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Understanding the Mechanisms of AI-Powered Virtual Assistants: Evaluating Their Impact on Consumer Decision-Making and Brand Loyalty as a Mediating Variable.

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Abstract

This research paper looks deeper into the implementation of fundamental AI-driven virtual assistants and estimates their impact on consumer decision-making processes and methods, considering brand loyalty as a leverage or mediating variable. The expansion of AI has led to the incorporation of virtual assistants similar to Google Assistant, Alexa, and Siri into daily life, offering customized assistance and suggestions fabricated to individual choices. These virtual assistants are past basic tasks, assisting consumers in product research and information gathering, suggestions, and decision-making processes. By catering individualized experiences, AI-driven virtual assistants have the ability to enhance loyalty towards brands among consumers. This study talks about and investigates the direct and indirect impacts of AI-powered virtual assistants on consumer decision-making processes, mediated by brand devotion. Literature review highlights the importance of factors such as accuracy of information, time efficiency, cost efficiency, and user experience in forming consumer behavior. Hypotheses are to examine the connection among these variables, which are tested through a mixed method, combining quantitative analysis along with mediation modeling. Findings direct a positive link among AI-run virtual assistants and consumer decision-making, with brand loyalty having a mediating role. Involvement for businesses also includes the improvement of individualized marketing strategies and the maintenance of consumer faith through transparency of AI engagement. Despite the revolutionized influence of AI-powered virtual assistants, constraints such as illustrative collection of data and the need for multiple research techniques and methodologies are recognized, recommending direction for future research to range from the shady dynamics of AI in consumer process of decision-making and brand devotion.

Keywords: *Artificial Intelligence, Virtual Assistants, Consumer Decision-Making, Brand Loyalty, SDG 9.*

1. Introduction

Our daily lives now depend highly on artificial intelligence, and AI-powered virtual assistants are just becoming a daily part of our lives as well. Virtual assistants of this sort, including Google Assistant, Alexa, and Siri, are programmed with very sophisticated artificial intelligence algorithms to cater to consumers' information and back them up with information that is specially tailored to them, according to each individual (Maedche et al., 2019; Balakrishnan & Dwivedi, 2021). Artificial intelligence (AI)-powered

virtual assistants have greater functions than simply basic tasks similar to playing games or setting appointments (Pugalenthi et al., 2020; Marinchak et al., 2019). They also execute proper product research, deliver recommendations, and help customers with decision-making (Dellaert et al., 2020; McLean et al., 2021). Additionally, by delivering a well-ordered and personalized consumer experience, virtual assistants backed up by AI possess the power to help improve brand loyalty among consumers (Curtis et al., 2021; Klaus & Zaichkowsky, 2020). Stronger virtual assistants have completely revolutionized the way customers decide by giving them super-fast access to data and personalized recommendations. The decision-making methods of consumers are directly and indirectly influenced by the deployment of AI-driven virtual assistants (Song, 2021; Lu et al., 2021).

Artificial intelligence (AI)-empowered virtual assistants may suggest products and services that best suit a user's needs and choices by very carefully examining consumer preferences, past behavior, and patterns of purchasing (Lee & Kwon, 2008; Dellaert et al., 2020). By giving the consumer, the most precise and relevant information, it does not only save time but also helps them progress their overall management in general (Andrade & Tumelero, 2022; Polas et al., 2022). Virtual assistants that are operated by AI also have the supremacy to increase consumer's brand loyalty. Virtual assistants foster brand loyalty and faith in brands by providing customized service and personalized advice (Delgado-Ballester & Munuera-Alemán, 2001; Rather et al., 2022). Consumers can create a sentimental bond with a company or a specific brand and become more attached to it if they get personalized recommendations and constant support which is given from AI-powered virtual assistants (Hoyer et al., 2020; McLean et al., 2021). Consumers' brand loyalty can develop as a result of evident assessment, high standards, and customer satisfaction, which increases brand loyalty (Yang, 2010; Zinkhan & Braunsberger, 2004).

It is possible to get a deep impact of virtual assistants driven by AI on consumer preferences and loyalty towards brands by focusing on trust as the mediating factor. When AI-enabled virtual assistants are very reliable and almost accurate to deliver product information, consumers can trust and rely more on them (Dellaert et al., 2020; Maedche et al., 2019). Additionally, these systems can evaluate and understand huge amounts of consumer data to highlight the choices, behaviors, and pre- and post-purchase patterns by using AI and machine learning approaches (Pugalenthi et al., 2020; Saxena et al., 2023). This helps increase customer and brand trust by supporting virtual assistants backed-up with AI to provide precise and personalized suggestions (McLean et al., 2021; Delgrange et al., 2020).

In conclusion, customer decision making as well as loyalty for a specific brand are significantly impacted by AI-enabled virtual assistants. They save time and most certainly improve the process of decision-making by catering tailored suggestions and backup that correspond with individual choices (Andrade & Tumelero, 2022; Song, 2021). Along with that, by fostering trust with the most accurate and very consistent information, AI-driven virtual assistants support brand loyalty (Delgado-Ballester & Munuera-Alemán, 2001; Rather et al., 2022). Furthermore, the consumer's experience has been enhanced by the application of bots or chatbots and artificial intelligence in assistance for customers (Curtis et al., 2021; Marinchak et al., 2019). Clients can get round-the-clock service, efficient replies, and effective setup of large quantities of exploration. By proper data analysis, AI-powered virtual assistants can cater individualized engagement, accurate and reliable information, and solution-centered dialogues (Andrade & Tumelero, 2022; Balakrishnan & Dwivedi, 2021). Companies that most effectively and quite consistently interact with their corporate image and objective have a better chance to synchronize the perspective of different employers, which expands overall brand interaction (Hoyer et al., 2020; McLean et al., 2021).

Artificial intelligence (AI)-driven virtual assistants tend to do more than just give individualized recommendations and assistance. They are also able to most efficiently deal with large amounts of query and discussion focused on solution finding. The entire consumer participation has been remarkably enhanced by the use of bots or chatbots and artificial intelligence in consumer dealing. Consumers now

get quicker replies and full availability, which certainly improves brand loyalty and interaction (Curtis et al., 2021; Marinchak et al., 2019).

Furthermore, AI-driven virtual assistants influence the improvement of faith and devotion within partners, workers and co-workers, and consumers by constantly interacting with the organizational image and mission or vision of the brand (Hoyer et al., 2020; Klaus & Zaichkowsky, 2020). Such constant presence assists to align the perspectives of various stakeholders, which increases total brand interaction and coordination. AI-enabled virtual assistants have the ability to further improve the retail industry in addition to their impact on customer decision-making process and loyalty towards brands. These systems can evaluate heavy volumes of consumer data to interpret choices, behaviors, and pre- and post-purchase patterns by implying AI algorithms and machine learning methods (Saxena et al., 2023; Pugalenthi et al., 2020). This enables the assistance of precise and personalized suggestions. Along with that, a more efficient and individualized purchasing instance might be the product from the usage of virtual assistants run by AI in e-commerce, which will increase customer satisfaction and loyalty towards the brand (Lee & Kwon, 2008; Song, 2021).

Consumer preference and brand devotion are beyond question impacted by AI-driven virtual assistants. Artificial intelligence (AI)-operated virtual assistants assist consumers in making better decisions and carry brand loyalty by catering individualized suggestions and assistance (Delgrange et al., 2020; Dellaert et al., 2020). Additionally, brand interaction and coordination can be positively influenced by the usage of AI-driven virtual assistants (Hoyer et al., 2020; McLean et al., 2021). Artificial intelligence (AI)-driven virtual assistants have the ability to persistently build trust and devotion among consumers, workers and co-workers, and partners by being dependable in communicating the brand's mission and image (Klaus & Zaichkowsky, 2020; Maedche et al., 2019). Establishing a consistent presence conveys confidence and loyalty among many stakeholders, which includes partners and consumers. Along with that, a thorough grasp of the doings of virtual assistants backed up by AI and how they affect consumer choice and brand loyalty necessitates inquiring into the possible drawbacks, ethical questions, changing chat-bot engagement, and the necessity for constant development (Marinchak et al., 2019; Curtis et al., 2021). Finally, we designed and identified the possible main factors of consumer decision with AI and understand how the independent factors impact it. The research questions are as follows:
RQ1: How can AI impact the influence of consumer decisions and brand loyalty?
RQ2: What are the important factors that play the most important role in AI virtual assistants?
RQ3: What are the possible benefits of using AI powered virtual assistants in consumer decision making and brand loyalty?

The literature review is followed by the formulation of hypotheses, which is later used to formulate a research technique that aligns with the model of the research project, data collection process, and lastly analyzing the results (Voorhees et al., 2016; Zait & Bertea, 2011). Following that, the findings are studied, including the demographics of the respondents, model assessment measurement, discriminant validity, structural model evaluation, and hypothesis testing. The conclusion part of this research highlights the study's impact after a review of previous studies and its limitations (Khalil et al., 1999; Ghizlane et al., 2018).

2. Literature Review

Consumer decision-making is a complicated process which is influenced and impacted by numerous factors like time-efficiency, cost-efficiency, user module, etc. The incorporation of AI-operated virtual assistants has significantly converted this process by impacting brand loyalty and consumer satisfaction. To gain a comprehensive understanding of consumer decision-making, AI and other essentials that are directly or indirectly connected to these factors need to be reviewed from existing literature and research studies.

There are numerous studies that have discovered the role of AI-powered virtual assistants in shaping consumer decisions. For example, a study by Lee and Kwon (2008) emphasized the impact of personalized recommendations provided by AI assistants on consumer decision-making (Lee & Kwon, 2008). Additionally, another research shows that mental and emotional factors influence why people come to depend on virtual assistants (McLean, Osei-Frimpong, & Barhorst, 2021; Marinchak, Forrest, & Hoanca, 2019). There is more evidential study showing the effectiveness of AI-powered virtual assistants in increasing consumer brand engagement, which is essential to conduct and improve research (Dellaert et al., 2020; Hoyer, Kroschke, Schmitt, Kraume, & Shankar, 2020; Klaus & Zaichkowsky, 2020). These studies together highlight the meaningful impact of AI-powered virtual assistants on consumer decision-making and brand loyalty. Now, based on the variables, the elaborative literature review is discussed below.

2.1. Accuracy of Information

AI-powered virtual assistants are designed in such a way that they provide accurate and relevant information to users, impacting their decision-making processes. Research by Saxena et al. (2023) highlights the importance of AI algorithms in analyzing vast amounts of data by integrating computer science, data science, and problem-solving strategies to generate almost accurate responses customized to user queries (Saxena et al., 2023). For instance, another study provides evidence that virtual assistants like Amazon's Alexa and Apple's Siri utilize natural language processing and machine learning algorithms to understand and respond to user inquiries with high accuracy (Pugalenthi, Chakkaravarthy, Ramya, Babu, & Krishnan, 2020; Kuznar, Tavcar, Zupancic, & Duguleană, 2016). This means that AI-enabled virtual assistants can provide high accuracy in providing information, as seen in the sector of voice assistance. This accuracy of information enhances user trust and confidence in the information provided, impacting their decision-making regarding product purchases or service selections.

H1: *Accuracy of information provided by AI-powered virtual assistants has a positive and significant relationship with consumer decision-making processes.*

2.2. Time Efficiency

One of the crucial and beneficial facts about AI-powered virtual assistants is offering time-saving benefits by instantly responding to user inquiries and performing tasks resourcefully. To understand this benefit of AI virtual assistants, we found research which demonstrates how virtual assistants modernize tasks such as online shopping, appointment scheduling, and information recovery, thereby saving users valuable time (Lee & Kwon, 2008; Lu, Su, Diao, Wang, & Zhou, 2021). For example, virtual assistants that are integrated into mobile devices or smart speakers allow users to accomplish tasks hands-free and with minimal effort, contributing to time efficiency in their daily activities (Marinchak, Forrest, & Hoanca, 2019; Balakrishnan & Dwivedi, 2021). This shows the evidential proof of saving time through the help of AI virtual assistants. This time-saving aspect of AI assistants influences consumer decision-making by making the purchase process more convenient and prompter, remarkably in the field of e-commerce and service industries (Song, 2021).

H2: *Time-saving features of AI-powered virtual assistants have a positive and significant relationship with consumer decision-making processes.*

2.3. Cost Efficiency

Another factor of AI-powered virtual assistant, that is, cost efficiency is considered to contribute to optimizing resource operation and minimizing expenditures for users. Research by Ghizlane, Abdellah, and M'hamed (2018) supports and highlights how virtual assistants help users to find the best deals, compare prices, and manage budgets successfully, which leads to cost savings benefits (Ghizlane, Abdellah, & M'hamed, 2018). For instance, virtual assistants like Siri, Google Assistant, Microsoft Cortana offer personalized recommendations and discounts based on user preferences and past behavior, which enhances the cost efficiency for the consumer in purchasing decisions (Kuznar, Tavcar, Zupancic,

& Duguleană, 2016; Lu et al., 2021). Additionally, the integration of virtual assistants in customer service reduces operational costs for businesses by automating recurring tasks and improving service efficiency, which again leads to cost-cutting benefits (McLean, Osei-Frimpong, & Barhorst, 2021; Curtis, Bartel, Ferguson, Blake, Northcott, Virgara, & Maher, 2021). Hence the hypothesis that can be applied here:
H3: *Cost efficiency facilitated by the use of AI-powered virtual assistants has a positive and significant relationship with consumer decision-making processes.*

2.4. User Experience

The user experience through AI-powered virtual assistants is enhanced through different instinctual interfaces, personalized interactions, and unified integration with various devices and platforms. The connection of user experience with consumer decision making is supported by the research done by Curtis et al. (2021) which emphasizes the role of virtual assistants in improving user engagement through conversational interfaces and context-aware recommendations (Curtis et al., 2021). Another study shows that virtual assistants like Siri, Cortana, and Google Assistant leverage natural language processing and sentiment analysis to understand intents and preferences of the users, thereby delivering them personalized experiences (Pugalenthi et al., 2020; Saxena et al., 2023).
H4: *The user experience offered by AI-powered virtual assistants has a positive and significant relationship with consumer behavior in decision-making processes.*

2.5. Consumer Decision-Making

For this study, the main area of concentration is on consumer decision-making, which is also the dependent variable of the study. It represents the outcome of dealings between individuals and the options available to them, that is, influenced by various factors including information accuracy, time efficiency, cost efficiency, and user experience. Zinkhan and Braunsberger (2004) point out the complexity of consumer decision-making processes, highlighting the role of rational and affective factors in shaping customers' preferences and choices (Zinkhan & Braunsberger, 2004). To validate this study, another research paper shows that AI-controlled virtual assistants impact consumer decision-making by providing timely and relevant information, reorganizing tasks, presenting cost-effective options, and enhancing overall user experience (Lee & Kwon, 2008; Balakrishnan & Dwivedi, 2021).

2.6. Brand Loyalty

In our study, brand loyalty functions as a mediating variable that connects the impact of AI-powered virtual assistants with consumer decision-making indirectly in the model. To understand the connection between brand loyalty, research by Kumar and Pansari (2016) defines brand loyalty as the result of positive consumer experiences, perceived value, and emotional attachment towards a brand itself (Delgado-Ballester & Munuera-Alemán, 2001). It was also identified that AI-enabled virtual assistants can contribute to brand loyalty through delivering personalized advice, ensuring reliable user experiences, and developing trust and satisfaction with brands (McLean et al., 2021). As consumers perceive value and satisfaction through interactions with AI-powered virtual assistants, their loyalty towards brands is reinforced, leading to repeated purchases and advocacy (Rather et al., 2022). Thus, brand loyalty acts as a mediator between the influence of AI-powered virtual assistants on consumer decision-making and the establishment of enduring brand relationships.

Now based on the mediating variable we came up with four other hypotheses to show the relationship between the variables:
H5: *Brand loyalty mediates the relationship between the accuracy of information provided by AI-powered virtual assistants and consumer behavior in decision-making processes.*
H6: *Brand loyalty mediates the relationship between time-saving features of AI-powered virtual assistants and consumer behavior in decision-making processes.*
H7: *Brand loyalty mediates the relationship between cost efficiency facilitated by AI-powered virtual assistants and consumer behavior in decision-making processes.*

H8: *Brand loyalty mediates the relationship between the user experience offered by AI-powered virtual assistants and consumer behavior in decision-making processes.*

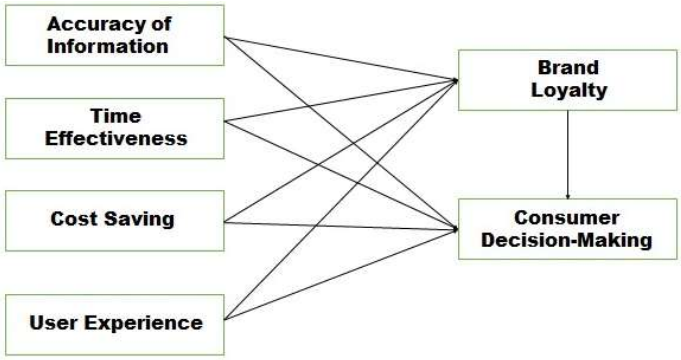

Figure 1: Conceptual Framework

Figure 1 reveals the framework of the study. Figure 1 illustrates the hypotheses that there is a positive and significant relationship between the AOI, TE, CS, US with CDM (H1, H2, H3, H4) and similarly it also shows the positive relationship between these variables with CDM while BL is the mediating variable (H5, H6, H7, H8).

3. Methodology

3.1. Context of the study

The study explores the mechanisms of AI-powered virtual assistants and their impact on consumer decision-making, with brand loyalty as a mediating variable. The research framework focuses on current consumer behavior in the digital age, where virtual assistants play an increasingly significant role in guiding purchasing decisions and fostering brand relationships. As technology continues to evolve, understanding the relationship between AI-powered virtual assistants, consumer decision-making processes, and brand loyalty becomes domineering for businesses seeking to optimize their marketing strategies.

3.2. Research Design

A descriptive research and mixed-method approach combining quantitative analysis and mediation modeling is employed in this study. Quantitative investigation allows for the systematic assessment of the impact of AI-powered virtual assistants on consumer decision-making, while mediation modeling enables the exploration of the mediating variable, i.e., brand loyalty in this correlation.

3.3. Questionnaire Design

The questionnaire consists of thirty questions, designed to capture various aspects related to AI-enabled virtual assistants, consumer decision-making, and brand loyalty. The questionnaire is structured into sections matching the independent variables (accuracy of information, time efficiency, cost efficiency, user experience), the dependent variable (consumer decision-making), and the mediating variable (brand loyalty). Likert scales have been used, ranging from strongly disagree to strongly agree, to measure respondents' perceptions and attitudes. Although, later on while assessing and analyzing through SEM some questions may be eliminated.

3.4. Sampling and Data Collection

The study employs a snapshot data collection method to recruit participants, encircling both consumers with prior experience and those without, in interacting with AI-powered virtual assistants across diverse sectors, including e-commerce, customer service, and personal productivity. Out of the total 65 respondents selected, individuals with awareness in engaging with AI-driven virtual assistants bring valuable insights into their usage patterns, preferences, and challenges encountered. On the other hand,

including participants lacking prior experience provides an opportunity to explore potential barriers to adoption, perceptions, and expectations surrounding these technologies. This comprehensive approach ensures a complete understanding of the subject matter, enabling robust analysis and informed conclusions. Social media networks are used to administer online surveys that gather data. The goal of the study and the fact that participation is entirely voluntary are explained to participants in detail. Before beginning the survey, participants' agreement is asked.

3.5. Data Analysis

Structural Equation Modeling (SEM) is utilized to understand and interpret data and test the research model. Specifically, the relationships between the independent variables (accuracy of information, time efficiency, cost efficiency, user experience), the dependent variable (consumer decision-making), and the mediating variable (brand loyalty) are examined using SEM techniques. For SEM analysis, SmartPLS software is used, which enables the evaluation of model validity, reliability, and feasibility. We evaluate both discriminant and convergent validity to make sure the measurement model is dependable.

4. Results

4.1. Profile of the Respondents:

This study is constructed based on snapshot data gathered from the audience from Facebook. Table 1 shows the demographics of the participants who took part in the survey. Men audience are 69.2 percent of the population; 92.3 percent were between the ages of 20 and 35.

Table 1:Demographic profiles of respondents.

Characteristics	Frequency	Percentage
Gender		
Men	45	69.2%
; \Women	19	29.2%
Prefer not to say	1	1.5%
Age		
Below 20	3	4.6%
20-25	60	92.3%
26-30	2	3.1%
	Total-65	

4.2. Model Measurement, Validity and Reliability

Table 2 shows the estimation of the measurement model using Smart PLS analysis provides insights into the reliability and validity of the constructs used in the study.

Reliability

- **Composite Reliability (CR):** All constructs show a composite reliability score greater than 0.70, indicating strong internal consistency and reliability for each construct. For instance, the CR for Brand Loyalty is 0.925 and for Consumer Decision Making is 0.914, both well above the threshold, indicating excellent reliability.
- **Cronbach's Alpha:** Each construct also satisfies the criterion for Cronbach's alpha, being greater than 0.70. Specifically, Brand Loyalty has an alpha of 0.898 and Consumer Decision Making has an alpha of 0.882, supporting the reliability of the constructs.

Validity

- **Convergent Validity:** The Average Variance Extracted (AVE) for each construct exceeds the recommended threshold of 0.50, demonstrating good convergent validity.

- **Outer Loadings:** Additionally, all items have loadings well above the 0.50 criterion, which further supports the adequacy of the measurement model. For instance, item AOI2 related to Accuracy of Information has a loading of 0.829, and item BL2 for Brand Loyalty has a loading of 0.878.

Structural Model

- **R-Square (R^2):** The R^2 values reported for mediating and dependent variables of Brand Loyalty (0.592) and Consumer Decision Making (0.677) respectively, indicates a substantial amount of variance explained by the independent variables. These values suggest that the model effectively captures the influences on consumer decision-making and brand loyalty.

The results indicate strong internal consistency, reliability, and validity of the measurement model used in the study. The high loadings and AVE values confirm that the constructs are well-represented by their indicators. The CR and Cronbach's Alpha values above the accepted limits corroborate the reliability of the constructs. Overall, the structural model and measurement model evaluations together provide strong support for the hypothesized relationships and the effectiveness of AI-powered virtual assistants in impacting consumer behavior and loyalty in decision-making scenarios.

Table 2: Measurement of model assessment

Constructs	Items	Loading	AVE	Alpha	CR	R-Square
Accuracy of Information (AOI)	AOI2	0.829	0.641	0.724	0.842	
	AOI3	0.843				
	AOI4	0.726				
Brand Loyalty (BL)	BL1	0.762	0.712	0.898	0.925	0.592
	BL2	0.878				
	BL3	0.874				
	BL4	0.895				
	BL5	0.802				
Consumer Decision Making (CDM)	CDM1	0.778	0.68	0.882	0.914	0.677
	CDM2	0.864				
	CDM3	0.82				
	CDM4	0.861				
	CDM5	0.797				
Cost Savings (CS)	CS1	0.814	0.681	0.844	0.895	
	CS2	0.76				
	CS4	0.886				
	CS5	0.838				
Time Efficiency (TE)	TE1	0.786	0.669	0.88	0.91	
	TE2	0.922				
	TE3	0.829				
	TE4	0.725				
	TE5	0.817				
User Experience (UE)	UE1	0.747	0.716	0.9	0.926	
	UE2	0.874				
	UE3	0.837				
	UE4	0.869				
	UE5	0.896				

4.3. Discriminant Validity

4.3.1. Fornell–Larcker Criterion Analysis

Table 3 shows a relationship between the square roots of latent variables (LVs) and AVEs. In order to verify the model's validity, we used the Fornell–Larcker criterion. AVE for every variable equates to the square root of the number of the given range (0.839–0.880). Therefore, the variables' discriminant validity was upheld and recognized for use in this study model.

Table 3. The Fornell–Larcker criterion analysis for discriminant validity.

	Accuracy of Information	Brand Loyalty	Consumer Decision Making	Cost Saving	Time Effectiveness	User Experience
Accuracy of Information	**0.801**					
Brand Loyalty	0.507	**0.844**				
Consumer Decision Making	0.465	0.803	**0.825**			
Cost Saving	0.46	0.546	0.486	**0.825**		
Time Effectiveness	0.688	0.597	0.57	0.551	**0.818**	
User Experience	0.575	0.722	0.693	0.48	0.583	**0.846**

The diagonal values are the square root of the AVE of the latent variables and indicate the highest in any column or row.

4.3.2. Heterotrait-Monotrait (HTMT) Analysis

In order to test the discriminant validity, the standard shows that the value should be always less than 0.85, and in this study, it was discovered that all values except brand loyalty are less than 0.85 (Table 4).

Table 4. The heterotrait-monotrait (HTMT) analysis for discriminant validity.

	Accuracy of Information	Brand Loyalty	Consumer Decision Making	Cost Saving	Time Effectiveness	User Experience
Accuracy of Information						
Brand Loyalty	0.605					
Consumer Decision Making	0.573	**0.893**				
Cost Saving	0.604	0.618	0.544			
Time Effectiveness	0.833	0.621	0.593	0.594		
User Experience	0.702	0.792	0.779	0.532	0.64	

Note: Discriminant validity exists if the HTMT should be less than 0.85, Discriminant validity exists if the HTMT should be less than 0.90.

4.3.3. Cross Loadings

Cross-loading values help in assessing discriminant validity, which is deemed sufficient when the loadings of indicators on their own constructs (latent variables or LVs) are higher than their loadings on any other construct. This ensures that each construct is clearly distinguished from others in the model. Below is an explanation of the cross-loading values presented in Table 6.

The table shows the cross-loading of each item (e.g., AOI2, BL1) on different constructs such as Accuracy of Information, Brand Loyalty, Consumer Decision Making, Cost Saving, Time Effectiveness, and User Experience.

Table 5: Values of the cross loads of individual variables in the SEM.

	Accuracy of Information	Brand Loyalty	Consumer Decision Making	Cost Saving_	Time Effectiveness_	User Experience
AOI2	**0.829**	0.486	0.384	0.38	0.591	0.552
AOI3	**0.843**	0.427	0.409	0.334	0.622	0.417
AOI4	**0.726**	0.271	0.314	0.412	0.408	0.402
BL1	0.335	**0.762**	0.571	0.355	0.351	0.477
BL2	0.45	**0.878**	0.644	0.462	0.564	0.568
BL3	0.45	**0.874**	0.694	0.516	0.535	0.663
BL4	0.459	**0.895**	0.711	0.471	0.533	0.623

	Accuracy of Information	Brand Loyalty	Consumer Decision Making	Cost Saving_	Time Effectiveness_	User Experience
BL5	0.429	**0.802**	0.745	0.476	0.506	0.683
CDM1	0.374	0.523	**0.778**	0.322	0.43	0.633
CDM2	0.465	0.737	**0.864**	0.495	0.488	0.608
CDM3	0.315	0.697	**0.82**	0.41	0.483	0.515
CDM4	0.388	0.648	**0.861**	0.427	0.414	0.588
CDM5	0.364	0.688	**0.797**	0.335	0.535	0.516
CS1	0.528	0.477	0.415	**0.814**	0.49	0.43
CS2	0.406	0.394	0.237	**0.76**	0.505	0.228
CS4	0.319	0.453	0.465	**0.886**	0.434	0.43
CS5	0.283	0.469	0.445	**0.838**	0.415	0.455
TE1	0.494	0.453	0.499	0.427	**0.786**	0.609
TE2	0.58	0.524	0.486	0.494	**0.922**	0.4
TE3	0.614	0.425	0.395	0.384	**0.829**	0.475
TE4	0.491	0.263	0.169	0.171	**0.725**	0.365
TE5	0.616	0.628	0.598	0.596	**0.817**	0.498
UE1	0.389	0.489	0.535	0.271	0.393	**0.747**
UE2	0.601	0.69	0.593	0.377	0.506	**0.874**
UE3	0.462	0.587	0.549	0.428	0.488	**0.837**
UE4	0.446	0.609	0.613	0.498	0.518	**0.869**
UE5	0.519	0.659	0.635	0.442	0.549	**0.896**

4.4. Structural Model Assessment

Figure 6 represents the assessment of the structural model done by SmartPLS. The inner model used was p-values and the outer model used was t-values and R squares were calculated using a 2000-sample bootstrapping approach.

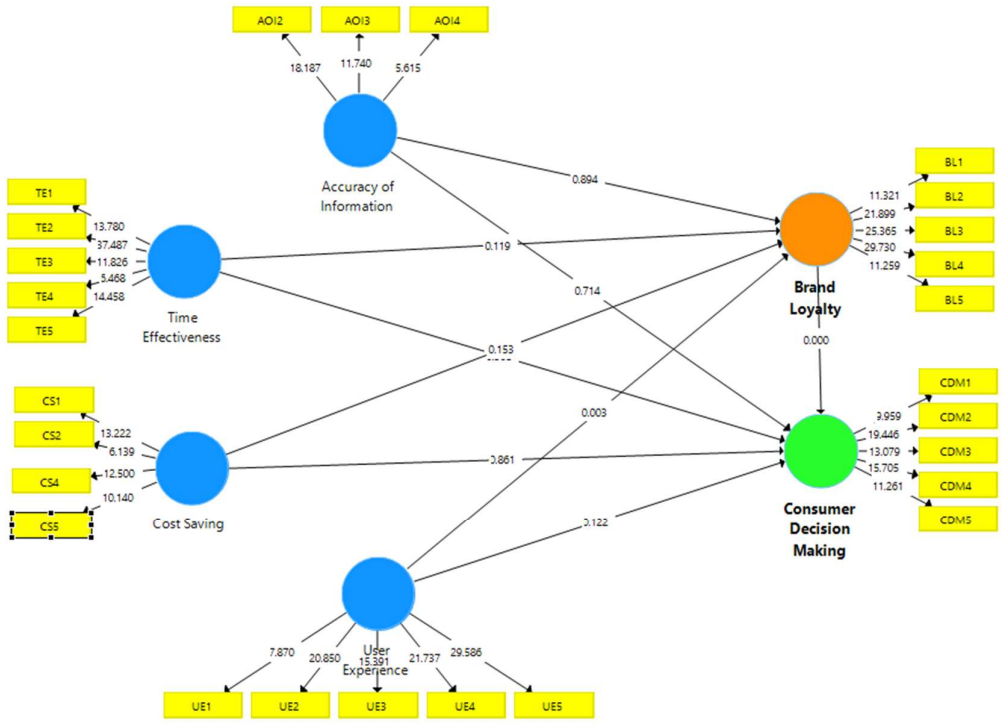

Figure 6. Standardized results of SEM calculations.

4.5. Hypotheses Testing (Direct and Indirect Effects)

Table 7 displays the results of direct and indirect hypotheses**.** Statistical t-values were assessed using bootstrapping, and a 95 percent confidence interval is employed, as recommended for social science studies by Smart PLS 3.2.8.

Table 7: Result of direct and indirect effect hypotheses.

Hypotheses	Relationship	Std Beta	Std Error	t-Value	p-Value	Decision
H1	Accuracy of information -> CDM	-0.05	0.135	0.367	0.714	Rejected
H2	Time Saving -> CDM	0.116	0.129	0.901	0.368	Rejected
H3	Cost efficiency -> CDM	0.016	0.093	0.175	0.861	Rejected
H4	User Experience -> CDM	0.21	0.136	1.549	0.122	Rejected
H5	Accuracy of information -> BL -> CDM	-0.019	0.143	0.133	0.894	Rejected
H6	Time Saving-> BL -> CDM	0.196	0.126	1.56	0.119	Rejected
H7	Cost efficiency -> BL -> CDM	0.194	0.135	1.431	0.153	Rejected
H8	User Experience -> BL -> CDM	0.526	0.179	2.94	0.003	**Accepted**

- **Hypothesis 1** proposed that the accuracy of information provided by AI-powered virtual assistants has a positive and significant relationship with consumer decision-making (CDM). The findings, however, show a negative association (β = -0.05, t = 0.367; p > 0.05, see Table 7). Thus, we can conclude that our primary hypothesis was not supported.
- **Hypothesis 2** suggested that time-saving features of AI-powered virtual assistants positively influence consumer decision-making. The data indicates a positive relationship, but not statistically significant (β = 0.116, t = 0.901; p > 0.05, see Table 7). Therefore, this hypothesis was also rejected.
- **Hypothesis 3** asserted that cost efficiency provided by AI-powered virtual assistants would significantly affect consumer decision-making. The findings reveal a very minimal positive effect (β = 0.016, t = 0.175; p > 0.05, see Table 7), leading to the rejection of this hypothesis as well.
- **Hypothesis 4** posited that user experience has a positive impact on consumer decision-making. Although a moderately positive beta coefficient was found (β = 0.21, t = 1.549; p > 0.05, see Table 7), it was not statistically significant, leading to the rejection of this hypothesis.
- **Hypothesis 5** suggested that brand loyalty mediates the relationship between the accuracy of information and consumer decision-making. The findings indicate a negligible negative mediation effect (β = -0.019, t = 0.133; p > 0.05, see Table 7), which is not supported by the hypothesis.
- **Hypothesis 6** proposed that brand loyalty mediates the relationship between time-saving features and consumer decision-making. Although a positive mediation effect was observed (β = 0.196, t = 1.560; p > 0.05, see Table 7), it did not reach statistical significance, thus rejecting the hypothesis.
- **Hypothesis 7** hypothesized that cost efficiency's impact on consumer decision-making is mediated by brand loyalty. The results show a positive mediation effect (β = 0.194, t = 1.431; p > 0.05, see Table 7), which, while promising, failed to achieve statistical significance, leading to hypothesis rejection.
- **Hypothesis 8** assumed that brand loyalty mediates the relationship between user experience and consumer decision-making. This was the only hypothesis supported, with a strong positive mediation effect (β = 0.526, t = 2.940; p < 0.05, see Table 7). This indication confirms the significant role of brand loyalty in enhancing the impact of user experience on consumer decision-making.

Only Hypothesis 8 found empirical support in the study, suggesting that while user experience significantly enhances consumer decision-making through the mediation of brand loyalty, other features like accuracy, timesaving, and cost efficiency did not show significant direct or mediated effects on consumer behavior in this particular study context.

5. Discussions

The study reveals that AI-powered virtual assistants effectively influence consumer decision-making and brand loyalty, enabling businesses to tailor marketing strategies for better engagement (Maedche et al., 2019; Hoyer et al., 2020). While the literature often highlights factors such as accuracy, time efficiency, and cost efficiency as primary drivers of consumer behavior (Khalil et al., 1999; McLean et al., 2021), this study presented mixed results. Specifically, the hypothesis that information accuracy directly drives decision-making was not supported, contrasting with some prior expectations in the field (Delgado-Ballester & Munuera-Alemán, 2001). Similarly, while time-saving features and cost efficiency are theoretically significant, they did not show statistically significant direct effects on consumer behavior in this specific context (Lee & Kwon, 2008; Balakrishnan & Dwivedi, 2021). However, User Experience emerged as the most critical driver, significantly enhancing consumer decision-making when mediated by brand loyalty (Curtis et al., 2021; Rather et al., 2022). This confirms that while functional benefits like speed are important, the emotional connection and seamless interaction provided by the interface are what truly secure consumer devotion (Yang, 2010).

The findings suggest that AI is not just a tool for efficiency but a strategic asset for economic sustainability (Polas et al., 2022). As AI evolves, the reliability of data and the personalization of recommendations remain central to building trust (Saxena et al., 2023). Consequently, businesses must look beyond mere metrics of speed and focus on the holistic user journey to foster genuine loyalty (Klaus & Zaichkowsky, 2020).

The study unlocks the understanding of AI-powered virtual assistants influencing consumer decision-making, enabling businesses to tailor marketing strategies to embrace better customer engagement (Marinchak et al., 2019). Recognizing the role of virtual assistants provides an understanding of personalized recommendations which prompts businesses to invest in AI technologies to steer business growth (Andrade & Tumelero, 2022). Additionally, ethical considerations regarding data privacy and transparency become vital for businesses to maintain consumer trust (Neupane, 2023).

The main hindrance of this study is its primary focus on the positive ends of AI regarding decision-making and brand loyalty. The use of snapshot data fails to represent variations in user experiences over time. Furthermore, data collection from a single location limits the universality of the findings to a broader population or different demographics. Future research should extend to a diverse range of data sources and methodologies, including qualitative methods like interviews, to gain a nuanced understanding of AI's impact. Studies might focus on specific industries or investigate additional variables to explore the intricate nature of consumer decision-making in the digital age.

6. Conclusion

Virtual assistants have become pathbreakers in consumer decision-making and brand devotion. However, this study highlights that while they handle heavy tasks and provide accurate recommendations, they cannot fully replace human elements. Consumers are still influenced by external factors, sentiments, and emotions that AI algorithms cannot yet fully grasp. Trust and loyalty often stem from human-centric experiences beyond virtual engagement. Thus, AI is merely one element in a complex web of factors influencing consumer behavior, and it cannot yet navigate the sophisticated nature of human decision-making alone. Businesses should utilize the potential of AI to produce captive headlines and draw

interaction, as AI shapes the future of the retail landscape. Investing in AI technologies is crucial for enhancing customer satisfaction and steering business growth. However, strategies must not rely solely on algorithms; they must value human-centric aspects of engagement. Furthermore, government and regulatory agencies should enforce strict ethical considerations regarding data privacy and transparency. This is essential to maintain consumer trust and ensure that the adoption of AI-driven virtual assistants aligns with user security and satisfaction.

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Appendix: Study Questionnaire Items

Accuracy of information

1. The AI-powered virtual assistant consistently understands my queries correctly.
2. AI-powered virtual assistants often provide information that matches my expectations for accuracy.
3. The accuracy of information from AI-powered virtual assistants influences my perception of the brand.
4. I feel confident making decisions based on the information provided by AI-powered virtual assistants.
5. Accurate information from AI-powered virtual assistants significantly enhances my user experience.

Time Efficiency

1. The AI-powered virtual assistant saves me a significant amount of time when performing tasks.
2. I prefer using the AI-powered virtual assistant because it speeds up my decision-making process.
3. I am satisfied with the time I save by using AI-powered virtual assistants for tasks and inquiries.
4. Using the AI-powered virtual assistant is quicker than using traditional methods.
5. The AI-powered virtual assistant helps me manage my daily activities more efficiently.

Cost Efficiency

1. Using the AI-powered virtual assistant reduces my overall expenses.
2. I find that the cost savings from using the AI-powered virtual assistant are significant.
3. The AI-powered virtual assistant helps me find the best deals and promotions.
4. I am likely to recommend AI-powered virtual assistants to others based on their cost efficiency.
5. Cost efficiency significantly enhances my overall satisfaction with AI-powered virtual assistants.

User Experience

1. I find the user interface of AI-powered virtual assistants to be user-friendly.
2. I feel satisfied with how the AI-powered virtual assistant handles my requests.
3. The AI-powered virtual assistant meets my expectations for functionality and performance.
4. The user interface of the AI-powered virtual assistant enhances my overall experience.
5. I am satisfied with the level of customer service provided by AI-powered virtual assistants.

Brand Loyalty

1. I feel emotionally connected and more loyal to brands that offer personalized experiences through their virtual assistants.
2. Brands that save me time through their virtual assistants gain my loyalty.
3. I consider myself a loyal customer of brands whose virtual assistants provide accurate information.
4. My loyalty to a brand increase if their virtual assistant enhances my user experience.
5. I trust brands more when their virtual assistants are efficient and cost-effective.

Consumer Decision

1. I feel confident in making a purchase when a virtual assistant provides timely and relevant information.
2. Cost-saving tips from virtual assistants significantly impact my purchasing decisions.
3. The efficiency of a virtual assistant affects my decision to choose one brand over another.
4. I am more decisive in my purchases when a virtual assistant offers personalized advice and support.
5. I trust brands more when their virtual assistants are efficient and cost-effective.