al., 2016). which refers to the tendency that is expressed by judging a specific person, object, or product (Eagly & Chaiken, 2007). Besides, attitude is defined as an affective and evaluative reaction to behavior (Ajzen, 1991). Studies focused on voice assistants found some supporting evidence on the applicability of TAM in the context of DVAs. Previous studies on DVAs point out that attitude is a positive determinant of continuance intention (Pal, Babakerkhell & Zhang, 2021; Hsieh & Lee,2021; Yılmaz & Rızvanoğlu, 2021). Muthukumaran and Vani (2020) discovered that users' favorable perceptions of voice assistants substantially impacted their propensity to utilize these technologies for shopping purposes. Hsieh and Lee (2024) illustrate that functional advantages enhance the perceived competence attributes of voice assistants. Anayat et al. (2023) investigated the adoption of AI-based voice assistants and discovered a favorable correlation between customers' attitudes and their intent to adopt. Moreover, they found that attitude functions as a mediator between 'reasons for' adoption, such as perceived usefulness and perceived ease of use, and adoption intention. Analysis reveals a strong indirect effect of 'reasons for' on adoption intention through attitude. Therefore, the following group of hypotheses are suggested:

H6: There is a positive and significant relationship between attitude and usage intention.

H7: Attitude mediates the association between PEU and usage intention.

H8: Attitude mediates the association between PU and usage intention.

2.3. Brand Trust

Brand trust is qualified as the inclination of the consumer to trust that a brand can accomplish its declared function (Chaudhuri & Holbrook, 2002; Fourner & Yao, 1997). The actions of brands should not be different from their communicated values to maintain trust (Portal, Abratt, & Bendixen, 2019).

Voice assistants are a great way for brands to connect with customers (Whang & Im, 2020). The rising usage of voice assistants paved the way for getting used to specific brands like Siri, Alexa, Cortana, or Google Assistant by integrating them into everyday life (Cai, Cain & Jeon, 2022). Those brand names helped to accelerate the acceptance of DVAs; since brand trust helps to mitigate specific risks (Becerra & Badrinarayanan, 2013). Trust in a brand crucial element in willingness to provide information to such devices. When consumers believe in the company and know their experience with the company's past behavior, they are likely to trust a novel technology (Wu et. al.,2012; Hasan, Shams & Rahman, 2020). Since trust can be a major enabler for accepting artificial intelligence-based technology (Marikyan et al., 2022), providing trust has the potential to make customers less suspicious and increase their likelihood of adopting the technology (Fernandes & Oliveira, 2021). Trust also affects attitude toward using artificial intelligence-based products (Hsieh & Lee, 2021) and the adoption of virtual assistants (de Blanes Sebastián, Guede & Antonovica, 2022). On the other hand, McLean et al. (2021) stated that distrust may bring negative consequences such as decreasing brand engagement. Moussawi & Benbunan-Fich (2021) revealed that emotion-based trust increases purchase intention in the context of personal intelligent assistants. Another study on smart homes that use voice-user interfaces proved that trust increases behavioral intention (Song, Yang & Cheng, 2022) and accelerates DVAs' adoption (Fernandes & Oliveira, 2021). A study indicated that trust in voice assistants has a positive impact on the intention to use virtual assistants when interacting with services (Malodia et al., 2023).

Thus, the following hypotheses are suggested:

H9: There is a positive and significant relationship between brand trust and attitude.

H10: There is a positive and significant relationship between brand trust and usage intention.

H11: Attitude has a mediating role between brand trust and usage intention.

2.4. Privacy Concern

Digital assistants can gather and store a variety of sensitive personal data, including conversations, photos, and locations (Almeida, Furtado & Furtado, 2020). Getting information is necessary for the devices since they need the data to determine the user's choices and help them via personalized answers (Saffarizadeh, Boodraj, & Alashoor, 2017; Sweeney & Davis, 2020). Accordingly, users frequently face a trade-off between using more customized services and putting their personal information in danger (Pal, Arpnikanondt & Razzaque, 2020; Manikonda, Deotale & Kambhampati, 2018).

According to Buteau & Lee (2021), privacy concern is a significant risk element related to voice assistants. Privacy concern is characterized as one's understanding and evaluation of the risks associated with privacy infractions (Tan et al., 2012). In this context, privacy concern delineates consumers' doubts about using personal DVAs because of the risk that using personal DVAs may disclose users' personal information to internet hackers (Maduku et al., 2023). The privacy risk of these devices is a great obstruction that prevents consumers from adopting digital voice assistants (Jain et al., 2022). Audio recordings are kept in cloud storage and analyzed for various purposes such as marketing, and the constant presence of always-active microphones can be considered a huge problem for privacy (Augustin, Carolus, & Wienrich, 2022). Consumers express concerns about the constant listening mode of virtual assistants, which undermines trust due to significant privacy issues (Malodia et al., 2023). Being always on implies constant listening, which unsurprisingly raises security and privacy issues (Anniappa & Kim, 2021). According to Schultz & Brüggemann (2021), privacy concerns are primarily related to individual data collection and data storage. The private and sensitive data collected by digital voice assistants stand as an important obstruction to adaptation (Pitardi & Marriott, 2021).

Additionally, trust in a brand might have the potential to help corporations lessen the perception of risk associated with their products (snevale, Loureiro & Kabadayi, 2018). Studies unveil that consumers' trust in digital voice assistants can be increased if the product belongs to a well-known brand (Jain et al., 2022) and perceived trust decreases perceived risk in the context of voice assistants (Pal, Arpnikanondt & Razzaque, 2020). Therefore,

H12: There is a negative and significant relationship between brand trust and privacy concerns.

The problems related to privacy concerns and data security have been the center of attention in DVA literature (Foehr & Germelmann, 2020; Graf & Zessinger, 2022; Aw et al., 2022). Studies on voice assistants point out that privacy concerns hinder the intention to use them (Schultz & Brüggemann, 2021; Cai, Cain & Jeon, 2022; Demaeght, Nerb & Müller, 2022). Buteau and Lee (2021) delineate that privacy concern has a negative relationship with attitudes toward using voice assistants, while attitude has a positive relationship with behavioral intention. In the same vein, another study shows that even among millennials, concerns exist about companies collecting and using private information (Ewers, Baier & Höhn, 2020). Furthermore, it is proven that privacy concerns negatively moderate the relationship between attitude and behavioral intent to use technological products (de Cosmo, Piper, & Di Vittorio 2021). Botelho (2022) emphasizes that some consumers have expressed privacy concerns about these assistants since they require a lot of personal data and are constantly "listening" to respond to voice commands. To enhance the user experience, virtual assistants then save voice interactions and private information. The companies that supply virtual assistants also uphold privacy policies, which outline how each one utilizes and disseminates customer information. In most circumstances, businesses don't divulge information that can be used to identify a consumer without the customer's permission. Another study found that privacy concern is a predictor of consumers' passion for digital assistants (Maduku et al., 2023).

Thus, the following hypotheses were developed:

H13: There is a negative and significant relationship between privacy concern and attitude.

H14: There is a negative and significant relationship between privacy concern and usage intention.

H15: Attitude has a mediating role between privacy concern and usage intention.

The conceptual model of the study which is formed based on the research hypotheses is illustrated in Figure 1.

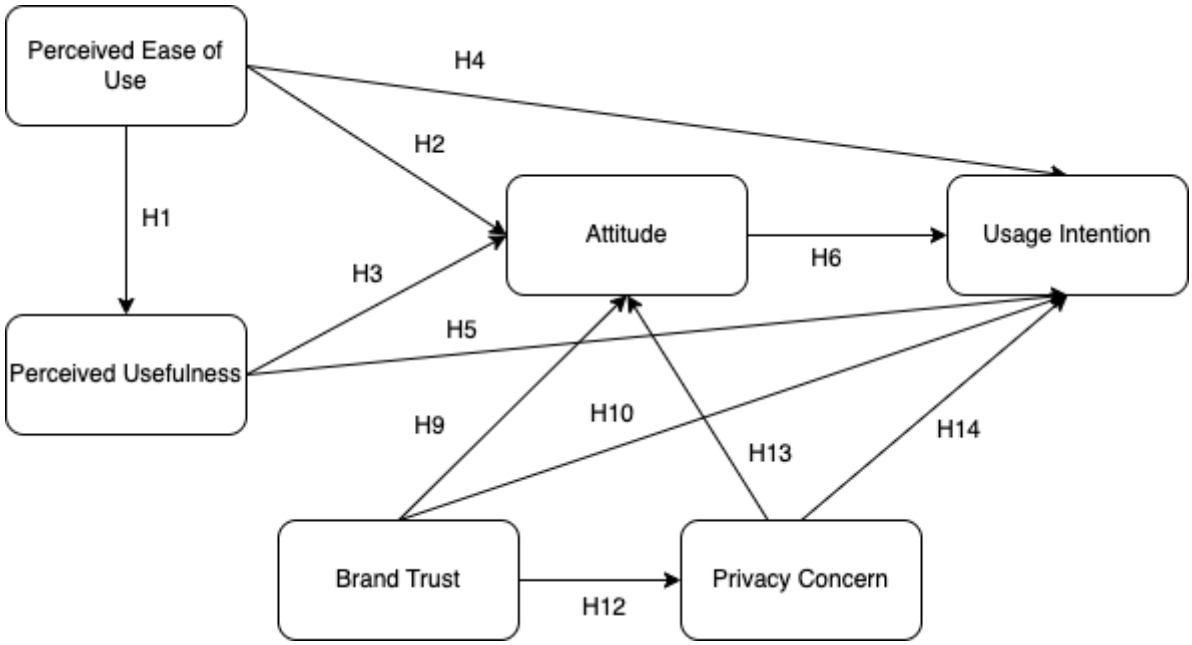

Figure 1. Conceptual model

3. Methodology

3.1. Participants and procedure

This study employs a cross-sectional research design. Data were gathered via an online questionnaires. Respondents were recruited from younger consumers to strengthen the representativeness of the sample based on the fact that millennials demonstrate a substantial inclination toward using voice assistants (Whang & Im, 2021; Lenzner & Höhne, 2022). Having experience in DVAs was chosen as the inclusion criterion of the participant to the research to ensure the high level of representatives of the sample.

To estimate the required sample size for this research, we first calculated the sample size a priori for SEM (Soper, 2022). The required minimum sample size was 236 with a medium effect size, 0.95 statistical power, and 0.05 probability level. In total, 411 participants were recruited (184 females and 227 males), ranging in age from 18 to 50. Most participants have at least an undergraduate level of education and have an income of 7500 TL. The most used voice assistant was Siri. The frequency of using DVAs was also examined and it was found that almost 52 percent of consumers indicated using DVAs occasionally while 38 percent of them use DVAs frequently. Smartphones are the most preferred devices for using DVAs. The majority of the participants checked the permissions they allowed to the applications while downloading the application. More than two-thirds of participants doubt that they are being listened to by their digital voice assistants.

3.2. Measures

To empirically test our proposed theoretical framework, an online survey was developed. To increase the response rate, a self-administered questionnaire was utilized for data collection via Google Docs. In the first section, there was a brief description to ensure the eligibility of respondents and explain the aim of the research. In the second part, there were control questions such as whether the participants already have a DVA on their phones, whether DVAs have been used before, and the frequency of use. In the third part, the 27 items used a 5-point Likert-type scale (1: strongly disagree; 5: strongly agree). PEU was measured using six items adapted from Hess et al. (2014) and Davis (1989), PU was measured with five items adapted from Yang & Lee (2019) and Davis (1989), attitude was measured with four items adapted from Moon & Kim (2001), usage intention was measured with four items adapted from Kasilingam (2020) and Kim et al. (2010), privacy concern was measured with four items adapted from McLean & Osei-Frimpong (2019), and brand trust was measured with four items adapted from Lucia-Palacios & Pérez-López (2021). In the last part of the questionnaire, demographic questions were asked.

3.3. Data analysis

The analysis was conducted in two phases to identify and validate factors influencing the intention to use DVAs. First, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were done to test the measurement model, validity, and reliability. Second, the structural model was analyzed and the path coefficients were investigated to understand the relationship among variables in the proposed model. Amos 23 and SPSS 26 were used for analyses. Variance inflation factor (VIF) scores were calculated to test multicollinearity. The highest VIF score was 1.45, representing no multicollinearity among the variables.

4. Results

4.1. Measurement Model

Composite reliability (CR) ratings and Cronbach's Alpha were used to assess the constructs' reliability. Table 1 displays Cronbach's Alpha, CR, item means, standard deviations, factor loadings, and AVE scores.

Table 1. Measurement Model Values

Variables and Items	Factor Loadings	Item Mean	SD	Cronbach α	CR	AVE
PEU: Perceived ease of use						
I can interact with digital voice assistants whenever I want.	0,899	3,8856	0,73190	0,947	0,946	0,744
Digital voice assistants are generally easy to use.	0,866	3,9294	0,80084			
I interact very easily with digital voice assistants.	0,837	3,8589	0,77115			
Learning to use digital voice assistants is very easy for me.	0,832	4,0730	0,74541			
Digital voice assistants easily do the commands I give them.	0,826	3,8418	0,76942			
I quickly become adept at using digital voice assistants.	0,806	3,9319	0,76524			
PU: Perceived usefulness						
Using digital voice assistants increases my effectiveness at work.	0,929	3,6375	0,82784	0,916	0,981	0,911
Using digital voice assistants improves my work performance.	0,911	3,6131	0,80772			
Using digital voice assistants allows me to get things done faster.	0,893	3,6472	0,82024			
Using digital voice assistants increases my productivity.	0,888	3,6521	0,80735			
Using digital voice assistants makes my job easier.	0,885	3,6253	0,82388			
BT: Brand trust						
The brand whose digital voice assistant I use gives me confidence.	0,940	3,5401	0,99522	0,906	0,942	0,803
The brand whose digital voice assistant I use is innovative	0,924	3,4891	1,00085			
The brand whose digital voice assistant I use has a high reputation	0,918	3,3966	0,98817			
The brand I use digital voice assistant is reliable	0,905	3,5255	0,98338			
UI: Usage intention						
I plan to use digital voice assistants.	0,882	3,8905	0,91608	0,909	0,993	0,974
As soon as I have access to digital voice assistants, I will use them.	0,881	3,8832	0,89769			
I think I will still use digital voice assistants	0,879	3,9075	0,88136			

5 years from now.						
I think I will use digital voice assistants in the next 6 months.	0,867	3,8589	0,93680			
PC: Privacy concern						
I have doubts about the privacy of my interactions with digital voice assistants	0,876	2,6034	0,96570	0,854	0,940	0,798
I'm worried that digital voice assistants are collecting too much information about me	0,871	2,5645	0,98159			
I'm worried that my personal information might be stolen because of digital voice assistants	0,860	2,6326	0,95703			
I hesitate to make financial transactions through digital voice assistants	0,828	2,5864	1,09509			
AT: Attitude						
I generally find it helpful to use digital voice assistants.	0,893	3,7640	0,75886	0,962	0,982	0,931
It's a good idea to use digital voice assistants.	0,888	3,7494	0,76380			
I love using digital voice assistants.	0,841	3,8881	0,87353			
I love using digital voice assistants.	0,837	3,7275	0,85180			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0,921					
Bartlett's Test of Sphericity	Approx. Chi-Square		16818,905			
	df		351			
	Sig.		0,000			

The robustness and validity of the theoretical constructs proposed, and the instrument's internal reliability are supported by the results of the exploratory factor analysis (EFA). Every item displayed commonalities between 0.806 and 0.940, suggesting that none of the elements has to be taken out of the model. The results of the Bartlett's sphericity test (chi-square: 16818,905; degrees of freedom: 351; p value<0.001) confirmed that the correlations between the items are strong enough for analysis, and the KMO index test of 0.921 indicates that the sample size and factorability are suitable for carrying out factor analysis. Six constructs were found by the EFA to account for 88.579% of the sample's explained variation; the factorial loads show the constituent elements of each construct. All things considered, the EFA validated the constructs and items for the sample in the suggested theoretical model (Table 3).

Each construct has notable internal consistency because its Cronbach alpha values were all higher than the recommended minimum level of 0.7 (Hair et al., 2017).

Additionally, positive results were obtained from the AVE and CR tests, with all AVE scores exceeding 0.5 and all CR values exceeding 0.7. These findings imply that the inter-construct validity and reliability of the instrument are satisfactory (Table 2). The correlation between each construct and the other constructs in the model is indicated by the AVE square root values, according to Fornell & Larcker (1981). The favorable outcomes show that there is a greater internal relationship between the constructs than there is with other constructs. the goodness-of-fit measurements concerning the structural model were evaluated and suggest that the study data align well with the research model (CFI:0.987; CMIN/df: 1.730; RMR: 0.028; GFI: 0.917; AGFI: 0.897; RMSEA: 0.042) (Hair et al., 2017). The model appears to be a decent fit for the data overall, according to the results.

Table 2. Discriminant Validity Results

Factors	**Mean.**	**SD**	**1**	**2**	**3**	**4**	**5**	**6**
PEU	3,920	0,676	**0,863**					
PU	3,635	0,787	0,427	**0,954**				
AT	3,782	0,747	0,390	0,383	**0,896**			
UI	3,885	0,900	0,448	0,460	0,435	**0,987**		
PC	2,597	0,920	-0,244	-0,437	-0,352	-0,533	**0,893**	
BT	3,488	0,963	0,335	0,263	0,373	0,427	-0,375	**0,965**

4.2. Results of Hypothesis Testing

After ensuring the soundness of the measures in the meaning of reliability and validity, structural equation model was implemented for testing hypotheses. Table 3 shows hypothesis testing results and model fit indices.

Table 3. Path Results

Hypo.	**Path**			**Std. Estimate**	**Estimate**	**S.E.**	**C.R.**	**P**	**Result**
H1	PEU	-->	PU	0,426	0,539	0,062	8,699	***	Supported
H2	PEU	-->	AT	0,221	0,257	0,06	4,281	***	Supported
H3	PU	-->	AT	0,187	0,172	0,046	3,716	***	Supported
H4	PEU	-->	UI	0,222	0,306	0,065	4,731	***	Supported

H5	PU	-->	UI	0,159	0,174	0,049	3,526	***	Supported
H6	AT	-->	UI	0,135	0,16	0,054	2,953	0,003	Supported
H9	BT	-->	AT	0,213	0,162	0,037	4,355	***	Supported
H10	BT	-->	UI	0,166	0,149	0,04	3,746	***	Supported
H12	BT	-->	PC	-0,375	-0,334	0,043	-7,672	***	Supported
H13	PC	-->	AT	-0,153	-0,131	0,043	-3,066	0,002	Supported
H14	PC	-->	UI	-0,336	-0,339	0,046	-7,359	***	Supported

Model Fit Indices: CFI:0,980; CMIN/df:2,076; RMR:0,127; GFI:0,903; AGFI:0,880; RMSEA: 0,051

The results indicate that there is a positive association between perceived ease of use and perceived usefulness (β=0.426; t=8.699). Thus, H1 was supported. H2, H3, and H9 predict that PEU, PU, and brand trust have a positive impact on attitude. The standardized coefficients revealed that PEU (β=0.221; t=4.281); PU (β=0.187; t=3.716) and brand trust (β=0.213; t=4.335) have significant impact on attitude. Hence, H2, H3, and H9 were supported. The study also found that PEU (β=0.222; t=4.731); PU (β=0.159; t=3.526); attitude (β=0.135; t=2.953) and brand trust (β=0.166; t=3.746) have salient effects on usage intention. Therefore, H4, H5, H6, and H10 were supported. Further, the expected negative impact of brand trust on privacy concerns was confirmed (β=-0.375; t=-7.672), indicating that the H12 was supported. H13 and H14, which predicted that privacy concerns have a negative impact on attitude (β=-0.153; t=-3.066) and intention to use (β=-0.336; t=-7.359), were supported. Results of the structural model analysis revealed that the original TAM explains 33.4% of the variance in intention to use DVA, while the proposed extended model explains 36.9%.

4.3. Mediation Analysis Results

The relationship between perceived usefulness and usage intention, brand trust and usage intention, privacy concern and intention to use, perceived ease of use, and usage intention was all examined using attitude as a mediating variable. To examine the mediating role of attitude, two models were developed. All research variables are included in the first model (Model 1), except attitude, and all research variables are included in the second model (Model 2). A comparison of the standardized estimated values for Models 1 and 2 is presented in Table 4. The paths of both models were statistically significant ($p<0.001$), however the standardized estimates of Model 2 decreased.

A mediator variable, attitude, was investigated in Model 2. In Model 1, the standardized estimate of the relationship between usage intention and PEU was found to be significant

(β=0.252). As a result, Model 2's standardized estimate of the link between usage intention and PEU dropped (β=0.222). The relationship between PU and usage intention was found to have a significant standardized estimate (β=0.184) in Model 1. Therefore, the standardized assessment of the correlations between perceived usefulness and usage intention in Model 2 (β=0,159) decreased. In Model 1, the standardized estimate of the correlation between usage intention and brand trust was substantial (β=0,195). Therefore, in Model 2, the standardized estimate of the association between usage intention and brand trust dropped (β=0,166). The standardized estimate of the relationship between privacy concern and usage intention was significant (β=-0.357). Hence, the standardized estimate of the relationship between privacy concern and usage intention decreased in Model 2 (β=-0.336). As a result of mediation analysis, attitude has a partial mediator role in the relationships between PEU and usage intention; PU and usage intention; brand trust and usage intention, and privacy concern and usage intention. In conclusion, H7, H8, H11, and H15 were partially supported.

Table 4. Mediation Analysis (Attitude)

Hypo.	**Path**			**Model 1 (Without Mediator) Std. β**	**Model 2 (With Mediator) Std. β**	**Result**
H7	PEU	-->	UI	0,252***	0,222***	Partial Mediation
H8	PU	-->	UI	0,184***	0,159***	Partial Mediation
H11	BT	-->	UI	0,195***	0,166***	Partial Mediation
H15	PC	-->	UI	-0,357***	-0,336***	Partial Mediation

5. Discussion

5.1. Theoretical Implications

The research provides two important theoretical contributions to the relevant literature on technology acceptance. Firstly, this study enriches the existing knowledge on technology adoption by incorporating two new variables; brand trust as a positive, and privacy concern as a negative variable to increase the robustness of TAM.

Our findings enrich the current literature by confirming that privacy concern has a significant role in the adoption of DVAs. Consumers seek to feel confident when communicating online through DVAs. This can be attributed to the uncertainty that arises in consumers' minds. Consumers often feel hesitant due to concerns about the potential misuse of their data beyond their control. Therefore, the positive role of tools or technologies that

reduce uncertainty and increase confidence as a psychological element in the adoption of a new technology is demonstrated. These results are parallel with the previous studies that approach privacy concerns, and keeping data confidential as remarkable barriers to adopting DVAs (Nallam et al., 2020; Schultz & Brüggemann, 2021) while trust is a significant facilitator (Pal et al., 2020; Pal, Babakerkhell & Roy, 2022).

Secondly, while examining the acceptability of DVAs, this study confirmed the TAM. The study's conclusions support the TAM's suitability in explaining users' intentions to utilize DVAs. Findings confirmed that PEU significantly affects PU. This finding points out that the easier to use DVAs, the more useful and familiar they are perceived. This is consistent with the relevant literature (Al Shamsi, Al-Emran, & Shaalan, 2022; Kim, 2012). Furthermore, our study aligns with previous research, demonstrating that perceived usefulness influences both customer attitudes and usage intentions (McLean et al, 2021; Yılmaz & Rızvanoğlu, 2021). In line with this, results indicate that PEU also affects customer attitude as also found by previous studies (Açıkgöz & Vega, 2022; Pitardi, & Marriott, 2021) and PEU is a predictor of usage intention as indicated in the previous literature (Kowalczuk, 2018; Zhong et al., 2024). According to the results, positive attitude increases intention to use digital voice assistants as asserted by Schultz & Brüggemann (2021). Previous research confirmed that attitude has a significant role in determining whether or not users intend to continue using voice-activated AI devices (Pitardi & Marriott, 2021; Mishra, Shukla & Sharma, 2021).

Furthermore, this study reveals that attitude plays a significant partial mediating role in the relationship between several key determinants and the intention to use DVAs. The mediating effect of attitude in the links between PEU and usage intention, as well as between PU and usage intention, underscores the importance of users' internal evaluations in shaping behavioral outcomes. This is consistent with previous studies suggesting that attitude functions as a conduit through which cognitive beliefs about technology influence intentions (Ajzen, 1991; Venkatesh & Davis, 2000). Likewise, the partial mediation observed between brand trust and usage intention highlights the role of affective mechanisms in technology adoption, suggesting that when users perceive a brand as credible and trustworthy, it fosters positive emotional responses that translate into greater intention to use (Pal et al., 2020; Malodia et al., 2023). In contrast, the negative indirect effect of privacy concern on usage intention through attitude indicates that privacy-related fears not only suppress direct usage intention but also erode favorable attitudes, weakening the cognitive-emotional pathways necessary for adoption (Buteau & Lee, 2021; Schultz & Brüggemann, 2021). Altogether, these findings emphasize that attitude operates as a central evaluative mechanism—mediating

the impact of both facilitating and inhibiting factors—and that adoption of DVAs is shaped by a dynamic interplay of cognitive assessments (e.g., usefulness, ease of use) and affective evaluations (e.g., trust, concern) (Eagly & Chaiken, 2007; Mishra, Shukla & Sharma, 2021).

5.2. Managerial Implications

This study provides valuable insights for product designers who are responsible for developing attractive attributes or features for technological products, as well as marketing executives. According to the findings, the easier to use digital assistants, the more useful they will be perceived. When it is easy to learn how to use these devices and when they are easy to interact with, they are perceived as beneficiary tools. Thus, to make customers believe that digital assistants increase their performance and effectiveness, it is important to design an assistant that is easy to utilize and seamlessly integrate into daily life. Voice assistant developers should ensure their products are designed with accessibility in mind and comply with accessibility standards to make them usable for all individuals, including those with disabilities. Consequently, improving the accessibility of DVAs is essential.

Technology developments also raise security concerns. The security issue is especially obvious in the context of DVAs because they are operated through a voice interface and run-on cloud-based intelligent technologies (Lee, Lee, & Sheehan, 2020). When companies have access to private information that a customer does not want to divulge, privacy worries increase (Mani & Chouk, 2016). To secure users' personal information, voice assistant developers should integrate strong security mechanisms including encryption and authentication. In the same vein, companies may offer transparent and coherent privacy policies that describe how user data is gathered, saved, processed, and used. They may also provide users further control over their data, such as the option to delete it, not allowing for sharing with third parties, or decline data gathering. Users may feel more in control of their data as a result, which can help allay privacy worries. Using tutorials to educate customers would help them become more aware of potential hazards and how to reduce them.

The results also underline that privacy concern negatively influences attitude as also presented in the prior studies (Pitardi & Marriott, 2021). Our findings demonstrate that privacy concern has the most powerful predictive power for usage intention. Burbach et al. (2019) also found that the most crucial element to accept voice assistants is privacy. When people have doubts about the privacy of their interactions with digital voice assistants and when they worry about the collecting of data, they hesitate to use the technology. In addition,

the probability that their data might be stolen also prevents people from using digital voice assistants.

In addition, privacy concerns and brand trust are crucial elements to consider together in the context of those devices. This research shows that brand trust decreases privacy concern. Several studies have indicated that trust is a crucial element in accepting a technology (Vimarkumar et al., 2021; Fernandes & Oliveira, 2021). DVAs gather a lot of information on user preferences and behavior. Although this information is useful to enhance the consumer experience, privacy and data security issues are raised. Therefore, the study accentuates the vital role of addressing privacy issues in the consumers' minds and presenting appropriate solutions. Trust can be built between the company and customer via multi-channel, integrated communication by using new technologies such as DVAs, which have a prompting role in creating high reputation and credibility. Companies investing in DVAs may consider boosting their brand reputation firstly to overcome the privacy concerns of customers. Companies should offer alternative options to consumers, such as time-limited usage or the ability to easily remove data from the database with a single click, when they consent to the use of their data, like voice recordings. Consumers who want to try voice assistants but find them intrusive can be targeted by building a strong brand reputation that will result in increased trust.

The research integrates both personal (privacy concern) and corporate (brand trust) perspectives into model building and hence it presents a holistic point of view. Considering that privacy concern is rather an individual issue, it would be harder to interfere in that area. Plus, while increasing security features to the system is beneficial, practitioners must be mindful that excessive preventive measures could backfire as Aw et al. (2022) underline. Therefore, to decrease privacy concerns, brands could make some improvements on the corporate side to increase brand trust.

5.3. Limitations and Future Research Recommendations

Although the research has made theoretical and managerial contributions, it also has some limitations to be addressed. First, the sample consists of only Turkish consumers, indicating a limited generalization of the findings. Thus, it would be fruitful to conduct similar research in different countries. This would help to understand the differences between developed and developing countries in the context of digitalization of consumer behavior. Although Türkiye is classified as a developing country, the usage of digital technology in the sample is relatively high. In line with this, more complex studies are needed to gain insights not only

from individual or cultural differences of consumers but also from digital competencies from a behavioral perspective. Further studies could add moderating variables such as technology anxiety and personal innovativeness for investigating whether personal factors differ in accepting that technology. Future models may include new variables from the viewpoint of hedonic values. Perceived enjoyment and pleasure aspects of using digital assistants can be used to extend the model as well as social effects and habits. Also, willingness to pay more would be examined together with behavioral intention as an outcome variable in further studies.

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