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THE IMPACT OF VIRTUAL REALITY MOBILE APPS ON CONSUMER REPURCHASE INTENTION TOWARDS ONLINE SHOPS: MEDIATING ROLE OF PERCEIVED RISK AND TRUST

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ABSTRACT

Virtual reality mobile apps enable consumers to control and explore their shopping options and make personalized changes while shopping online. This study aims to examine the relationships between interactivity, vividness, trust, perceived risk, attitudes toward VR mobile apps, and repurchase intentions relying on the telepresence model and theory of reasoned action. This study also tested the mediating role of trust, perceived risk, and attitudes towards VR mobile apps. A cross-sectional method was employed to collect the data from 316 participants from Saudi Arabia. Thus, the data was analyzed using a structural equation modeling approach. Findings from the present study confirmed a significant positive impact of interactivity on trust and perceived risk. Thus, vividness has a significant impact on perceived risk. Surprisingly, the present study found no significant impact of vividness on trust. Furthermore, trust and perceived risk have a significant impact on attitudes towards virtual reality mobile apps. Finally, the present study found a significant impact of attitudes towards virtual reality mobile apps on repurchase intention. The present study shows that trust mediates the link between interactivity and attitude toward virtual reality mobile apps, but not between vividness and attitude. Meanwhile, perceived risk mediates the effects of both interactivity and vividness on users' attitudes. Finally, users' attitudes toward virtual reality mobile apps mediate the relationship between trust, perceived risk, and repurchase intention, underscoring how trust and risk perceptions shape behavioral outcomes through attitudinal responses. Findings from the present study offer valuable insights for retailers, marketers, and business policymakers seeking to navigate the evolving landscape of e-commerce and the adoption of virtual reality mobile apps.

KEYWORDS: Interactivity, Trust, Vividness, Perceived Risk, Attitudes, Virtual Reality, Repurchase Intention, E-Commerce

1. INTRODUCTION

In the recent technological revolution in the production and services industry, the retail sector has experienced notable shifts (Kang et al., 2023; Saleem et al., 2025) practically, it is evolving at an accelerated rate due to potential changes made modern technological revolution and its implications (Taheri et al., 2024). Advanced technologies, such as augmented reality (AR) and virtual reality (VR), are transforming the consumer experience from in-store to online (Saleem et al., 2023). VR technology in the retail industry plays a strategic role in enhancing engagement and transformation with consumers, promoting products, and facilitating the shopping experience (Lee et al., 2020). Several existing studies have demonstrated that VR technologies have significant potential to alter consumers' perceptions by superimposing virtual products into a real-time environment (Lin et al., 2024). With its omnipresence, it is constantly being used by retailers as a tool for establishing an immersive experience for consumers. For instance, Sephora, IKEA, Apple, Burberry, and Ray-Ban have recently launched their VR mobile applications (apps) that are featured on smart devices.

In this view, the retail industry is offering consumers novel and captivating experiences through the use of VR technologies. Practically, VR mobile apps go beyond traditional modes of interaction, enabling users to engage with products more viscerally and immersive (Zhao et al., 2023). This shift from traditional to modern retailing, with its interactive dynamics, raises pertinent questions about how these immersive VR mobile app experiences influence consumer behavior, particularly in terms of the intention to buy (Jadil et al., 2022). In this view, Chen et al. (2023) observed that VR mobile apps are potentially supporting the development of a strong and positive perception among consumers towards products. Similarly, Chen et al. (2023) highlighted that the increasing prevalence of VR technologies in the retail industry has transformed the landscape of consumer experiences, offering immersive and interactive environments that extend beyond conventional platforms.

Notably, Lee et al. (2021) suggested that VR technologies have the potential to create immersive computer-generated objects in virtual environments that simulate real-world shopping scenarios, allowing consumers to interact with products and services. Furthermore, Cowan and Ketron (2019) stated that VR mobile apps in the retail industry aim to enhance consumers' trust, satisfaction, and

intention to buy, thereby rapidly driving sales in the rapidly evolving digital commerce market. In the rapidly changing landscape of VR mobile apps in the retail industry, Kim et al. (2021) suggest that understanding the impact of VR on purchase behavioral intention is a crucial area of research. Similarly, Chen et al. (2023) noted that the VR mobile app has emerged as a potent communication tool capable of influencing individuals' intentions to purchase products and/or services. Hence, limited previous empirical studies from developing nations have examined and concluded on the overall impact of VR mobile apps on consumers' buying intentions. On the other hand, empirical studies have emphasized that various factors, including inaccurate product representations, technical glitches, and privacy issues with VR mobile apps, collectively pose significant threats to consumers regarding retailers' products. For example, Salehi et al. (2021) and Mainardes et al. (2020) discussed how the lack of consumer trust in VR mobile apps, which mainly present products in a virtual world, is primarily due to the absence of face-to-face interactions and the considerable geographical distances characterizing online transactions. Therefore, Hess et al. (2009) suggested that ensuring trust and managing risk perception is paramount for the sustained success of immersive virtual retail experiences for consumers. Existing research on the use of VR technologies in online shopping has consistently highlighted the importance of online trust as a means to alleviate perceived risks in consumer transactions (Al-Debei et al., 2015; Jadil et al., 2022).

However, empirical studies have extensively explored various drivers of trust towards online sellers, including consumer-based, website-based, organizational, and institution-based factors. There is a conspicuous gap in empirical evidence about the formation of online purchase decisions in emerging e-commerce markets using VR mobile apps in Saudi Arabia (Alkarney and Almakki, 2022). Consequently, a comprehensive understanding of how Saudi Arabian consumers develop trust and shopping intentions toward VR retail channels remains elusive, warranting further investigation. Limited existing studies investigated and concluded the consumers' trust, risk perception, and behavioral intention to repurchase in a VR shopping environment. Considering these considerations, the present study aims to bridge these practical gaps by examining the determinants of Saudi Arabian consumers' online trust and risk perception, exploring the relationship between telepresence of VR, online trust, risk

perception, and repurchase intentions relying on the telepresence model and theory of reasoned action (TRA) with a specific focus on the mediating role of online trust and perceived trust. To comprehensively validate this complex model, the present study draws upon a conceptual framework. Thus, this study offers valuable insights for both online retailers and researchers, contributing to the understanding of how consumer behavior in emerging e-commerce markets and informing strategic approaches to enhance trust perceptions and reduce perceived risks in online shopping using VR mobile apps.

This paper is structured as follows: Section 2 presents a comprehensive review of existing research on the use of VR mobile apps in the retail industry, consumer trust, risk, and the exploration of repurchase intention. Following this, Section 3 provides empirical evidence that substantiates the research hypotheses embedded in the theoretical framework. Section 4 explores the research method and the procedures used for data collection. The outcomes of reliability and validity assessments are reported, along with the examination of hypotheses and the results of mediation analyses presented in Section 5. Section 6 discusses the results, offering insights into their implications for both theory and practice. Furthermore, limitations are acknowledged, and directions for future research are outlined. Finally, in Section 7, the study culminates with a comprehensive summary of overall findings, encapsulating the essence of the research.

2. THEORY OF REASONED ACTION

The theory of reasoned action (TRA), outlined by Fishbein and Ajzen in 1975, aims to predict consumer attitudes, actions, and behavioral intentions towards a new and/or existing technology. Numerous researchers across diverse countries have adopted an extended version of TRA as a foundational model for unraveling the decision-making process in online shopping scenarios. For instance, Marza et al. (2019) extended TRA by adding perceived risk, encompassing concerns about financial security, privacy, and the quality of products/services, influencing consumers' behavioral intentions to buy. The extension incorporates perceived risk as a significant factor shaping users' attitudes toward shopping in a virtual environment. In this view, Jadil et al. (2022) stated that a higher perceived risk leads to cautious attitudes, which in turn impact the likelihood of online shopping engagement among consumers. Another empirical study by Lin et al. (2024) suggested that the TRA must be extended by adding of trust of users on the system. in the support

of this, Kang et al. (2023) highlighted that the trust of consumers on a product or services mainly in online environment support brands to build their VR mobile app. Hence, by including trust and perceived risk, the extended TRA offers a more comprehensive framework for understanding online shopping behavior (Hsu et al., 2014). Such theoretical modification aligns with the complexities of the digital marketplace, acknowledging the unique challenges and considerations that influence consumers' decisions in an environment characterized by virtual interactions and uncertainties. Extending the TRA by incorporating trust and perceived risk in the context of online shopping enhances the model's explanatory power and relevance in the digital age. The TRA primarily focuses on attitudes that influence behavioral intentions to repurchase; however, in online transactions, trust and perceived risk play pivotal roles (Jadil et al., 2022). Trust is vital in online shopping; consumers must rely on virtual platforms and unfamiliar sellers. Trust in the online environment is established through website security, vendor credibility, and past positive experiences, which in turn influence consumers' attitudes toward online shopping (Aghdaie et al., 2011).

3. TELEPRESENCE MODEL

The telepresence model describes the sensation of being present in a specific environment through the use of virtual communication media (Steuer, 1995). Similarly, Chen et al. (2023) defined interactivity as a psychological state experienced by users during their interaction with an online VR mobile app, acknowledging the cognitive processing and engagement involved in the activity. Another empirical study by Ambika et al. (2023) pointed out that the primary dimensions of perceived interactivity encompass perceived user control, two-way communication, and perceived responsiveness. Therefore, Cowan and Ketron (2019) and Kim et al. (2021) emphasized that interactivity and vividness are fundamental dimensions of the telepresence model, advocating for the presence of physical products in a virtual environment. Furthermore, Kim et al. (2021) defined telepresence as the psychological state of 'being there' in a computer-mediated environment enriched by focused attention. This state is marked by cognitive and sensory arousal, control, and immersion, wherein individuals perceive themselves as deeply immersed and interacting with an environment that offers a continuous stream of stimuli and experiences. Consequently, Lee et al. (2020) defined perceived

interactivity as an experiential occurrence emerging when participants engage with a web or other computer-mediated entities, characterized by being two-way, controllable, and responsive to their actions using 3D technologies. In the realm of 3D product presentation for online retailers, Park and Yoo (2020) gauged telepresence by considering two crucial factors: control, which denotes users' ability to manage their sensory responses to stimuli, and color vividness, which signifies users' capability to modify the presented stimulus. Kim et al. (2023) aligned with Park et al. (2020)'s definition of interactivity, focusing specifically on control and defining it as users' capacity to customize the content and form of the 3D virtual model. More recently, Zhao et al. (2023) adopted the concept of telepresence to examine users' feelings of being "transported" by new technology, emphasizing that control and interactivity act as catalysts for telepresence. Hence, Steuer (1995) suggested that interactivity involves users actively modifying the form and content of the mediated environment in real time. Mollen and Wilson (2010) introduced a revision to the definition of interactivity, suggesting that past research had failed to distinguish between perceived and structural interactivity. Therefore, prior scholarly work has argued that the VR mobile app manipulates the physical environment of a product (Kim et al., 2021), emphasizing richness (Surovaya et al., 2020) and personalization (Yang et al., 2009), thereby addressing both experiential and cognitive

processing. Thus, interactivity and vividness are discussed in the following sub-sections.

4. DEVELOPMENT OF CONCEPTUAL FRAMEWORK

To achieve the aim of the present study, which explores the role of VR in the retail industry, this study integrated and employed various well-established theoretical frameworks to predict consumers' behavioral intention to buy in an online shopping environment (Mainardes et al., 2020). Prominent among these models are Telepresence, according to Steuer (1995), the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), the Theory of Planned Behavior (TPB) (Ajzen, 1985), and the Technology Acceptance Model (TAM) (Davis, 1989). Thus, the presented study integrated and applied the telepresence model and TRA. Wide existing studies suggested that these two theories are solid to predicate the direct and indirect relationships between interactivity and vividness of VR mobile app recommended by telepresence model Haile and Kang (2020) and Saleem (2022) and perceived risk, trust, attitudes towards VR mobile app, and repurchase intention was backed by TRA as suggested by Chiu et al. (2009); Lio et al. (2022); and Saleem et al. (2022). Furthermore, the operational definitions of the key constructs are presented in Table 1.

Table 1: Operational Definitions of Key Constructs.

Construct and items	Operational definition	References
Interactivity	Interactivity refers to the extent and quality of user engagement, responsiveness, and two-way communication within the VR application.	Haile and Kang (2020)
Vividness	In VR and online shopping, vividness operationally refers to the richness and intensity of sensory experiences provided by the VR environment.	Saleem et al. (2022)
Perceived Risk	In VR shopping purchases, perceived risk operationally refers to consumers' subjective assessment and evaluation of potential uncertainties, concerns, or adverse outcomes associated with purchasing within a VR-enabled online shopping environment.	Liao et al. (2011)
Trust	Online trust refers to how users' beliefs in a VR mobile application's reliability, security, and credibility influence their overall attitudes and predispositions toward adopting and engaging with the app.	Liao et al. (2011)
Attitudes Towards VR Apps	Attitudes toward VR apps refer to the degree to which users' overall evaluations, preferences, and predispositions toward VR applications influence their intentions and behaviors related to making purchases.	Saleem et al. (2022)
Repurchase intention	Repurchase intention operationally refers to a consumer's expressed willingness, inclination, or intention to make a future purchase of a product or service from a well-known brand, company, or provider.	Chiu et al. (2009)

4.1. Interactivity, Vividness, and Trust

Interactivity and vividness of telepresence play pivotal roles in shaping consumers' trust, influencing their perceptions and experiences within products

and/or services in a virtual environment (Cowan and Ketron, 2019). Interactivity refers to the degree to which users can potentially engage with and modify the mediated virtual environment in real-time, thereby enhancing trust by giving users a sense of

control (Kim et al., 2021). Interactivity empowers users, while vividness captivates their senses, collectively shaping a favorable and trustworthy user experience in the evolving landscape of online interactions and virtual reality environments. Similarly, Mollen and Wilson (2010) highlighted that when users feel empowered to navigate, customize, and interact within a product in a virtual space, it significantly fosters a positive perception of reliability and authenticity, contributing to heightened online trust. Empirically, Etemad-Sajadi (2016) applied the telepresence model to examine users' perceptions of immersive environments, finding that telepresence has a significant influence on users' trust. Similarly, Yang and Wu (2009) studied and found that telepresence has a significant impact on perceived trust in the online shopping environment. Additionally, they elaborated that color vividness was the primary indicator of telepresence shaping consumers' trust in brands within a virtual environment. Simultaneously, vividness, characterized by the richness and intensity of sensory stimuli, significantly impacts trust through its ability to create immersive and memorable experiences (Kim et al., 2021). Rich, vivid content captures users' attention, evoking emotional responses that enhance the overall engagement and perceived authenticity of the virtual environment (Redaelli, 2018). Thus, Cheon (2013) confirmed that vividness plays a wide role in the development of consumer trust towards brands in a virtual environment. Hence, interactivity and vividness form a dynamic foundation for building users' trust in a product that appears in a virtual environment. Thus, the present study proposed the following hypotheses.

H1: Interactivity has a significant positive impact on users' trust in virtual products.

H2: Vividness has a significant positive impact on users' trust in virtual products.

4.2. Interactivity, Vividness, and Perceived Risk

The impact of interactivity and vividness on perceived risk in online shopping is substantial, influencing how users assess the potential uncertainties and drawbacks of virtual transactions (Al-Debei et al., 2015). Interactivity, which denotes how users can actively engage and shape their online shopping experience, can either mitigate or exacerbate perceived risk (Yang and Wu, 2009). Empirically, Cowan and Ketron, (2019) investigated and confirmed a significant impact of interactivity on the perceived risk, further, they added that the interactivity of virtual environment allows users to

customize, explore, and actively participate, tends to reduce perceived risk by providing a sense of control and familiarity within the digital realm. Conversely, Etemad-Sajadi (2016) suggested that vividness has a significant impact on the perceived risk, referring to the richness and intensity of sensory stimuli in the online shopping environment. A vivid and immersive experience, rich with detailed visuals and interactive features, tends to alleviate perceived risk by creating a more realistic and engaging online shopping atmosphere. When users can vividly visualize products, explore them interactively, and feel a sense of presence, it diminishes uncertainties related to product quality or fit (Hess et al., 2009). Therefore, this study formulated the following hypotheses.

H3: Interactivity has a significant and positive impact on perceived risk.

H4: Vividness has a significant and positive impact on perceived risk.

4.3. Trust and Attitude towards Virtual Reality Mobile Apps

Trust refers to the user's confidence, which is based on the function's reliability, data protection, and the ability to offer an authentic and secure immersive experience when using a new system (Jadil et al., 2022). It shapes users' willingness to engage and continues their intention to use the technology. Empirically, Hsu et al. (2014) extended TRA by introducing trust to examine and understand its impact on the consumer's attitude towards online shopping apps and reveal a significant relationship. Similarly, Jadil et al. (2022) examined online shoppers, incorporating factors such as trust, familiarity, perceived reputation, and offline presence, and revealed that trust, familiarity, perceived reputation, and offline presence significantly predicted consumers' attitudes toward e-shopping. Furthermore, consumers' trust and attitude towards online shopping have a positive influence on purchase intentions (Chetioui et al., 2021). Notably, an empirical study by Kumar et al. (2018) emphasizes the significance of trust in influencing the behavioral intention to purchase among online consumers. Similarly, Fakhoury and Aubert (2015) acknowledged the adverse influence of consumers' trust on perceived risk in the realm of online shopping in Lebanon. Echoing this perspective, Cho and Sagynov (2015) observed that elevated levels of trust among e-shoppers correlate with reduced risk perceptions in online grocery shopping. Extensive research on VR mobile apps has consistently identified users' trust as a critical

determinant of attitudes towards predicting user attitudes (Al-Debei et al., 2015; Loketkrawee and Bhatiasevi, 2018). Thus, we proposed the following hypothesis.

H5: Users' trust has a significant positive impact on attitudes towards VR mobile apps.

4.4. Perceived Risk and Attitude towards Virtual Reality Mobile Apps

According to Zendejdel et al. (2015), the perceived risk associated with VR mobile apps refers to an individual's belief in potential losses when purchasing from a specific e-commerce website. These perceived risks may include concerns such as receiving a defective product, the theft of credit card numbers, and unauthorized sharing of personal information. Research in online shopping consistently indicates that as perceived e-commerce risks decrease, attitudes toward Internet shopping tend to strengthen (Sarkar and Khare, 2017). Empirically, many existing studies examined the impact of perceived risk on the users' attitudes. For instance, Marza et al. (2019) revealed that the risk associated with online shopping has a direct negative impact on consumers' attitudes towards online shopping. Accordingly, Arora and Rahul (2017) emphasized that consumer beliefs regarding risks in e-commerce hinder positive attitudes toward online purchases. This direct relationship between perceived risk and customers' attitudes towards using an online store is supported by Sarkar and Khare (2017), who demonstrated that a consumer's perceived risk negatively correlates with e-shopping attitudes. Zendejdel et al. (2015) further suggested that a low level of risk leads to a positive attitude toward online purchasing. Thus, the present study proposed the following hypothesis.

H6: Perceived risk has a significant positive impact on attitudes towards VR mobile apps.

4.5. Attitude towards Virtual Reality Mobile Apps and Repurchase Intention

According to Fishbein and Ajzen (1975), attitude refers to an individual's immediate evaluation, either favorable or unfavorable, of performing a specific behavior. This study adopts the definition proposed by Al-Debei et al. (2015), conceptualizing consumers' attitudes towards online shopping as a particular positive or negative evaluation of using VR mobile apps. Chetioui et al. (2021) highlight that elevated levels of trust among online shoppers significantly shape positive attitudes toward online purchasing, which also minimizes risk perception. This observation is corroborated by Al-Debei et al. (2015),

who suggest that perceived trust in online shopping has a positive influence on the formation of consumers' attitudes, ultimately shaping users' intention to buy. Accordingly, Mosunmola et al. (2017) further establish a positive relationship between consumers' attitudes and intention to buy using online marketplaces in Nigeria. Additionally, Loketkrawee and Bhatiasevi (2018) find that a more trustworthy online grocery shopping website is associated with a positive attitude towards the online retail environment. Building upon this cumulative evidence, we propose the hypothesis that online trust and perceived risk will have a significantly positive effect on an individual's attitude. Various scholars have emphasized the pivotal role of attitude in influencing intentions to shop within a web-based environment, as demonstrated by Salehi et al. (2021). Kim et al. (2011) highlighted that attitudes toward purchasing from an online store significantly determine consumers' intentions to purchase online tourism products in South Korea. Lim's (2015) study reveals that a positive attitude toward e-shopping enhances consumers' intentions to make online purchases. Similarly, Peng and Kim (2014) establish a direct and significant relationship between positive attitudes and consumers' likelihood to purchase online. Supporting this perspective, Zhang et al. (2023) suggest that when consumers have a positive evaluation of online apparel websites, they are more likely to engage in transactions with online retailers. In alignment with the theory of planned behavior and the aforementioned empirical evidence, the seventh hypothesis is formulated:

H7: Attitude towards VR mobile apps has a significant positive impact on repurchase intention.

The mediating role of Perceived Risk and Trust

H8: Trust mediates the relationship between interactively and attitudes towards VR mobile apps.

H9: Trust mediates the relationship between vividness and attitudes towards VR mobile apps.

H10: Perceived risk mediates the relationship between interactively and attitudes towards VR mobile apps.

H11: Perceived risk mediates the relationship between vividness and attitudes towards VR mobile apps.

H12: Attitude towards VR mobile apps mediates the relationship between trust and repurchase intention.

H13: Attitude towards VR mobile apps mediates the relationship between perceived risk and repurchase intention.

5. METHODS

This study focused on individuals residing in Jeddah, Saudi Arabia, who had prior experience with online shopping. Employing a cross-sectional research design, this study utilized self-administered online surveys to assess and validate constructs (i.e., interactivity, vividness, perceived risk, trust, attitude towards AR mobile apps, and intention to repurchase). Given the widespread use of the internet among e-commerce consumers (Marza et al., 2019), an online survey was chosen as the data collection method due to its efficiency and cost-effectiveness. Hence, the data for the present study were collected from November 2024 to December 2024. Participants were recruited through email invitations and different social media groups.

The questionnaire consisted of two sections (Section A: demographic questions and Section B: measurement items). The measurement items for the present study were adapted from the existing empirical studies, for instance, the indicators for interactivity were adapted from Haile and Kng (2020), vividness (Saleem et al., 2022), trust, perceived risk, attitude, and intention to repurchase were adapted from (Liao et al., 2011). Therefore, a five-point Likert scale (1 = strongly agree to 5 = strongly disagree) was applied to measure the indicators. Notably, to ensure the validation and reliability of the measurement items, this study conducted a pilot test with 50 Saudi Arabian consumers experienced in online shopping using mobile apps, aiming to assess the appropriateness and clarity of the

measurement items.

5.1. Participant Characteristics

Overall, 316 male and female respondents from Jeddah, Saudi Arabia. Most respondents were male (75.33%), while females constituted a smaller percentage (24.67%). This suggests that online shopping is more prevalent among males in the surveyed population. The age distribution reveals that the highest percentage of respondents falls within the 18–22 years category (44.02%), followed by the 23–44 years group (31.88%) and the 45 and above years group (24.10%). Thus, the majority of respondents have a university degree (47.66%), followed by high school graduates (16.41%), university undergraduates (9.4%), and individuals with elementary and secondary school education (8.88%). The data suggests a positive correlation between higher education and online shopping engagement. In addition, the most common online shopping frequency is "Once in two months" (25.16%), followed by "More than once in a month" (22.36%) and "Once in a quarter" (12.11%). This indicates that many respondents engage in regular online shopping activities. Finally, clothes (28.55%) and electric items (22.45%) are the most popular product categories among online shoppers, followed by food (21.83%), shoes (13.14%), home appliances (11.27%), and jewelry (7.36%). This breakdown suggests diverse preferences in online shopping, with a notable interest in fashion and technology-related products. Therefore, we presented demographic data in Table 2.

Table 2: Demographic Characteristics.

		n	%
Gender	Male	238	75.33
	Female	78	24.67
Age	18-22 years	153	44.02
	23-44 years	111	31.88
	45 and above years	52	24.1
Education	Elementary and secondary school	34	8.88
	High school	63	16.41
	University Graduated	183	47.66
	University Undergraduate	36	9.4
How often do you shop online?	Once a week	19	5.91
	Once a month	33	10.28
	More than once a month	72	22.36
	Once every two months	81	25.16
	Once in quarterly	39	12.11
	Once in six months	48	14.89
	Once a year	24	7.45
Please specify the type of product you are shopping for online. [multiple choice]	Shoes	107	13.14
	Clothes	233	28.55
	Home appliance	92	11.27
	Food	178	21.83
	Jewelry	60	7.36
	Electric items	183	22.45

6. DATA ANALYSIS AND RESULTS

The data were analysed using partial least squares (PLS) through SmartPLS software 4. The choice of this statistical method is justified by its widespread use in technology adoption research, particularly among individuals in the context of e-commerce adoption, as evident in studies by Jadir et al. (2022). The versatility of PLS, which enables the examination of measurement relationships between observed and latent variables, as well as the structural relationships linking exogenous and endogenous latent variables, further supports its application in estimating model parameters for variance-based structural equation modeling (SEM), as illustrated in Figure 1.

6.1. Measurement Model

The analysis of the measurement model addresses various aspects. First, internal consistency for reliability was estimated, followed by an evaluation of convergent and discriminant validity, as

recommended by Saleem et al. (2022). To assess the reliability of items and internal consistency among measures, Cronbach's α scores and composite reliability (CR) were employed (Hair et al., 2017). As depicted in Figure 1, the results reveal that Cronbach's α and composite reliability (CR) coefficients for all six constructs range > 0.700 (Saleem et al., 2023). Hence, both composite reliability and Cronbach's α indicate strong measures of reliability and internal consistency. As per Hair et al. (2017), Convergent validity was assessed in two phases. Firstly, the outer loadings of the measurement items were examined, and secondly, average variance extracted (AVE) values were verified. Reviewing the convergent validity values, we found evidence that all items loaded > 0.600 on their corresponding latent variables (Hair et al., 2017). Furthermore, the AVE for all constructs was reported to be greater than 0.50, exceeding the recommended minimum AVE criterion of 0.50, which indicates satisfactory convergent validity (Saleem et al., 2023).

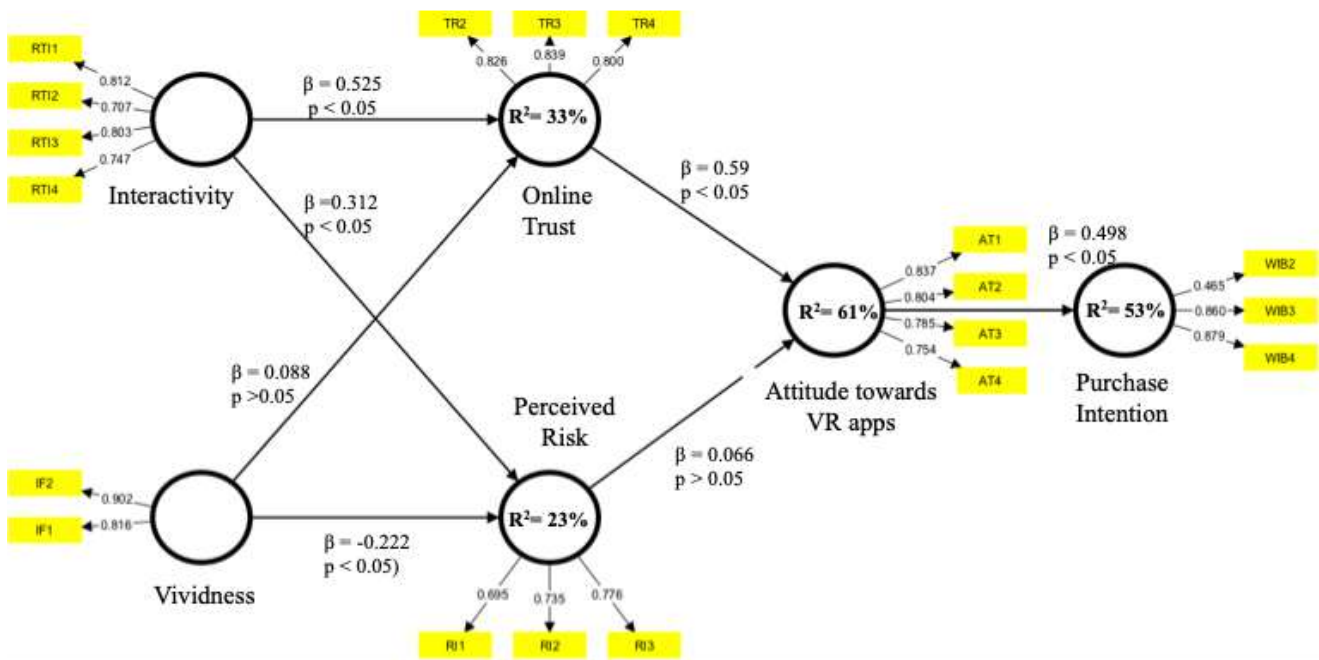


Figure 1: Measurement Model.

6.2. Discriminant Validity

Cross-loadings and the Fornell-Larcker criterion were examined to discern discriminant validity (Kamarudin et al., 2022). The objective was to confirm that each reflective construct exhibits stronger relationships with its indicators than any other latent variable. Cross-loading analysis reveals that all measurement items consistently loaded

significantly higher on their respective latent constructs than on any other (refer to Table 3).

The Fornell-Larcker assessment indicates that the square roots of AVEs (bold diagonal elements) in all cases exceed the inter-construct correlations (off-diagonal elements) (refer to Figure 1). Overall, both cross-loadings and the Fornell-Larcker criterion support the discriminant validity of the six constructs.

Table 3: The Fornell-Larcker Assessment.

Constructs	1	2	3	4	5	6
Attitude towards VR mobile apps	0.871					
Interactivity	0.390	0.767				
Trust	0.611	0.554	0.780			
Perceived Risk	0.254	0.239	0.320	0.694		
Repurchase intention	0.498	0.498	0.751	0.294	0.760	
Vividness	0.223	0.330	0.261	0.119	0.211	0.862

6.3. Direct Hypotheses

Given that the assessment of the measurement model yielded evidence of internal reliability, convergent validity, and discriminant validity, the structural model was examined through (i) the significance of path coefficients (p-value) using the bootstrap technique with 5000 resamples and (ii) the coefficient of determination (R2) for the endogenous or dependent latent variables (Saleem et al., 2023). Thus, the results of the PLS-SEM analysis are presented in Table 4 and Figure 2.

Hypothesis (H1) suggests that the coefficient ($\beta = 0.525$; $p < 0.05$) indicates a significant positive impact of interactivity on trust. This implies that higher levels of interactivity contribute to increased online trust. Indicating H1 is supported. Hypothesis (H2), with a coefficient of ($\beta = 0.088$; $p > 0.05$), suggests a positive, yet insignificant, impact of vividness on trust. Revealing H2 is not supported. Hypothesis (H3), the coefficient of ($\beta = 0.312$ and $p < 0.05$), emphasizing that interactivity has a significant positive impact on the perceived risk. Thus, H3 is

supported. Hypothesis (H4) states that the coefficient ($\beta = -0.222$; $p < 0.05$) indicates a significant negative impact of vividness on perceived risk. Thus, H4 is supported. The negative relationship implies that higher vividness is associated with lower perceived risk. This suggests that more vivid experiences may mitigate risk perceptions in the studied context. Hypothesis (H5) suggests that the coefficient ($\beta = 0.59$; $p < 0.05$) indicates a significant positive relationship between trust and attitude towards VR mobile apps. Therefore, H5 is supported. The significant positive association implies that online trust substantially fosters a positive attitude toward VR mobile apps. Hypothesis (H6), with a coefficient of $\beta = 0.066$ ($p > 0.05$), indicates an insignificant positive relationship between perceived risk and attitude towards VR mobile apps. Illustrating H6 is not supported. Finally, Hypothesis (H7), with a coefficient of $\beta = 0.498$ ($p < 0.05$), indicates a significant positive relationship between attitude towards VR mobile apps and repurchase intention. Showing H7 is supported.

Table 4. Direct Hypotheses.

Direct Paths	β	T statistics	P values	Decision
Interactivity -> Trust	0.525	9.692	0.000	Supported (H1)
Vividness -> Trust	0.088	1.592	0.111	Not-Supported (H2)
Interactivity -> Perceived Risk	0.312	5.315	0.000	Supported (H3)
Vividness -> Perceived Risk	-0.222	3.047	0.002	Supported (H4)
Trust -> Attitude towards VR mobile apps	0.590	13.673	0.000	Supported (H5)
Perceived Risk -> Attitude towards VR mobile apps	0.066	1.521	0.128	Not-Supported (H6)
Attitude towards VR mobile apps -> Repurchase intention	0.498	10.058	0.000	Supported (H7)

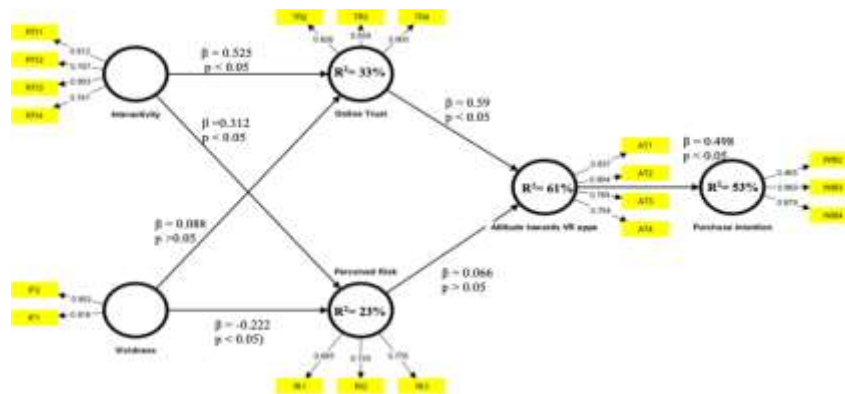


Figure 2: Structural Model.

6.4. Mediating Hypotheses

Table 5 presents the results of the mediating hypotheses, indicating how certain variables mediate the relationship between other variables in the model. Therefore, the results are discussed below.

Hypothesis (H8) suggests that the coefficient ($\beta = 0.310$; $p < 0.05$) indicates a partial mediation of the relationship between interactivity and attitude towards VR mobile apps by trust. This implies that part of the impact of interactivity on attitudes towards VR apps is explained by the influence of interactivity on online trust. Hence, H8 is supported. Hypothesis (H9), with a coefficient of ($\beta = 0.052$; $p > 0.05$), indicates that trust does not mediate the relationship between vividness and attitude towards VR mobile apps. In other words, changes in vividness do not appear to be channeled through online trust to impact attitudes toward VR apps statistically significantly. Therefore, H9 is not supported. Hypothesis (H10), with a coefficient of ($\beta = 0.020$; $p < 0.05$), suggests that perceived risk partially mediates the relationship between interactivity and attitude towards VR mobile apps. This implies that part of the impact of interactivity on

attitudes towards VR apps is explained by the influence of interactivity on perceived risk. Illustrating H10 is supported. Hypothesis (H11), the coefficient of ($\beta = 0.015$; $p < 0.05$), demonstrating that the perceived risk partially mediates the relationship between vividness and attitude towards VR mobile apps. This implies that part of the impact of vividness on attitude towards VR apps is explained by the influence of vividness on perceived risk. It emphasized that H11 is supported. Hypothesis (H12), with a coefficient of ($\beta = 0.294$; $p < 0.05$), indicates that attitude towards VR mobile apps partially mediates the relationship between trust and repurchase intention. This suggests that the effect of online trust on purchase intention is partly explained by its impact on attitudes towards VR apps. Therefore, H12 is supported. Finally, Hypothesis (H13), with a coefficient of $\beta = 0.154$ ($p < 0.05$), suggests that attitude towards VR mobile apps partially mediates the relationship between perceived risk and repurchase intention. This implies that the influence of perceived risk on attitude towards VR apps explains part of the impact of perceived risk on purchase intention. Thus, H13 is supported.

Table 5: Mediating Hypotheses.

Indirect Paths	β	T statistics	P values	Decision
Interactivity -> Trust -> Attitude towards VR mobile apps	0.31	7.362	0.000	Supported (H8)
Vividness -> Trust -> Attitude towards VR mobile apps	0.052	1.569	0.117	Not-Supported (H9)
Interactivity -> Perceived Risk -> Attitude towards VR mobile apps	0.02	4.392	0.000	Supported (H10)
Vividness -> Perceived Risk -> Attitude towards VR mobile apps	0.015	5.371	0.000	Supported (H11)
Trust -> Attitude towards VR mobile apps -> Repurchase intention	0.294	6.232	0.000	Supported (H12)
Perceived Risk -> Attitude towards VR mobile apps -> Repurchase intention	0.154	4.831	0.000	Supported (H13)

7. DISCUSSION

The present study was conducted to explore users' attitudes and repurchase intentions towards AR mobile apps for fulfilling online shopping purposes in Saudi Arabia. Hence, this study aimed to deepen our understanding of the role of interactivity, vividness, trust, perceived risk, and attitude toward AR mobile apps in influencing consumers' repurchase intentions. To test direct and indirect hypotheses, a survey was conducted with 316 Saudi Arabian consumers in Jeddah, and empirical validation was assessed using PLS-SEM methods. The findings of this study have significantly enhanced our understanding of how the interactive and vividness of AR mobile apps influence attitude and repurchase intention. At the same time, trust and perceived risk serve as mediating variables. The direct hypotheses in the present study explain the

wide range of images by probing into the intricate relationships between key variables, shedding light on the dynamics of consumer intention to repurchase using VR mobile apps.

First, the significant and positive impact of interactivity on trust aligns seamlessly with the study's overarching aim of deciphering the determinants of consumer behavior in immersive digital environments. This finding highlights the notion that heightened interactivity fosters trust, a crucial aspect in successfully integrating VR experiences into the online shopping landscape. The findings from the present study aligned with previous empirical studies. For instance, Kumar et al. (2018) examined and suggested that immersive experiences build trust and elicit consumer concerns. This aligns with the study's objective to explore the complex interplay between consumer perceptions and the immersive qualities of VR mobile apps. On

the other hand, the present study found an insignificant impact of vividness on trust, which was previously supported by Taheri et al. (2024). Notably, the insignificant relationship between vividness and trust is seen as potentially overlaying persuasive or emotional elements, which may reduce credibility (Ahmad and Ali, 2018). Wang et al. (2022) noted that the audiences often value formality, authority, and factual clarity over expressive or dramatic content. Therefore, vividness might not significantly influence trust, as trust is rooted more in perceived expertise and social credibility, practically in the context of Saudi Arabia. Hence, the mixed results concerning vividness unveil the complexity of its impact on online trust and perceived risk, reflecting the multifaceted nature of immersive experiences. While a non-significant relationship exists between vividness and trust, the negative association between vividness and perceived risk suggests that more immersive experiences may alleviate consumer apprehension (Saleem et al., 2022). These findings underscore the importance of considering the specific elements of VR mobile app content and design that contribute to trust-building and risk mitigation.

Second, the present study confirmed a significant positive impact of this. This reveals that when VR content is more interactive and vivid, it draws greater attention and emotional involvement from the audience, leading them to perceive higher levels of risk. These findings from the present study aligned with Chetioui et al. (2021). It has been noted that virtual engagement is rapidly growing and that interactive and vivid formats may heighten awareness and concern, particularly when addressing sensitive topics. These features of VR mobile apps likely amplify message prompting users to feel more cautious or vulnerable. As a result, enhanced presentation styles can unintentionally elevate perceived risks associated with the content.

Third, the present study found a significant positive relationship between trust and users' attitudes toward VR mobile apps. This demonstrates that when users perceive VR mobile apps as trustworthy, secure, reliable, and credible, they are more likely to develop favorable attitudes toward using them. In this view, Salehzadeh et al. (2023) examined and confirmed a significant impact of trust on attitudes. In addition, O'Brolcháin et al. (2016) discussed how the privacy, data security, and cultural appropriateness of VR mobile apps may significantly influence technology adoption, leading to a higher level of acceptance. Hence, a high level of trust can reduce perceived risk and skepticism,

encouraging more openness to new technologies like VR. Thus, building user trust is essential for enhancing the acceptance of VR mobile apps (Saleem et al., 2022).

Fourth, the study emphasized that perceived risk has an insignificant impact on attitudes toward VR mobile apps, suggesting that users' concerns about potential risks, such as privacy, security, or misuse, are not significant. Previously, an empirical study by Cabeza-Ramírez et al. (2022) confirmed that the perceived risk does not predict the attitude towards use. In the Saudi Arabian context, this may be due to increasing comfort and familiarity with advanced technologies, particularly among younger users. Saleem et al. (2023) stated that cultural trust in platforms may also minimize the weight of perceived risk in shaping consumers' positive and strong attitudes. As a result, consumers may prioritize novelty, functionality, or social influence over potential threats, meaning risk perception alone does not deter positive views toward adopting VR mobile apps.

Finally, the present study confirmed a significant impact of attitudes toward VR mobile apps on repurchase intentions, which offers insights into the downstream effects of online trust and perceived risk on consumer behavior. This positive relationship highlights the pivotal role of trust in shaping positive consumer attitudes and subsequent purchase intentions in the context of VR mobile apps (Shoab and Saleem, 2023).

The mediating hypotheses in the present study play a pivotal role in elucidating the nuanced pathways through which key variables interact, shedding light on the overarching aim of understanding the determinants of Saudi Arabian consumers' behavior in VR and online shopping. The positive mediation between interactivity and attitudes toward VR mobile apps through trust unveils a critical aspect of the study's focus – the central role of trust in shaping favorable attitudes. This mediation aligns seamlessly with the study's aim to explore the psychological mechanisms underlying consumer responses to immersive experiences, emphasizing the significance of establishing trust for fostering positive attitudes toward VR mobile apps. Similarly, the mediation role of perceived risk between interactivity and attitudes toward VR mobile apps adds depth to the study's objectives by highlighting the intricate relationship between immersive experiences, perceived risk, and subsequent attitudes. This finding suggests that immersive experiences may influence attitudes both directly and indirectly through the mediation of

perceived risk, contributing to the study's aim of unraveling the complexities within the consumer decision-making process in the context of VR technology.

8. THEORETICAL IMPLCATIONS

The present study integrated the telepresence model and the TRA, advancing theoretical frameworks in understanding attitudes and repurchase intention towards VR mobile apps. This theoretical foundation offers a significant perspective, bridging the gap between the immersive nature of VR mobile app experiences. In addition, identifying consumers' trust and perceived risk as mediating variables enriches existing theoretical models. Understanding how these factors mediate the relationship between immersive experiences and attitudes toward VR mobile apps offers a more comprehensive understanding of the psychological processes shaping consumer perceptions towards online shopping in Saudi Arabia. In addition, the present study shed light on the demographic variations (e.g., age, gender, and education) extends theoretical discussions on the heterogeneity of consumer responses towards VR mobile apps in Saudi Arabia, which highlights the need for a nuanced understanding of how different demographic groups (digital natives and immigrants) interact with and perceive VR mobile apps while doing of online shopping.

9. PRACTICAL IMPLICATIONS

The present study highlights substantial implications for various stakeholders, providing practical guidance and strategic considerations in strategic marketing, user experience design, e-commerce platform development, consumer education, and policymaking related to VR adoption in online shopping environments.

Strategic marketing and user experience design can significantly benefit from the study's identification of factors influencing online trust and perceived risk. Marketers and designers can strategically capitalize on the immersive qualities of VR mobile app experiences, emphasizing interactivity and vividness to cultivate trust and mitigate potential risk perceptions. By tailoring marketing strategies and designing user experiences that align with these findings, businesses can elevate overall consumer satisfaction and drive positive engagement in VR-enhanced online shopping environments. Furthermore, e-commerce platform development can gain valuable insights by understanding the impact of immersive experiences

on online trust and confidence. With this knowledge, platform developers can enhance VR offerings, creating environments that facilitate trust and foster heightened engagement. This is crucial for the sustained growth and competitiveness of e-commerce platforms, particularly in the dynamic landscape of increasing VR adoption. Consumer education and communication emerge as essential tools in mitigating potential concerns related to VR mobile apps. The positive relationship between interactivity and online trust underscores the importance of transparent communication about features and security measures. Establishing trust through clear communication is a crucial strategy for fostering positive attitudes and influencing purchase intentions among consumers. Furthermore, the study's findings have implications for policy considerations regarding the adoption of VR in online shopping environments. Policymakers can leverage these insights to inform regulations and policies, creating an environment that supports the responsible and ethical deployment of VR technologies. This ensures that the integration of VR into online shopping aligns with consumer expectations and industry standards. Overall, the practical implications offer tangible pathways for businesses, marketers, and policymakers to navigate and capitalize on the evolving landscape of immersive technologies in online shopping.

10. LIMITATIONS AND FUTURE DIRECTIONS

Despite the insightful contributions made by the current study, several limitations and future research gaps were identified.

First, this study aims to understand consumers' attitudes and repurchase intentions toward VR mobile apps in Saudi Arabia. Thus, it is also essential to explore and understand how cultural factors influence consumers' attitudes and intentions in diverse global markets. In this view, future research is recommended to explore cultural variations and their impact on consumers' attitudes and repurchase intentions using VR mobile apps. Second, the present study employed a cross-sectional method to achieve its aim. Future research should consider longitudinal designs to track changes in consumer attitudes and behavior using VR mobile apps. Third, the present study touches on demographic factors but does not extensively explore potential moderators. Investigating how factors like age, education, and cultural background moderate the relationships identified in the study could provide a more nuanced understanding. This would enable researchers to

identify subgroup differences in response to VR experiences. Fourth, the study focuses on trust, risk perception, and attitudes, providing an opportunity to explore the impact of VR on overall consumer experience and satisfaction. Future research could investigate the holistic impact of immersive experiences on consumer satisfaction and loyalty, encompassing factors beyond trust and risk. Fifth, the present study relies on self-reported measures. Future research could incorporate behavioral metrics, such as actual purchase behavior, dwell time

in VR environments, and user engagement. Combining self-reported data with objective behavioral measures would enhance the robustness of the findings. Finally, given the rapid evolution of VR mobile apps, future research should remain current with technological advancements. Exploring how emerging features, such as augmented reality (AR) integration or haptic feedback, influence consumer perceptions could provide valuable insights into the changing landscape of immersive technologies.

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