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FACTORS INFLUENCING SERVICE CONTINUATION INTENTION: A SEQUENTIAL MEDIATION MODEL

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Abstract

With Artificial Intelligence (AI) and voice assistants (VAs) gaining presence of mind and going into the mainstream of most lifestyles, it is important to know what influences long term user loyalty, more so in emerging economies like Pakistan. This research deals with the interaction between psychological and behavioral processes of continuation attitude towards service, by the users to VAs. The study allows exploring the influence of user perceptions associated with privacy (privacy concern, privacy risk, privacy cynicism), trust, and usability (ease of use, perceived usefulness) on their intention to use these services any longer and suggests a sequential mediation structure of these values, as they influence attitude, which, subsequently, influences engagement further resulting into service continuation intention. In a quest to look into this framework, a cross-section study survey of 350 consumers in Lahore, Pakistan, who had been using VAs actively within three months, was developed. Analysis of the data obtained were carried out through Partial Least Squares Structural Equation Modeling (PLS-SEM) in order to recognize both the measurement and structural models. Cronbach alpha, composite reliability and validity (convergent and discriminant) tests proved the reliability and validity of the constructs, making it strong basis of the testing of hypotheses as well. The results demonstrate that the attitude of users toward VAs is strongly and positively influenced by three factors, namely perceived usefulness, ease of use, and trust where the former is the most effective predictor. Privacy concern and privacy risk on the other hand projected a high negative significant effect on user attitude together with privacy cynicism.

Volume. 4 Issue No. 3 (2025)
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Through the analysis, it was also ascertained that user engagement is the most powerful direct determinant of service continuation intention. The moderate of this study, the sequential mediation model, was proved and all its six hypotheses found to be true. The findings demonstrate that attitude towards use of VAs and participation with VAs in a sequential scenario acts as mediators between every one of the six antecedents (privacy concern, privacy risk, privacy cynicism, trust, ease of use, and perceived usefulness) and the final service continuation intention. This paper offers valuable contribution just because it proves that the route into long-term VA usage is not narrowly functionality-bound, the process is buried deeper in the realm of psychological comfort and behavioral investment of users. Although the usability and functionality act as the key aspects of the formation of the positive initial attitude, it is the further meaningful interaction that confirms the user that they should proceed with using the service. The findings are of paramount importance both to the developers, marketers, and policymakers, advertising the significance of developing the trust with them and being transparent in discussing the privacy concerns and thus gaining user loyalty. Business that want to succeed in current changing environment of digital world in Pakistan and other markets need to develop VA experience in a way that it is not only useful and easy to interact with but it also develops a trusted engaging relationship with user.

Keywords: Service Continuation Intention, Voice Assistants, Attitude, Engagement, Privacy Concern, Privacy Risk, Privacy Cynicism, Trust, Perceived Usefulness, Ease Of Use

Introduction

Artificial intelligence (AI) is radically reshaping industries all across the world, including health and finance, transportation, and communication (Dwivedi, 2021). One of the major uses of this transformation is the emergence of voice assistants such as Google Assistant, Amazon Alexa, and Siri by Apple. Such voice-based interfaces are quickly becoming a part of everyday life as they can

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

now control any device and use administration of services by repeating a few words out loud and thus improve convenience and accessibility (Hoy, 2018; Smith, 2024). The mega-trend in the high adoption of such voice-enabled devices is that constant breakthroughs in AI and natural language processing (Johnson & Lee, 2023; Brown et al., 2022).

Nevertheless, such increased dependence on voice AI technology has sparked pronounced privacy and security issues that have diluted user excitement (Chen, 2023). On the one hand, users are satisfied with the advantages; however, lots of people get more concerned about the threat to privacy that such devices possess (Jones, 2024). Data collection habits, information storage, and even a risk of misusing the data gave a feeling of opposition (Garcia & Miller, 2022). This concern is frequently embraced in the form of privacy concerns, the perceived privacy risk, and even privacy cynicism, which can damage the user loyalty and make them doubt whether they want to continue to use these services (Lee, 2023; Lopatka, 2018). As a result, the trust of the user on the forms of technology and the service providers itself has emerged as a key ingredient reducing such concerns and enables long-term engagement (Kim, 2024; Martin & Murphy, 2017).

In addition to such privacy dynamics, the classic drivers of technology adoption continue to be of paramount importance. Perceived ease of use and perceived usefulness are predetermining factors that frame a user of a service on whether they want to continue or not to continue using a service (Davis, 1989; Venkatesh et al., 2003). It is understood that more likely, users will be loyal to voice assistants that are easy-to-use and beneficial in achieving their everyday tasks (Thompson, 2022). The effectiveness of every technology is ultimately based on a careful balance between the perceived utility, ease of use, and the trust that users assign to the technology (Choi & Oh, 2019).

The use of AI technologies in Pakistan is gaining pace because of the increased access to the internet and popularity of smartphones (Pakistan Telecommunication Authority, 2024). Notwithstanding such growth, little is

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
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known about certain attitudes and behaviors of the Pakistani consumers on AI (Khan et al., 2022). The peculiar socio-cultural environment, as well as obstacles in the form of language dissimilarities and infrastructural issues, makes it tricky to directly translate the discoveries obtained in the context of Western markets (Ali et al., 2023). There is a major research gap in the interactions or interdependencies between privacy concern, trust, and the factors related to usability in designing longer-term intentions to use this new market. The literature has analyzed these variables independently, but little has been done to analyse the mediating relations that exist between the variables leading to continuance of service of voice assistants in Pakistan.

This paper will attempt to address this gap by examining the major determinants of why Pakistani users opt to become persistent users of AI-powered voice assistants. It suggests a sequential mediation model that will help to separate complicated connections among perceptions of the user and their final intention of behaviors. In particular, the following study will examine specific instances of how underlying forces, including privacy concern, trust, and usability shape the attitude of a user to using voice assistants and, consequently, define its level of interaction with the technology and, thus, establishing their intention to use the service further. The results will be valuable to developers, businesses, and policymakers in an attempt to build responsible, sustainable behavior in adoption of AI in Pakistan and other emergent markets.

The paper is driven by the fact that the research aims at establishing the psychological path that drives continued use of voice assistants. The crux of this study is to evaluate a multi-mediational model in which the role of significant independent variables regarding service continuation intention is mediated by the attitude of a user, followed by their engagement. Specific objectives are:

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

- To examine that attitude towards using voice assistance and engagement with voice assistance sequentially mediates the relationship between privacy concern and service continuation intention
- To examine that attitude towards using voice assistance and engagement with voice assistance sequentially mediates the relationship between privacy risk and service continuation intention
- To examine that attitude towards using voice assistance and engagement with voice assistance sequentially mediates the relationship between privacy cynicism and service continuation intention
- To examine that attitude towards using voice assistance and engagement with voice assistance sequentially mediates the relationship between trust and service continuation intention
- To examine that attitude towards using voice assistance and engagement with voice assistance sequentially mediates the relationship between ease of use and service continuation intention
- To examine that attitude towards using voice assistance and engagement with voice assistance sequentially mediates the relationship between perceived usefulness and service continuation intention

Literature Review

2.1 *Attitude And Engagement Between Privacy Concerns And Service Continuation Intention*

The interaction between voice assistant (VAs) continuous use and the interest of users to ensure privacy is of great concern to research and user attitude and engagement appear to be one of the sequential mediators. Privacy concern, which can be referred to as the anxiety of an individual about the possible inability to control the loss of a personal privacy when using VAs to collect and utilize personal information (Kim et al., 2023), has been repeatedly listed as one of the key obstacles to VAs adoption and their further use. They feel uncomfortable using the gadgets due to the fact that they are always listening, and there is a lack of clarity over how such information gets recorded, stored,

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

and accessed, giving rise to a vague sense of mistrust (Seymour et al., 2023). These fears lead to direct formulation of user attitudes: these are the psychological evaluations of a technology, the cognitional and emotional perceptions.

Recent literature establishes the fact that increase in privacy concerns creates more negative attitudes toward VAs. As an example, privacy concerns have been demonstrated to essentially reduce the intentions of users to accept voice AI services (Kim et al., 2023). This attitude is enhanced by the fact that the technology vendors do not tend to be transparent in their activities, and users might not know whether they are being recorded, in what context, and where their data is kept (Seymour et al., 2023; Sharif & Tenbergen, 2020). Such confusion erects a mental wall of distrust and creates skepticism and a guarded attitude toward technology. When issues of consent are pooled into communal areas, they are compounded, with VAs potentially capturing non-consenting third parties (and introducing an element of social complexity that risks turning into negative attitudes and disconnection) (Germanos & Kavallieros, 2020).

Such negative attitudes can then affect user engagement which is an assessment of the degree and quality of a user interaction with the technology. With issues of privacy, the users tend to change their behavior to establish some control vicinity like reducing their interactions, restricting the use of delicate commands, or switching off particular functions (Seymour et al., 2023). This brief interaction denies users the chance to know the entire usefulness of the VA and as such, reduces their desire to use the service in the long run. The sequential process implies that the privacy threats contribute to sourcing of the user attitude which in turn is reflected in the diminished engagement which finally leads to service continuation (Maccario & Naldi, 2022).

Nonetheless, this connection is not an absolute one. As much as they have their reservations, the use of VAs is still quite common among users, and this

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

generally can be attributed to the phenomenon of the so-called privacy paradox wherein the convenience and personalization benefits of VAs outweigh their perceived risk (Pal et al., 2020). Trust is a great moderator in this interaction. Whether the users trust the technology or feel confident in the brand, there are fewer chances of the privacy issues manifesting themselves in negative attitudes or disengagement (Schultz & Paetz, 2023). A positive emotional and relational experience with the VA can additionally induce user satisfaction and so motivate the habituation even when the concern over these privacy issues is present (Choi, 2023). However, there are usually not enough regulatory mechanisms to deal with those issues and individual users are forced to handle them on their own, as well as without easy-to-understand privacy settings (Seymour et al., 2023; Sharif & Tenbergen, 2020). The literature as a whole would indicate a mediation process wherein uncombated privacy issues worsen the attitudes towards the user, which consequently lessens engagement, and lastly decreases the desire to continue the service. Therefore, we hypothesized that:

H1: Attitude Towards Using Voice Assistance and Engagement with Voice Assistance Sequentially Mediate the Relationship Between Privacy Concern and Service Continuation Intention.

2.2 *Attitude And Engagement Between Privacy Risk And Service Continuation Intention*

With voice assistants becoming increasingly prevalent in everyday routines, the attendant risk of using the device due to the potential misuse of personal data has been of concern as a key psychological hurdle to keep using voice assistants (Liu et al., 2025). Perceived privacy risk is the subjective feelings about these risks of adverse outcomes, based on the information collection and usage of users. The lack of transparency of the data processing conducted by VAs including its always-listening and opaque approach to the sharing of such data contributes to this feeling of risk by literally creating a bad attitude and undermining trust (Liu et al., 2025; Moorthy & Vu, 2021).

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

The cases of perceived high privacy risk are significant indicators of negative attitude towards VAs. In practice, this tends to manifest itself in defensive trends, as users will go out of their way to restrict or disable VA characteristics to curb alleged dangers (Choi et al., 2023). The negative attitudes are essential since they act as the initial cognitive screen upon which the users judge the technology. An unfavorable attitude weakens the perception of utility of the VA and deteriorates the possibility of further interaction, which leads to the deterioration of overall satisfaction and anexcessive possibility of subsequent use (Choi et al., 2023). But this is buffered. The perceived negative effect of considering privacy risk to carry on with its negative outcomes can also be addressed by the level of trust in the technology vendor especially when it comes to the aspects of transparency and security (Schultz & Paetz, 2021).

Privacy risk in turn determines the attitude of the user that predetermines the degree of the engagement. The frequency and richness of engagement is impaired when the users feel that they are being monitored or the danger involved. Issues resulting in surveillance have been found to curtail the desire by a user to share personal information, a factor that directly curtail engagement and by extension it inhibits the intention to use the service in future (Abdussami & Candiwan, 2021). Privacy apprehension might outweigh these benefits even when the VAs provide considerable hedonic or utilitarian advantages regardless of whether said risk is seen as minimal or severe (Salih et al., 2021). It is the tension in the context of the personalization-privacy paradox, and the same data sharing that makes possible personalized, engaging services creates the basis of privacy risk that may undermine trust and positive attitudes (Pal et al., 2020).

A number of factors may moderate this pathway. The negative attitudes formed as a result of the risk of privacy can be partially neutralised by the attribute of perceived ease of use and utility, which implies that users run a somewhat complicated cost-benefit analysis (Acikgoz et al., 2022). In addition,

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

the use of strategic design decision can also be used to reduce risk perceptions. Such attributes as anthropomorphism (a human-like design) and a clear mechanism of how the data is used can help create a perceived sense of control and trust that would help alleviate the consequences of privacy risk on user attitudes (Liu et al., 2025). This will not only make the users feel empowered and strengthen their good impressions but also persuade them to keep using them through proper education (which should include visual indicators of microphone status) and easy- to-access privacy settings (Choi et al., 2023). Such a model of sequential mediation is highly validated in the literature as perceived privacy risk can affect attitudes, which induces engagement that finally defines the intention to remain to use the service (Salih et al., 2021; Abdussami & Candiwan, 2021). Therefore, we hypothesized that:

H2: Attitude towards using voice assistance and engagement with voice assistance sequentially mediates the relationship between privacy risk and service continuation intention

2.3 *Attitude And Engagement Between Privacy Cynicism And Service Continuation Intention*

On top of just being worried and anxious about risk, the sense of privacy cynicism has become an important consideration in the long-term use of VA. The cynicism of privacy can be understood as the user approach to the death of the hopes to protect their personal data, in which the user believes that nobody can prevent the abuse of his data and his personal struggle does not push back the menace (Acikgoz & Perez-Vega, 2021). Being in this powerless state and regularly exposed to the information about data leaks and knowing that a person is under constant surveillance generates a highly cynical attitude towards technologies that collect data (Acikgoz et al., 2023; PMC, 2023).

Such cynical attitude has a significant influence on attitude towards the user. Users who have a high degree of privacy cynicism use negative sentiments against VA and have negative emotions towards them, with

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

negative perception as something to be suspicious of and to be less trusting about (Acikgoz et al., 2023). However, such a perspective is not only a response to individual anxieties but is also due to a greater social discourse about data exploitation and a sizable corporate lack of transparency (Das & Nathan-Roberts, 2021). This leaves one feeling helpless and subsequently develops a state of apathy regarding thorough adoption of VA technologies, where one wonders on the morality and intentions of the companies associated with the technology (Maier et al., 2023; Wang et al., 2023).

There is a direct impact on the quality and depth of user engagement directly by negative attitude powered by cynicism. The very nature of cynical users would mean that they take on a self-limiting strategy where they only participate in low complexity interactions entailing low risk actions and when used, they refuse to use functions that need a heavy amount of data sharing (Acikgoz et al., 2023). This leads to the behavior acting as a coping mechanism where the users feel that they can derive basic convenience out of the VA in an apparent self-preservation act of insuring against perceived privacy exposure (Acikgoz & Perez-Vega, 2021). Nonetheless, such restricted interaction does not help build the habitual pattern of use and the possibility of the user extracting substantial value out of the service, hence crippling their long-term commitment to the service.

Attitude and engagement mediates the cynicism to service continuation pathway. Studies reveal that when users experience the high privacy risks, a perception that is commonly combined with cynicism, such attitudes turn negative and undermine their involvement with the service gradually by reducing the intention to restart it (Liu et al., 2025). The fact of perceived surveillance lowers an individual disclosure of personal information directly and, accordingly, lowers the intention of service continuation (Abdussami & Candiwan, 2021).

Nonetheless, some elements have the ability to reduce the negative outcomes of cynicism. Boxing and numbing against cynical beliefs are not

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

always over powering, and perceived usefulness and trust in brand can promote future usage (Acikgoz et al., 2023). Critical to this are strategic design and corporate behavior. Some of the wariness can be reduced by anthropomorphic design characteristics and clear exchanges regarding data practices (Liu et al., 2025). Users might be ready to use them even with the hidden cynicism when they feel that the companies show they are socially responsible and handle data ethically (Wang et al., 2023). Finally, even though the perceived value of personalization and utility may often outweigh the concern about losing personal information in some cases (Pal et al., 2020; Ghosh & Eastin, 2020), there is a certain level of cynicism that will inevitably undermine positive responses and engagement throughout time and weaken eventual user loyalty. Therefore, we hypothesized that:

H3: Attitude towards using voice assistance and engagement with voice assistance sequentially mediates the relationship between privacy cynicism and service continuation intention

2.4 *Attitude and engagement between trust and service continuation intention*

User-technology relationships rely heavily on trust, and this has had an enormous impact on the attitudes, engagement and intentions to keep using an AI voice assistant (VA). It is not a single- sided abstraction but a complex entity consisting of cognitive, emotional, and behavioral components that influence the decision-making of users altogether (Acikgoz et al., 2023). Cognitive trust involves logical evaluation of competence and integrity of a VA, which means that he/she can complete tasks in reliable and ethical ways. Such a type of trust plays a vital role because it reduces fear of privacy-related issues and increases perceptions of utility and easy-to-use effects, which make the tech worthwhile to use with a positive attitude to it (Schultz & Paetz, 2023). In parallel, emotional trust emerges as the user trusts in the intentions of the VA system helping them, rather than working against, which leads to a state of relational security and the attitudes also develop favorable disposition

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

(Leonidou & Zantis, 2024). Such internal states are realized via the behavioral trust, i.e., the readiness of the user to do something based on their confidence and state by reporting and sharing information or delegating tasks to the VA (Acikgoz et al., 2023).

Meaningful user engagement as an outcome of trust-based attitudes is directly preceded or caused by the latter. Once a user believes in the functionality of the VA and its benign intentions, there are higher chances to leave shallow, functional orders behind and experience a broader set of functions (Schultz & Paetz, 2023). It is deeper engagement that is always a product of quality, rather than mere quantity and may be augmented by habituation; a repeated positive engagement will cement trust and actualize positive attitudes and form a feedback loop that can create greater dependency and psychological ownership (Acikgoz et al., 2023). On the other hand, when the trust is low, consumers use the service in a superficial manner and are less willing to share sensitive information, and, therefore, cannot reap meaningful benefits (Maier et al., 2023). This effect can be increased by the design of VAs especially via anthropomorphism. Turning to making VAs human-like allows the designers to infiltrate the feeling of social presence and empathy, which enhances emotional trust and cultivates the user-involvement experience to a greater extent (Leonidou & Zantis, 2024; Huh et al., 2023).

Finally, such extended and relevant participation is the crucial connection between the continuation of services intentions. Emotional and functional value help to guarantee that users will be even more willing to use the service provided an individual has obtained both emotional and functional value (Leonidou & Zantis, 2024). Engagement serves as an intervention in the form of an external practice of internal trust and favorable attitudes, transforming them to turn following the long-term user loyalty (Schultz & Paetz, 2023). Such a linear direction (both trust creating a positive attitude, and the latter leading to engagement, which would in response promote continuation) is empirically proved through various theoretical formulations, with

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

Behavioral Reasoning Theory, along with the Technology Acceptance Model being mentioned in particular (Acikgoz et al., 2023). The results of the various fields such as voice commerce and healthcare support that trust minimizes user willingness to wait and one of the main adopting and loyalty determinants (Schultz & Paetz, 2023; Zhan et al., 2024). Nevertheless, the given trust is very weak; any breach of the security or an ethical hack can break the trust of users, and they will disengage at once (Maier et al., 2023). Thus, sustainable trust entails constant information as well as a high level of integrity on the part of the technology providers. Therefore, we hypothesized that:

H4: Attitude towards using voice assistance and engagement with voice assistance sequentially mediates the relationship between trust and service continuation intention

2.5 Attitude And Engagement Between Ease Of Use And Service Continuation Intention

Perceived Ease of Use (PEOU) is one of the fundamental parameters of Technology Acceptance Model (TAM) and plays an immensely significant role in determining user behavior with relation to VAs and begins a causal chain which affects attitude and engagement and the service continuation intention. PEOU is defined as how convinced a user is that the interaction with a technology would not need any effort. The more that the user perceives a VA to be simple, sensitive, and frictionless, the more that their attitude towards it is positive (Yilmaz and Rizvanoglu, 2022). And such positive rating is directly correlated with the quality of the system used in VA and demonstrated to be a good indicator of perceived usefulness and the overall satisfaction (Oktavia et al., 2023). Easy to use VA can greatly reduce the cognitive load on patients and thus have highly positive attitudes towards it, encouraging its use in everyday health management processes in situations such as healthcare that are very sensitive to cognitive loads (Ahanin & Sade, 2024).

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

Ease of use, which fosters this positive attitude, is one of the most important initial mediators in the road to long-term use. The seamless experience creates a perception that the VA is not only worthwhile but also reliable and fun that prompts the user to go past the basic acceptance phase to active exploration (Oktavia et al., 2023; Acikgoz et al., 2023). The second sequential mediator is engagement which is a behavioral product of this positive mindset. It is not only about the regular communication but is also about the emotional closeness and the desire to tap into the advanced features offered by the VA (Nyamekye et al., 2024). It has been found that a responsive and controllable interface of the VA makes a user feel greater psychological ownership and comfort that boosts engagement and the service continuance intention (Zhang & Zhou, 2023).

There are other factors that affect this pathway. The factor of trust becomes influential, as performance provided with a user-friendly interface is consistent and reliable, which creates the sense of confidence, and provokes the positive experiences of the first encounters to morph into long-term loyalty (Schultz & Paetz, 2023). Nevertheless, the simplicity of use is not the only criterion because when the VA does not work correctly after a certain period of time, users will lose interest (Yılmaz & Rızvanoğlu, 2022). Individual variations and situational matters also have a moderating effect. Older adults could also associate emotional support provided by a VA as crucial as ease-of-use (Liu et al., 2023) and, in one cultural condition, usability may be prioritized over privacy (Oktavia et al., 2023). Moreover, influential outside circumstances provided by such an event as the COVID-19 pandemic prompted VA adoption when users wanted to interact easily, without contact or touching dirty surfaces, which speaks of usability as a key motivating factor toward long-term engagement (Guha et al., 2023). The hedonic and social utility in an easy-to-use VA also creates a feeling of a custom or enhances the cost of terminating the services. (Nyamekye et al., 2024; Badghish et al., 2024). Therefore, we hypothesized that:

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

H5: Attitude towards using voice assistance and engagement with voice assistance sequentially mediates the relationship between ease of use and service continuation intention

2.6 *Attitude And Engagement Between Perceived Usefulness And Service Continuation Intention*

The perceived usefulness (PU), another cornerstone of TAM is one of the key determinants in the first adoption and subsequent continuous use of VAs. PU is characterised as the extent to which one feels that the use of a technology will assist in increasing performance at his or her job or in everyday life. When they feel that VA can help them save time, get the correct information, or multitask, they have high chances of developing an intention to use them continuously (Saavedra- Llamas et al., 2023; Molinillo et al., 2023). This connection though is not direct. Rather, the perceptions of usefulness to service continuation sequentially contribute first to the attitude of the user and then to his or her interaction with the technology.

Attitude is the initial mediator of this process. Positive perceptions of the usefulness of a VA, i.e., the usefulness of a VA to make tasks more convenient and efficient, directly stimulates positive attitudes, e.g., the trust, satisfaction, and a desire to delve deeper into advanced functionality (Mishra et al., 2021). Such positive judgments are, in turn, based on the high quality of either the process of the interactions (e.g., seamless voice recognition) or the quality of the outcomes of the interactions (e.g., information accuracy) (Saavedra-Llamas et al., 2023). This psychological stimulus that leads to involvement at the deeper behavioral level is a necessity brought by these positive attitudes formed on the basis of the tangible benefits which the VA offers. The attitude positiveness leads to attitude of usefulness being changed into the need to further interact with the technology.

This motivation is expressed behaviorally in the form of engagement, which is the second mediator. The level of interaction with a VA is deeper than its frequency of use and includes the establishment of an emotional

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

connection, discovering new capabilities, putting the assistant to various practical purposes (Kang et al., 2024). When the users are very involved, then they considerably gain a feeling of psychological ownership which in turn intensifies their vision of maintaining the service. The Stimulus-Organism-Response (S-O-R) framework cites that perceived usefulness (known as the stimulus), leads to a positive attitude (known as the organism), which consequently brings about sustained engagement (known as the response). Attributes that increase the interactivity, i.e., responsiveness and a sense of control, can be especially successful in creating this affect and stimulating repeated use (Kang et al., 2024). Highly personally innovative or experienced users are particularly skilled in achieving their utility out of VAs, which results in the more positive attitudes and continuance intentions (Molinillo et al., 2023; Choung et al., 2022). In other situations, perceived usefulness may be so strong that it can even assist in privacy concerns in reliance to the idea that it outweighs the benefits, which the users experience (Saavedra-Llamas et al., 2023).

H6: Attitude towards using voice assistance and engagement with voice assistance sequentially mediates the relationship between perceived usefulness and service continuation intention

Methodology

The study used the descriptive and cross-sectional type of research design (Dulock, 1993; Pandis, 2014) to study the aspects that determine the intention of continuity of using AI voice assistant services by adult users in Lahore, Pakistan, at one particular moment. The target group consisted of 18 and above years old people who have more than three months of active use of such services as Google assistant, Siri, or Alexa. Data was collected using non-probability convenience sampling. The resultant final sample size was 350 respondents, a figure identified to be sufficient to generalize, using a rule of thumb of Nunnally (1978) according to which ten subjects per question asked are sufficient. The initial number of paper and online surveys that were

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

gathered consisted of 380 surveys, out of which 350 were found to be appropriate to analyze. Another demographic variable such as gender, age, and education level were also considered with gender and age being controlled for because the literature noted that this could significantly affect the attitude toward AI (Su, 2019; Kaya, 2024; Gnambs, 2019). The ethical guidelines were observed without exception; every participant was briefed about the academic nature of the study and guaranteed of absolute confidentiality of data; thus, all information was being gathered in a fair manner without any maneuvering.

The main data collection tool was a structured questionnaire on a five assigning based on the Likert scale (1=Strongly Disagree, 5=Strongly Agree), which is supposed to eliminate the element of response bias (Feldman and Lynch, 1988). Two four-item scales used by Xu et al. (2011) were used to measure variables in the study: Privacy Concern and Privacy Risk. The measure of Privacy Cynicism relied on four items by Choi et al. (2018), whereas Trust was assessed with two items by Kim et al. (2019). The two Technology Acceptance Model constructs, Ease of Use and Perceived Usefulness were derived based on the work of Davis (1989) and measured accordingly by Rattan (2015) using four and five items respectively. The Attitude Toward Using and Engagement were both five and four item scales respectively, by Moriuchi (2019), the mediating variables. Lastly, Service Continuation Intention is a dependent variable which was assessed on a three-item scale using both Bhattacherjee (2001) and Ashfaq (2020). The analysis of data was conducted using the SmartPLS 4 software utilizing Partial Least Squares Structural Equation Modeling (PLS-SEM) that is appropriate in complex predictive models (Hair et al., 2017; Memon, 2021). The analysis carried out a two-step process as the reliability (Cronbach alpha, composite reliability) and validity (AVE, Fornell-Larcker, HTMT) of the measurement model was evaluated following the evaluation of the structural model path coefficients

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

(beta) and significance levels of the path using a bootstrapping (with 5000 resamples) procedure to test sequential mediation hypotheses.

Analysis and Results Discussion

The sample within the study greatly consists of single (75.5 percent), educated, young women, which is extremely pertinent to the study of voice assistants. More than half of the participants were women (61.7%), and the vast majority of them were aged 20-25 (76.6%), yet the majority possessed an undergraduate degree (65.5%). The given composition creates the impression of a tech-savvy audience the values of which are instrumental to the future of AI technologies. Yet, the predominance of females may impact the results pertaining to privacy and emotional interaction, whereas they are highly educated, which presupposes the familiarity to the core topics of the usability and Internet trust in the study. The demographic of a young and highly digital integrated user demographic offers very important information on how voice assistants are used and perceived.

4.1 Measurement Model

Table 4. 1: Measurement Model Results

Variables	Cronbach's value	Composite Reliability	Average Variance Extracted
Attitude towards using VA	0.859	0.861	0.640
Ease of Use	0.874	0.887	0.731
Engagement with Voice Assistance	0.757	0.777	0.584
Perceived Usefulness	0.861	0.873	0.648
Privacy Concern	0.786	0.788	0.610
Privacy Cynicism	0.696	0.705	0.526
Privacy Risk	0.873	0.877	0.726

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

Service Intention	**Continuation**	0.712	0.738	0.577
Trust		0.723	0.723	0.783

It was revealed that the internal consistency of all constructs was supported, and the Cronbach Alpha values were mostly greater than 0.70 accepted value. The constructs that yielded commendable reliability include Ease of Use (0.874), Privacy Risk (0.873), Perceived Usefulness (0.861) and Attitude towards using V A (0.859). Other measures that revealed reliable measures include Privacy Concern (alpha=0.786), and Trust (alpha=0.723). Even though Privacy Cynicism (alpha = 0.696) has slightly failed to meet the requirement of 0.70, it lies within the range suitable enough to run exploratory analysis. This means that the players gave similar answers in each of the questions concerning each construct.

All constructs were reliable since Composite Reliability (CR) that is a reliable estimate of internal consistency had an acceptable value of 0.70 and above. The three variables Ease of Use (CR = 0.887), Privacy Risk (CR = 0.877) and Perceived Usefulness (CR = 0.873) have extremely good internal consistency, which demonstrates that the measurement items belonging to these variables are strongly interconnected. The construct that complies with the minimum requirement even in the lowest value, Privacy Cynicism (CR = 0.705), justifies its usage. These high CR values justify that all constructs have been properly and reproducibly measured against the concept they impose.

Average Variance Extracted (AVE) was used to determine the convergent validity and ensured that each of the constructs exceeded the suggested compulsory level of 0.50. This implies that the psychometric properties of the items in each scale are good in that the items adequately measure their latent construct. The evidence of strong convergent validity (high AVE) was evidenced with Trust (AVE = 0.783), Ease of Use (AVE = 0.731), and Privacy Risk (AVE = 0.726). The constructs which have a cutoff score the lowest, Privacy Cynicism (AVE = 0.526) and Service Continuation Intention (AVE =

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

0.577) were still above the line. With these AVE results, it is confirmed that the variance explained by each construct is larger than the variance due to measurement error, hence, providing evidence of the theoretical and structural validity of the model.

Table 4.2: Discriminant Validity

	ATA	EOU	EVA	PU	PC	PCY	PR	SCI	TR
Attitude towards using VA (ATA)	0.800								
Ease of Use (EOU)	0.605	0.855							
Engagement with VA (EVA)	0.035	0.021	0.764						
Perceived Usefulness (PU)	0.690	0.828	0.056	0.805					
Privacy Concern (PC)	0.535	0.613	0.003	0.574	0.781				
Privacy Cynicism (PCY)	0. 076	0.513	0.071	0.500	0.597	0.725			
Privacy Risk (PR)	0.473	0.553	0.097	0.528	0.752	0.721	0.852		
Service Continuation Intention (SCI)	0.016	0.035	0.402	0.042	0.072	0.032	0.003	0.760	
Trust (TR)	0. 438	0.563	0.081	0.535	0.654	0.627	0.679	0.070	0.885

The presented analysis accomplishes the fact that all constructs of the model satisfy the Fornell- Larcker condition and prove excellent discriminant validity. This implies that the different constructs are not repetitive with others. The square root of each construct average variance extracted (AVE) is

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

always larger than its correlation with any other construct. As an example, the square root of the AVE of Attitude Toward Using Voice Assistance (ATA) is 0.800 and is stronger as compared to the correlations of Ease of Use (EOU) (0.605) and Perceived Usefulness (PU) (0.690). Likewise, the AVE square root (0.855) of EOU is higher than the value obtained in the strongest correlation of EOU and PU (0.828), although the relationship between the two is supposed to be strong.

The above pattern of uniqueness can also be applied to the remaining variables. The AVE square root of the Engagement with Voice Assistance (EVA) is 0.764, substantially greater than the correlations it has with constructs such as ATA (0.035) and EOU (0.021). Perceived Usefulness (PU) also has its distinctive identity owing to its AVE square-root of 0.805 which is beyond its high correlation with EOU. The privacy constructs positively correlated conceptually such as Privacy Concern (PC), Privacy Cynicism (PCY), and Privacy Risk (PR) are even revealed to be independent. As an example, the square root of AVE of PC (0.781) is higher than the correlation between PC and PR (0.752) and the square root of AVE of PR (0.852) is higher than its correlation with PC (0.752).

Moreover, Service Continuation Intention (SCI) is the behavioral construct that also differs with regard to the other behavioral constructs by having an AVE square root of 0.760 and has weak relationships with the other behavioral constructs such as EVA (0.402) and Trust (0.070). Finally, Trust (TR) has a highest AVE square root of 0.885, and it is statistically different with corresponding similar notions on PR (0.679) and PC (0.654). Overall, the model has managed to avoid multicollinearity and conceptual and empirical soundness of each construct occurred through their uniqueness, even in the situations of strong correlations.

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

Table 4.3: Principal Component Analysis Results

Latent Constructs		Items	Item Loadings
Attitude towards using Voice Assistance	ATA_1	I think using a voice assistant for information-seeking would be useful	0.823
	ATA_2	I think using a voice assistant for information seeking would be realistic	0.831
	ATA_3	I think using a voice assistant for information-seeking would be informative	0.815
	ATA_4	I think using a voice assistant for information seeking would be specific	0.734
	ATA_5	I think using a voice assistant for information-seeking would be logical.	0.792
Ease of Use	EOU_1	I think using a voice assistant would be easy to understand and clear	0.913
	EOU_2	I think I would find a voice assistant easy to use.	0.903
	EOU_3	I think I would find it easy to use a voice assistant for accessing information.	0.875
	EOU_4	I think I would be easy for me to become skillful at using a voice assistant.	0.715
Engagement with Voice Assistance	EVA_1	I think I engage in a conversation with a 8 assistant when I need customer support	0.747
	EVA_2	I think I feel that the engagement I have with a voice assistant is very human-like	0.836
	EVA_3	I think the engagement I have with a voice assistant would be very meaningful.	0.780
	EVA_4	I think the engagement I have with a voice assistant would have a huge impact on my purchasing decisions.	0.821
Privacy Concern	PC_1	I think I would be concerned that the information I submit to a voice assistant could be misused.	0.774
	PC_2	I think I would be concerned that others can find private information about me from a voice assistant	0.777
	PC_3	I think I would be concerned about providing personal information to a voice assistant because of what others might do with it	0.825
	PC_4	I think I would be concerned about providing personal information to a voice assistant because it could be used in a way I did not foresee	0.747
Privacy Cynicism	PCY_1	I think I would have become less interested in online privacy issues.	0.787

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

	PCY_2	I think I would become less enthusiastic in protecting personal information provided to online vendors.	0.650
	PCY_3	I think I would doubt the significance of online privacy issues more often	0.773
	PCY_4	I think I would just want to use Internet services and not to be bothered by online privacy issues	0.680
Privacy Risk	PR_1	I think in general; it would be risky to give personal information to a voice assistant	0.772
	PR_2	I think there would be high potential for privacy loss associated with giving personal information to a voice assistant	0.877
	PR_3	I think personal information could be inappropriately used by a voice assistant.	0.874
	PR_4	I think providing a voice assistant with my personal information would involve many unexpected problems.	0.880
Perceived Usefulness	PU_1	I think using a voice assistant would enable me to accomplish more tasks more quickly	0.851
	PU_2	I think using a voice assistant would increase my productivity	0.894
	PU_3	I think using a voice assistant would make it easier to store information	0.779
	PU_4	I think overall, using a voice assistant would be advantageous	0.830
	PU_5	I think using a voice assistant would improve my life.	0.721
Service Continuation Intention	SCI_1	I intend to continue using this chat bot in the future	0.721
	SCI_2	I will always try to use this chat bot in my daily life.	0.868
	SCI_3	I will strongly recommend others to use it.	0.851
Trust	TR_1	I think a voice assistant in a reliable way such that business transactions would be conducted	0.885
	TR_2	I think a voice assistant would handle personal information in a competent fashion	0.885

Outer loadings analysis shows that item reliability and convergent validity within the framework of most constructs are high. On Attitude Toward Using VA (ATA), Ease of Use (EOU), Engagement with Voice Assistance (EVA), Privacy Concern (PC), Privacy Risk (PR), Perceived Usefulness (PU), Service Continuation Intention (SCI) and Trust (TR) all the loadings are significantly higher than the generally agreed upon loading of 0.70. It means that the items are outstanding measures of the corresponding constructs and may be

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

effectively used to explain substantial variance in user's attitudes, perceptions, and behaviors concerning voice assistants. However, the Privacy Cynicism (PCY) construct can be slightly variable as two of the items (PCY 2 0.650 and PCY 4 0.680) are below the expected 0.70 mark, although they are within the acceptable range considered by exploratory research expected to exploit the model in subsequent research options. Altogether, the high loadings with consistency in most constructs represent the good internal consistency and confirm the validity of the measurement model to be used later in the structural equation modeling.

4.2 Structural Model

Table 4. 4 Hypothesis Testing

	Hypotheses	Beta Value	T-Values	P-Values	Result
H1	PC -> ATA -> EVA	-0.005	0.572	0.000	Supported
H2	PR-> ATA -> EVA -> SCI	-0.003	0.575	0.000	Supported
H3	PCY -> ATA -> EVA -> SCI	-0.004	0.366	0.000	Supported
H4	TR -> ATA -> EVA -> SCI	0.042	0. 363	0.002	Supported
H5	EOU -> ATA> EVA -> SCI	0.017	0.245	0.000	Supported
H6	PU -> ATA -> EVA -> SCI	0.507	0.676	0.005	Supported

Hypothesis 1, one that attitudinal intention towards the use of voice assistance and the use of voice assistance sequentially as mediators between the relationship between privacy concern and intention of wanting the service to continue was accepted. The observation is supported by a substantial literature that indicates the preeminence of privacy concerns in defining the attitude users have towards voice assistants (VAs), and the levels of

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

engagement with them. The privacy issues are cognitive-emotional cues that tend to tarnish the confidence and to awaken suspicion concerning data gathering and monitoring (Seymour et al., 2023). Ambiguity of the exact time of VA recording, the location of the data, and the people accessing it tends to create a cautious or negative attitude in the user (Kim et al., 2023). Such attitudes lead to behavioral consequences such as less engagement or VA use being limited to the bare basic functions, which subsequently undermine the intentions to continue using a service. Another important fact noted by Schultz & Paetz (2023) is that, the more a brand can be trusted, the more the user can ignore issues related to privacy and the user will still be given time. Thus, user attitude and engagement constitutes a very vital sequential route, and mediates effects of privacy concern on consequent use, as validated by the accepted hypothesis.

Hypothesis 2, which speculated that attitude towards use of voice assistance and engagement with use of voice assistance sequentially mediated the connection between privacy risk and service continuation intention, was also approved. The possibility of data misuse is also called perceived privacy risk or it is not the overall concern; rather, it is the belief by the user that their information may be abused and they must feel compelled to use VA indefinitely due to such a psychological obstacle. Since VAs are characterized by constant data tracking, as it is mentioned by Liu et al. (2025) and Moorthy & Vu (2021), they contribute to mistrust and form negative attitudes to discourage deeper interaction. According to Choi et al. (2023), the presence of these negative attitudes is proven to trigger a direct decline in the engagement since users tend to turn off features or use them as minimally as possible to protect their information. Abdussami & Candiwan (2021) also point out that it is surveillance issues that undermine engagement and, as a result, services are abandoned. Although there is a negative relationship between trust and the effects, these effects can be lessened; however, since perceived privacy risks affect attitude and engagement less there is a strong

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

path of mediation; that is greater the perceived privacy risk there is a reduced attitude and engagement, which ultimately reduces the long-term usage, hence confirming the hypothesis.

Hypothesis 3, which stated that the attitude towards using voice assistance and engagement with voice assistance sequentially mediates the position between the privacy cynicism and service continuation intention, was also accepted. Privacy cynicism (believing that the misuse of data is simply unavoidable), squashes to severe levels the emotional investment of users regarding VAs. According to Acikgoz et al. (2023) and Das & Nathan-Roberts (2021), such cynicism contributes to skepticism, suspicion, simultaneously increasing barrier to trust specifically among digital natives who are highly reflexive of surveillance and unable to do much about it. This creates a negative attitude, and results to a lack of motivation or extreme specificity in the use of VAs, usually only on those tasks with low risk. According to Maier et al. (2023), the quality of interaction is degraded by such attitudes, and the levels of habitual use are decreased. Whereas the fact that some users engage in the paradox of cynical trust and use trusted brands (Acikgoz & Perez-Vega, 2021) remains, most show less engagement and less desire to keep using them. Thus, it can be concluded that the offered hypothesis is substantiated by empirical sources declaring the effects of privacy cynicism on further use by influencing attitudes and a lack of engagement, which are demonstrated by research findings.

The fourth hypothesis assuming that attitude toward using voice assistance and engagement with voice assistance sequentially mediate the relationship between trust and service continuation intention was rejected. Trust is basic in development of positive perceptions concerning technology. According to Schultz & Paetz (2023), trust is seen as both cognitive (confidence in competence of the assistant) and emotional (confidence in its good nature), which lead to a positive user attitude. These favorable attitudes next get converted into greater and more involvement with the assistant which

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

creates a cycle of recognition and devotion. Leonidou & Zantis (2024) substantiate that emotional trust produces a more robust social presence that motivates services to explore features and ultimately use the service over a long period. Acikgoz et al. (2023) reveal that highly trusted users have a stronger intention to reveal personal information and discover VA functionalities, which enforces the chain of further usage. Although trust should always be upheld and not to discourage it, the original impact of attitude and behavior is considered to be the fundamental pathway covered by this hypothesis, therefore, making its acceptance.

The Hypothesis 5, that stated that attitude toward the use of voice assistance and engagement with voice assistance as sequential mediates between ease of use and service continuation intention, was also supported. Technology acceptance models are deeply rooted in ease of use, and its attitudes have always been proved by literature. According to Yilmaz & Rizvanoglu (2022), intuitive interfaces with faultless performance increase the level of perceived satisfaction and promote a positive attitude. The users experience when they find VAs to be simple in use will be eager to incorporate the VA into their daily activities and use it more often. According to Ahanin & Sade (2024), the ease of use reduced the burden of the user considerably in health situations,

enhancing frequent use. The same ease applies to behavioral commitment: as less labor-intensive the interaction becomes; the more confident users use VAs. As Acikgoz et al. (2023) and Zhang & Zhou (2023) illustrate, the process of positive interactions that are repetitive and built through ease of use contributes to the presence of psychological ownership, which positively reinforces continuation intentions. The fact that the hypothesis is corroborated by the finding that usability helps in building trust, thereby promoting attitude as well as engagement justifies its acceptance.

Hypothesis 6 which was tentatively given was also approved that is, attitude to using voice assistance and involvement with voice assistance sequentially

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

mediates the linkage between perceived usefulness and continuation of action with regard to service continuation intention. One of the major cognitive factors in establishing user loyalty and integration with technology is the perceived usefulness (PU). The favorable attitude the users take towards VAs improves satisfaction and curiosity when viewing them as beneficial multitasking, information retrieving, or time-saving (Saavedra-Llamas et al., 2023). Mishra et al. (2021) establish that PU brings about a rise in trust and satisfaction, which is equivalent to intensive discovery and emotional attachment. Kang et al. (2024) underline that an element of PU, responsiveness, exhibits the most significant effect on continuing use. Individuals that perceive practical utility in VAs are likely to adopt and apply it across devices, obtain emotional satisfaction of using the products and be sticky. Molinillo et al. (2023) also note that the tech-savvy users enjoy greater utility of VA which results in more significant continuation intention. Therefore, the postulated hypothesis is correct in that perceived utility develops a resounding cognitive-emotional channel through the attitude and participation to sustained utilization.

PLS Path Coefficient Model

In PLS-SEM, hypotheses are tested by running an algorithm with the inspection of the variable relationships through a bootstrapping process.

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

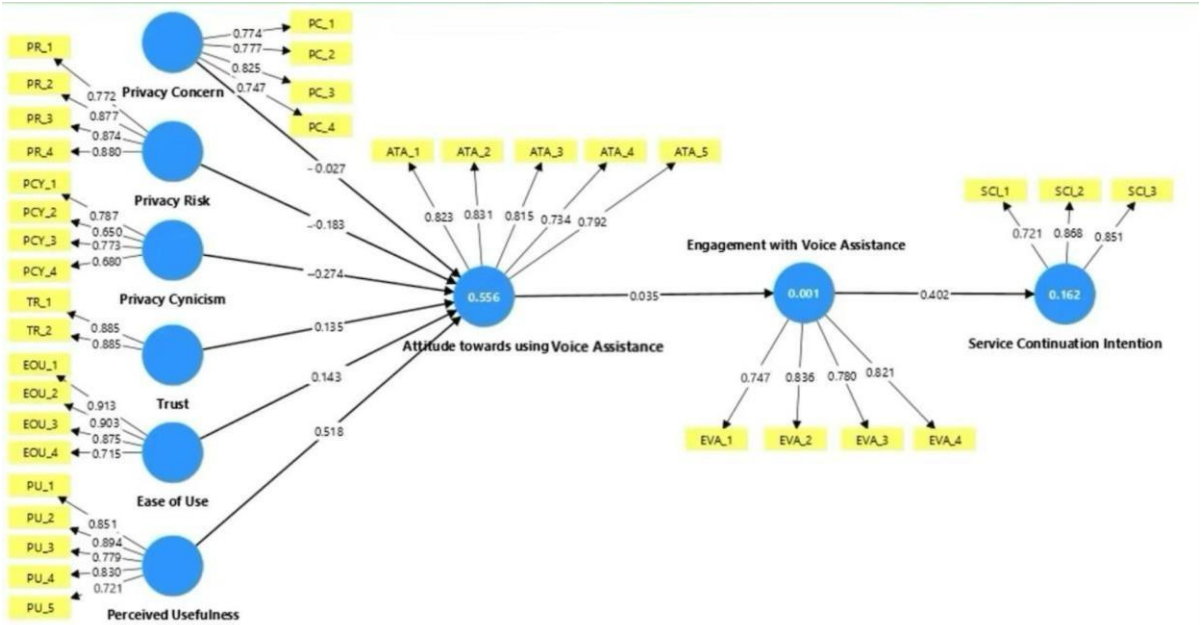

Figure: PLS-SEM Algorithm

Theoretical Contributions

The present research is of great theoretical value to comprehending technology acceptance, user engagement, and privacy attitudes concerning voice assistants with AI developments. One of them is the extension of the Technology Acceptance Model (TAM) by proposing a two-level mediation process whereby user attitudes and user involvement in the service intervene between relationships between a number of antecedents (including ease of use, usefulness, and trust) and the intention to keep on using the service. This model suggests that the positive attitudes should result in engagement which will cause the long-term usage as a more dynamic and multifaceted perspective compared to the linear models of user behavior.

Also, the study presents a new model to interpret the significance of privacy. It reduces the privacy concerns into three distinct psychological dimensions which are privacy concern, privacy cynicism and privacy risk. According to the findings, another outcome is the impact on privacy cynicism which is a previously understudied factor and makes a significant negative contribution to user attitudes. This points to the existence of a wide range of

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

differences between the functional dimensions of the technology, which affects user actions directly, and the emotional, moral understanding of data security to which users are much less indifferent. Trust as a mediator also gets affirmative in the study as it has proven to be critical in moderating and filtering unfavorable privacy concerns and, therefore, is an undeniable support as an emotional barrier of sustained usage. In general, this study offers a well-rounded behavioral model incorporating positivity and negativity factors that reveal that technology adoption is a mixed emotional mediated and privacy- sensitive process not an uncomplicated cost-benefit analysis.

Practical Contributions

The current paper also presents meaningful and actionable recommendations to designers, developers, and marketers of voice assistants based on AI. The most important lesson is that creating a positive attitude on the part of users and a high level of engagement is of paramount importance because it forms the main factor in the long-term persistence of services. The practitioners should not only consider the basics of usability and usefulness, such as simple interfaces and obvious commands but the establishment of experiences that would stimulate the emotional sense of attachment and the cognitive attachment. It includes creating functionalities which will facilitate individualization, a natural interface and on-demand assistance to build habits and emotional ties that will help breed user loyalty.

In addition, the study reveals the necessity to actively manage and minimize user concerns especially in form of privacy concerns. The firms need to do more than the bare minimum of being compliant and aim at establishing trust with radical transparency. This encompasses the open articulation of data routines, the availability of clear controls that are simple to use to administer accreditations and voice history and furthermore a regarded clear use of the benevolent utilization of data. In this way, they will be able to overcome the detrimental effects of privacy concern, cynicism, and perceived risk, which the study determines to be prominent obstacles to sustained use.

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

Finally, the study would require a broader development that puts more emphasis not only in technical operations but also in the psychological and emotional experience since the trust and meaningfulness build the user loyalty.

Limitations

This study has limitations significant to the point of defining its purpose and effect. Mainly, the limitations of the study are its research design and limited sample hypothesis. The first limitation is that the sample was geographically and demographically homogenous and comprised of 350 unmarried educated girls of the city of Lahore in Pakistan. The hyper-technological and digitally acculturated nature of this group suggests that their notions of utility, privacy and trust will not reflect on all populations, especially older or less-educated members of a society who can be culturally different. As a result, the results and especially the significant impact of privacy cynicism might not apply to a larger, more heterogeneous group of users in general.

The cross-sectional research design is another major limitation since it only provides one moment in time. The PLS-SEM would indicate suggested causal relationships of attitude to engagement to continuation, but this chronological relationship cannot be absolute and such a study could be addressed only in a study over a length of time. Experimental or longitudinal design would be needed to verify the fact, e.g. in case that a growth in trust does generate the growth in engagement and then an increase in retention with time. There is also the drawback in the study with respect to the use of self-reported outcome that is prone to a common method-bias and social-desirability influences. It is possible that the respondents could be overestimating or underestimating the extent of their involvement and consequently reducing the accuracy of the results to reflect a possible match to their actual behavior. The combination of self-reported data and objective measurements (e.g., usage logs, or app analytics) that will show a more accurate picture would be beneficial in future studies.

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

Lastly, the model of the research is not exhaustive. It does not consider other possible impactful contributors of technology continuation like the hedonic motivation, social convergence, or user habit. Neither did it test moderating influences of other factors such as age, or sex. Such omissions suggest that the model does not entirely reflect the reality of the multi-dimensional user behavior when using AI voice assistants.

Future Research Directions

Based on the findings and the weaknesses of this research paper, a set of future research directions will be suggested to develop a better insight into service continuation intentions in using voice assistants and conceptual advancements of the sequential mediation model.

Investigating the Attitude toward Voice Assistants in Cross-Cultural Context: This research study has been carried in one culture and geographical location known as Lahore, Pakistan, which is a limitation of the study in terms of generalizability of findings. Future studies may extend to cover cross-cultural sample to determine the differences in cultural norms, privacy attitude as well as acceptance of technology across regions. Take the case of the level of trust in voice assistants and beliefs about the issue of privacy that might differ between collectivist and individualist cultures. These comparative studies would offer an understanding of the cultural contextually of these relations between the context of privacy concern on the one hand and user attitude, user engagement, and continuance of service intentions.

Additional Mediators and Moderators: Though this study has centered our minds on the sequential mediating position of the user attitude and engagement, other psychological and behavioral processes that can be used to control the further gate passage of voice assistant services can still be investigated. Other mediators that can be envisioned in the future research to be tested are: habit, technology anxiety, enjoyment, perceived interactivity. Similarly, such moderators as age, digital literacy, user experience with AI,

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

and trust disposition might offer additional trial by indicating under which circumstances the sequential pathways will be reinforced or diminished.

Longitudinal Research to Assess Continuation Over Time: In this study, a cross-sectional design was used that fails to describe the change in user perceptions or behavior. This can be followed up in future studies with a longitudinal design because the same individuals develop or lose trust in the voice assistant operating system and usage behavior may change over time. Longitudinal data would allow the researcher to better examine the causality nature of engagement and whether it persists over time and use or it declines over time and use.

Research of Negative User Experiences and digital burnout: Because not all relationships in this model are positive (e.g., high privacy concern resulting in a less favorable attitude or acceptance), future studies need to investigate circumstances when voice assistant usage results in dissatisfaction or mistrust or abandonment. Example, the user who finds voice assistants invasive or unresponsive will have what is known as digital fatigue. Research can be conducted at the boundaries at which privacy concern, information overload, or performance failure supersedes perceived usefulness, which causes user drop out.

Exploring the Position of AI Ethics and Regulatory Consciousness: A future study might want to look and the effect protection awareness on users (e.g. GDPR, local data laws) has, on trust, attitudes and decision to continue. Such variables as perceived ethical alignment or awareness of data protection policies could be included to throw some light on understanding how institutional trust influences the behavior of the user.

Responses to investigating Voice Assistant Design and Personalization factors: Lastly, in future studies, it might be of interest to investigate the impact of such design aspects as personalization, voice tone, emotional intelligence, or cultural adaptability on engagement and retention. The anthropomorphism and emotional responsiveness of voice assistants will be

Volume. 4 Issue No. 3 (2025)
Online ISSN: 3006-2047
Print ISSN: 3006-2039

important aspects because these elements will be critical in looking at the long-term adherence attitude of the users to using a particular service.

In brief, in order to create a more complete picture of what, future studies are recommended to carry on refining the theoretical framework of the study by broadening its scope, incorporating alternative methodologies, and covering contextual, psychological, and technological factors.

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