

An investigation into Mobile Augmented Reality Applications and its influence on Patronage intention towards Fashion brands: A Rural Customers' Perspective

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KEYWORDS	ABSTRACT
N/A	<p>E-commerce is a popular buzzword in the modern era. The development and widespread use of e-commerce technologies and websites have transformed business models. However, one problem in E-commerce is conversions. Around 77.3% of shoppers leave their carts empty before making a purchase. This is due to the inability to see and test out the products physically. In this situation, customers can benefit from augmented reality (AR) solutions that simulate the experience of physical interaction and give them a sense of how a product looks and feels. This study aims to determine whether the customer's perceived ease of use, immersive experience, hedonic motivation, and innovativeness can influence their patronage intention toward augmented brand fashion. It also unveils the perspective of rural customers (Generation Z) towards the various features of MAR apps for fashion brands.</p> <p>The sample size for the study was 673. The participants are primarily from the Bengaluru Rural District. All items of the constructed scale were measured using a five-point Likert scale. The statistical tool SmartPLS was used to develop structural equation modeling. It was found that the Perceived Ease of Use, Immersive experience, hedonic motivation, and innovativeness of the customer have a positive and significant influence on Patronage intention towards the augmented fashion brand. Our study offers helpful guidelines for fashion-related brands for creating consumer-driven augmented reality applications that meet the interests and preferences of young consumers.</p>

1. INTRODUCTION

E-commerce is a buzzword that is popular in the modern era. Business models have been transformed by the development and widespread use of e-commerce technologies and websites (Nicolai, M. and Grange, C.,2021). The percentage of total retail sales in worldwide e-commerce increased from 15% in 2019 to 21% in 2021. It currently represents an estimated 22% of sales. The e-commerce business has a lot of space to grow in the long run and could go from \$3.3 trillion in 2017 to \$5.4 trillion in 2026(Morgan Stanley, 2022). India is one of the economies in the world with the quickest growth rates. The Indian e-commerce market is expanding rapidly as well. The Indian e-retail sector is expected to attract more than 300–350 million customers over the next five years, increasing the online Gross Merchandise Value (GMV) to US\$ 100–120 billion by 2025(IBEF Report). Global Data, a data and analytics firm with offices in London, has data that confirms the prediction mentioned above that e-commerce sales will increase at a compound annual growth rate (CAGR) of slightly over 18% between 2021 and 2025, reaching \$120.1 billion (Rozario, K., 2021). However, one problem in E-commerce is conversions. Around 77.3% of shoppers leave their carts empty before making a purchase, according to Statista (an online market research, and business information platform). Conversion rates for regular retail purchases range from 20 to 40 percent, whereas those for online



purchases are merely 2 to 4 percent. This is due to the inability to physically see and test out the products. Digital marketing tools, such as social media marketing tools, conversion optimization tools, graphic design tools, etc., have been used by businesses to attract customers in a variety of ways, but they do not provide the same experience as physically checking out the products. In this situation, customers can benefit from augmented reality (AR) solutions that simulate the experience of physical interaction and give them a sense of how a product looks and feels (Vo, K. N., Le, A. N., Thanh Tam, L., & Ho Xuan, H. 2022).

Augmented Reality (AR) is “an environment in which digital information, which is both spatially and temporally registered with the physical world and interacts in time, is placed on the physical world” (Craig, 2013). Sales based on augmented reality will climb from USD 12 billion in 2020 to USD 72 billion in 2026 (Hsu et al., 2021). As smartphones and mobile internet connections become an essential part of customers' daily lives Mobile Augmented Reality (MAR) applications created by companies have evolved into crucial resources for communicating with customers. Customers may be able to try out the products they want to buy by utilizing these Mobile Augmented Reality (MAR) applications of businesses/brands (Eru, O. & Y.V. Topuz & R. Cop, 2022). Mobile Augmented Reality (MAR) apps are a developing technology that could have a positive impact on a variety of industries and sectors, including research, business, education, tourism, advertising and shopping, and entertainment. (Hilken et al., 2018; Javornik et al., 2022). Despite its prospective application of MAR apps across the world, very little literature is available in the Indian context, particularly about the customer's acceptability of the use of MAR apps in rural areas. Due to the novelty of AR technology and its applications in the fashion retail industry, there is a lack of theoretical development on the impacts of this AR technology on patronage intention of fashion-related products in rural areas.

Augmented Reality

Augmented Reality (AR) is a cutting-edge technology that enables individuals to view the real world through a transparent or digital interface while simultaneously overlaying virtual objects onto the physical environment.

The essence of AR lies in three key components:

- a) Real-time interaction and responsiveness, ensuring seamless user engagement.
- b) Integration with the real-world physical environment, allowing virtual elements to coexist with reality.
- c) Three-dimensional registration, accurately aligning virtual objects within the 3D space of the real world. (Van Krevelen & Poelman, 2010; Zhou, Duh, & Billingham, 2008; Azuma, 1997).

Mobile augmented reality

With smartphones and mobile internet becoming integral to daily life, Mobile Augmented Reality (MAR) applications have emerged as vital tools for companies to engage and communicate with their customers.

Customers may be able to try out the products they want to buy by utilizing these MAR applications of businesses/brands (Eru, O. & Y.V. Topuz & R. Cop, 2022).

MAR integrates the physical environment with virtual objects presented to the user on mobile devices (Höllerer and Feiner, 2004).

As per A. B. Craig (2007) MAR is part of the AR that users can take with them wherever they go, and the distinction of MAR against portable AR is that MAR enables users to effortlessly access services on their mobile devices anytime, anywhere.

Need for the Study

Retail Sector

Indian retail industry has emerged as one of the most dynamic and fast-paced industries in recent times. It accounts for over 10% of the country's Gross Domestic Product (GDP) and around 8% of the employment. India is the world's fifth-largest global destination in the retail space.

India ranked 73 in the United Nations Conference on Trade and Development's Business-to-Consumer (B2C) E-commerce Index 2019.

The retail sector in India is poised for remarkable growth, with its value projected to reach an impressive US\$ 2 trillion by 2032, according to a recent analysis by the Boston Consulting Group (BCG).

The changing technological environment significantly reshaped consumer preferences, behaviors, and attitudes over the last few years, profoundly influencing how people purchase and consume products and services. Global retailers are leveraging innovative business strategies to capitalize on emerging opportunities in the retail landscape. Consumers now view offline and online consumption as a seamless experience, prompting major companies to experiment with integrated retail



experiences across all channels. Retailers are blending traditional retail practices with modern e-commerce platforms to develop new revenue models and strengthen their value propositions for customers.

E-Commerce

India has witnessed a remarkable surge in internet and smartphone adoption in recent years. According to a report by IAMAI, the number of internet users in India is expected to grow from 622 million in 2020 to 900 million by 2026, reflecting a robust CAGR of 45% during this period. Of the total internet connections, 55% are in urban areas, with 97% of these being wireless.

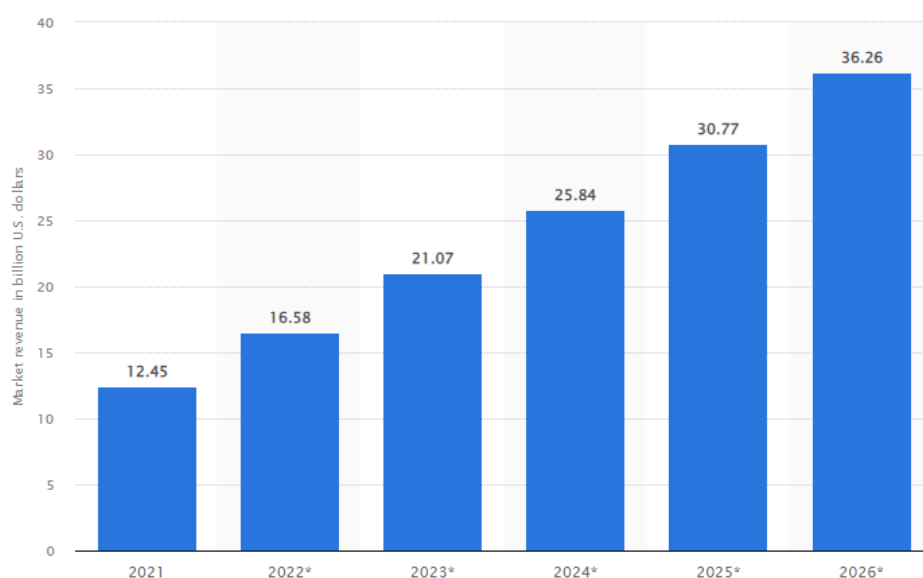
Smartphone adoption has also seen significant growth, with the smartphone base projected to reach 1 billion by 2026. Notably, Indian consumers are increasingly embracing 5G smartphones even before the nationwide rollout of next-generation mobile broadband technology. This rapid increase in internet penetration, coupled with rising incomes, has fuelled the expansion of India's e-commerce sector. E-commerce continues to grow steadily, offering consumers an ever-expanding range of products at highly competitive prices.

E-commerce is revolutionizing the retail industry in India, a trend that is expected to persist in the coming years. The online retail market, estimated at US\$ 55 billion in 2021, is projected to reach US\$ 350 billion by 2030, driven by the growing number of online shoppers in the country. However, despite all the growth, online penetration of retail was 4.7% in 2019 and is expected to reach 10.7% by 2026.

One more problem in E-commerce is conversions. Around 77.3% of shoppers leave their carts empty before making a purchase, (Statista 2022) Conversion rates for regular retail purchases range from 20 to 40 %, whereas those for online purchases are merely 2 to 4%. This is due to the inability to physically see and test out the products.

In this situation, customers can benefit from augmented reality (AR) solutions that simulate the experience of physical interaction and give them a sense of how a product looks and feels (Vo, K. N., Le, A. N., Thanh Tam, L., & Ho Xuan, H. 2022).

Graph no. 1: Mobile augmented reality (AR) market revenue worldwide from 2021 to 2026

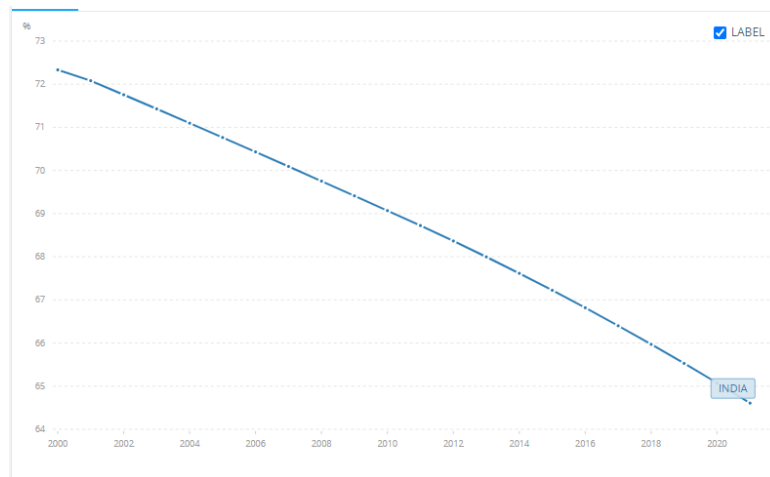


Nevertheless, while by many standards, AR is becoming one of the emerging trends across globe, however customers in India “are still uncertain about the value of AR” (Narang & Shankar, 2019; de Ruyter et al., 2020).

This void tenders theoretical and practical marketing opportunities. Hence, there is a need for reviewing and analysing the antecedents of MAR and its influence on prospective customers



Graph no. 2: Rural India – Population living in Rural Area

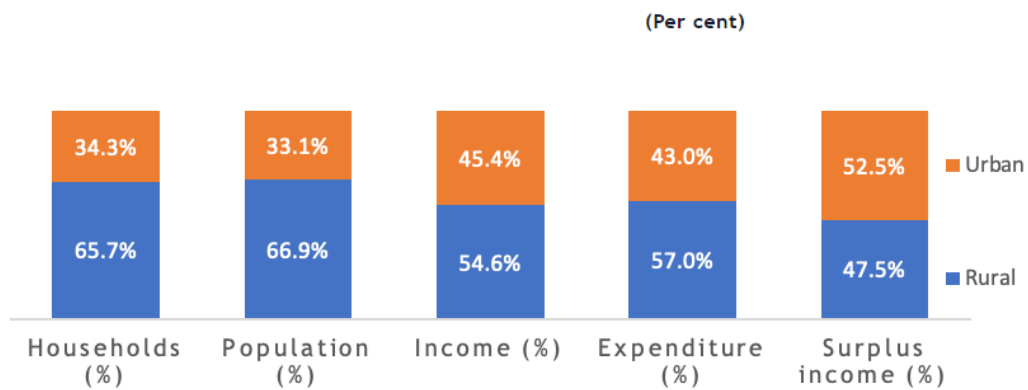


Rural India

Rural economy contributes 46% towards the national income and 25-30% of India's GDP.

Therefore, it is extremely essential to focus on the growth and development of India's rural economy in our journey to become \$5 Trillion economy by the year 2025.

Graph no. 3: Distribution of income, expenditure and surplus income by location



- According to a recent study published by data and market measurement firm Nielsen, the Indian rural market has a 20% higher presence of internet users than urban parts of the country, and as per Boston Consulting Group, will account for over half of e-shoppers.
- Mobile affordability in rural India as an information device has created a growth path for E-commerce as a new way of conducting business.
- For e-commerce to realize its full potential, it is necessary to tap the Indian rural market.
- There is a need for retailers to understand, how rural people perceive new technology while shopping online. How do they view new technology like MAR apps??? Do they get influenced by MAR while making purchase decisions???

2. LITERATURE REVIEW

Augmented Reality is a collection of technologies that integrates real-world environments and computer-generated virtual objects (Azuma, 1997; Fan et al., 2020; Lamantia, 2009), thus enhancing reality by supplementing it with real-time interaction.

As consumers are willing to shop more online, Augmented Reality (AR) is listed as one of the top technological solutions that may allow them to evaluate online merchandise (Tavolieri, 2019) and “help them recreate the real-world shopping experience in the virtual world” (Conger, 2020). MAR apps is the latest technological innovation that may revolutionize consumer behaviors (Moorhouse et al. 2018).



Javornik (2014) looked into MAR as a tool that offers new capabilities to enhance consumers' experiences through direct interaction and brand engagement through advertising, product customization, virtual product try-outs, and customer service, to name a few

MAR allows marketers to engage customers with relevant and within-context information to enhance consumers' shopping experience, i.e., showing consumers how they would look wearing a specific product (Parise, Guinan, & Kafka, 2016).

Fashion is an industry of \$1.75 trillion and numerous main fashion-related brands' sales are developing quickly around the world (Taylor & Costello, 2017). In an interview with Vogue, Apple CEO Tim Cook said that Augmented Reality is about to modernize shopping experiences and fashion runways. He also said that there is no sector or industry that AR won't touch.

Augmented Reality technology is completely changing industries and the ability to see fashion products in real-time and explains the potential for AR to create a more engaging and interactive retail experience (Bhageria, P. 2020).

Eyewear:

The value of the global eyewear market is on an upward trend. Worth around \$147 billion in 2021, the market is expected to reach a whopping \$197 billion by 2027. A large proportion of these sales will happen through the Internet. In 2020, over 44% of adults who bought glasses used online sources to help them in their buying journey, with more than 14% purchasing glasses directly from e-commerce stores

AR and Eyewear

With the proliferation of e-commerce, retailers saw a real benefit in implementing AR capabilities to their stores, websites, and apps (Cruz et al., 2019). A simple online search for "eyewear virtual try-on" reveals that many major eyewear retailers, including LensCrafters and Warby Parker, as well as e-retailers like glasses.com, glassesusa.com, eyeconic.com, and lingo.com, have adopted virtual try-on AR technology for glasses and frames. Prominent brands such as Armani, Burberry, Oakley, and Ray-Ban have also integrated this feature into their online platforms to enhance the shopping experience.

AR and Eyewear

Substantial research has been done at a global level on how AR influences customer decisions when purchasing eyewear (Pantano, Rese, & Baier, 2017; Roxo & Brito, 2019).

However, in the Indian context, limited research has been conducted on the impact of Mobile Augmented Reality (MAR) on customer decision-making when purchasing eyewear, particularly from the perspective of rural consumers.

AR and Beauty Care Market

A recent market research report by Global Market Estimates predicts that the Global Augmented and Virtual Reality (AR & VR) in the Cosmetic and Beauty Market will grow at an impressive CAGR of 25.5% from 2022 to 2027.

This growth is attributed to factors such as improved quality of life, the positive impact of cosmetics and personal care products on self-esteem and social connections, and a growing consumer inclination toward premium beauty brands.

The report highlights that 92% of Gen Z consumers are interested in using AR for shopping. Specifically, 88% of Gen Z shoppers are keen to utilize AR to try on makeup or clothing. Additionally, 55% believe AR will simplify the shopping experience, while 43% are more likely to experiment with new looks, with beauty products they've virtually tried on being twice as likely to be part of their experimentation. However, in the Indian (rural) context very little literature has explored Gen Zer's interest in using AR for Beauty care product shopping.

In this regard present study explores the Gen Zer's (from a Rural area) interest in using MAR and various factors influencing their patronage intention towards various fashion brands.

Purpose:

The purpose of this study is to determine whether the customer's perceived ease of use, immersive experience, hedonic motivation, and innovativeness can influence their patronage intention toward augmented brand fashion. It also unveils the perspective of rural customers (Generation Z) towards the various features of MAR apps for fashion brands.

Hypothesis Development

Operational Definition

Perceived Ease of Use: Perceived ease of use is the extent to which a person does not experience difficulties when using a particular system (Davis, 1989)

Immersive Experience: Immersive experience is how a customer is absorbed in, involved with, and engrossed in a virtual environment (Georgiou & Kyza, 2018)

Hedonic Motivation: The pleasure experienced when employing a particular technology (V. Venkatesh, J. Y. L. Thong, and X. Xu, 2012)



Innovativeness of Customer: It is defined as people's willingness to try new technologies (Robinson et al., 2005; Huang & Liao, 2015).

Patronage Intention: Purchasing intention is closely related to consumers' interest to purchase, recommend, and willingness to repurchase a given product in the future (Peter & Olson, 2010; Kim & Ko, 2012).

Perceived ease of use (PEOU) has been used as an indicator of users' acceptance of new technologies in recent years.

It is assumed that the higher the degree of perceived ease of use of technology for a user, the greater the enjoyment he or she will feel when browsing the platform content ultimately resulting in product purchasing by the customers (Do et al., 2020).

Zhang et al. (2021) in his study found that perceived ease of use has a significant influence on patronage intention towards clothes and accessories. Ramayah and Ignatius (2005) indicate that perceived ease of use is positively related to the intention to shop online.

Various empirical studies have shown the profound impact of Immersive experience on consumers' patronage intentions (Ye et al., 2021; Lu, Fan, & Zhou, 2016). Perannagari K.T. and Chakrabarti S. (2020) found that the Immersive experience of AR has a significant influence on patronage intention towards retail brands.

In their study, Wang, Y., Ko, E., and Wang, H. (2022) discovered that Mobile Augmented Reality (MAR) technology stimulates exploratory behavior among consumers, which directly influences their intention to patronize. Furthermore, the study revealed that consumers' perceptions of patronage intention vary based on their levels of individualism and fashion innovativeness when engaging with MAR technology.

The patronage intention is influenced by previous shopping experiences, store atmosphere, and customer hedonic values (Afaq et al., 2020).

The literature indicates that the hedonic benefits and the quality of augmented reality contribute to enhancing consumers' attitudes toward brands (Rauschnabel et al., 2019; Poushneh and Vasquez-Parraga, 2017).

Eru, O. , Topuz, Y. V. & Cop, R. (2022) in thier study found that consumer innovativeness influence the patronage intention towards the retail brands.

Proposed Hypothesis

H1: Perceived Ease of use of MAR apps has a significant influence on patronage intention towards fashion brand

H2: Immersive experience of MAR apps has a significant influence on patronage intention towards fashion brand

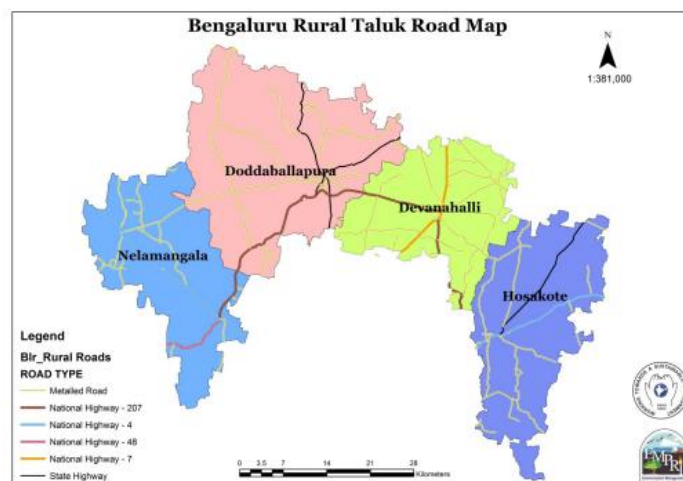
H3: Hedonic motivation of MAR apps has a significant influence on patronage intention towards fashion brand

H4: Innovativeness of the customer has a significant influence on patronage intention towards fashion brand

3. METHODOLOGY

Most college students utilize smartphone applications and incorporate them into their daily life, which makes them more comfortable with and quick to adapt to new technologies than other customers (i.e. older customers). As a result, college students have emerged as crucial target respondents for the present study. The sample size for the study was 673. The participants are primarily from the Doddaballapura, Devanahalli, Hosakote, and Nelamangala taluks of the Bangalore Rural District (refer to figure 1).

Figure 1: Bangalore Rural District

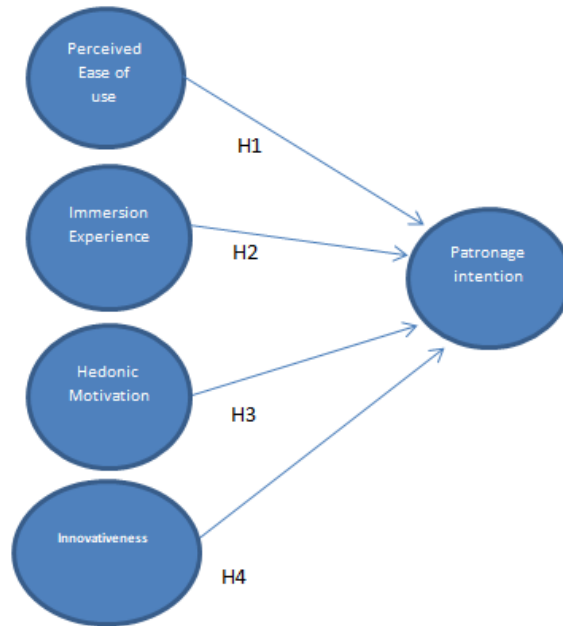




Source: KRSAC

Before asking them to complete the survey, the respondents were instructed to download two fashion-related applications and experience its products through the AR feature. Participants were urged to share their personal experiences of using AR in mobile applications. The questionnaire consists of three segments namely segment 1: Demographic information, segment 2: Customer’s view towards e-commerce and fashion brands, and segment 3: Patronage intention towards the augmented brand (SEM). All items of the constructed scale were measured using a five-point Likert scale (1=strongly disagree to 5=strong agree). The statistical tool SmartPLS was used to develop structural equation modeling (refer to Figure 2).

Figure 2: Research Model



Source: Model developed by the researcher

4. DATA ANALYSIS

Table no. 1: Sample Adequacy

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.861
Bartlett's Test of Sphericity	Approx. Chi-Square	3593.469
	df	105
	Sig.	0.000

Note: For reference, Kaiser put the following values on the results:

0.00 to 0.49 unacceptable. ; 0.50 to 0.59 miserable; 0.60 to 0.69 mediocre; 0.70 to 0.79 middling; 0.80 to 0.89 meritorious; 0.90 to 1.00 marvelous.

For Factor Analysis to be recommended as suitable, Bartlett’s Test of Sphericity must be less than 0.05.

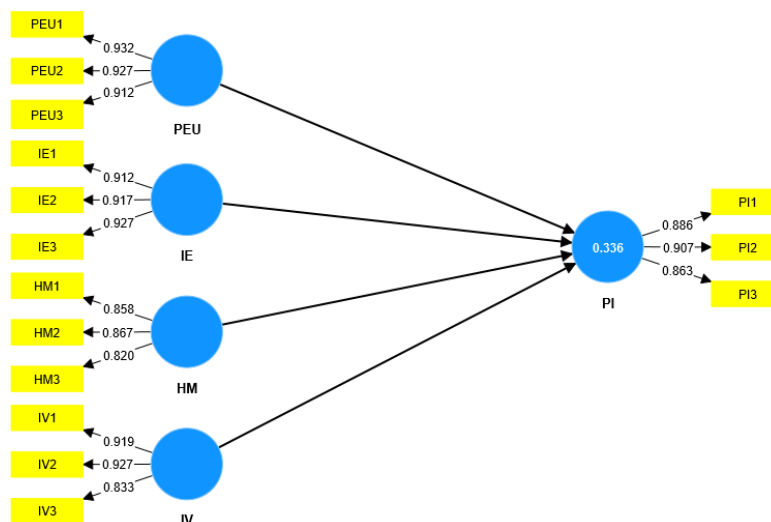
While the KMO ranges from 0 to 1, the world-over-accepted index is over 0.6.



Table no. 2: Scale items and its Factor loadings

Constructs	Symbol	Statements	Factor Loadings
Perceived Ease of Use	PEU1	My interaction with Mobile AR apps of Fashion brands is clear and understandable.	0.932
	PEU2	It would be easy for me to become skilful at using Mobile AR apps of fashion brands.	0.927
	PEU3	Learning to use Mobile AR apps of fashion brands would be easy for me.	0.912
Immersive experience	IE1	I lost track of time while using the MAR feature	0.912
	IE2	The sense of being in the AR environment stronger than the sense of being in the real world.	0.917
	IE3	I felt completely immersed	0.927
Hedonic Motivation	HM1	Using the fashion brands' AR apps is fun	0.858
	HM2	Using the fashion brands' AR app is enjoyable	0.867
	HM3	Using the fashion brands' AR apps is very entertaining	0.820
Innovativeness of the customer	IV1	I am the first in my circle of friends to know about MAR apps	0.919
	IV2	I always use the MAR apps before other people	0.927
	IV3	I like to experiment with new MAR apps	0.833
Patronage Intention	PI1	I will consider the MAR feature as the first choice while shopping for fashion brands	0.886
	PI2	I am willing to recommend the fashion brands to others, provided those brands has MAR feature	0.907
	PI3	I am willing to repurchase a fashion brand with MAR feature	0.863

Research Model





Note: PEU: Perceived Ease of Use; IE: Immersive experience; HM: Hedonic Motivation, and IV: Innovativeness of the Customer

Table no. 3: Convergent Validity

	Cronbach's alpha	rho_A	Composite reliability	Average variance extracted (AVE)
HM	0.805	0.807	0.885	0.72
IE	0.908	0.915	0.942	0.844
IV	0.874	0.886	0.923	0.8
PEU	0.914	0.922	0.946	0.853
PI	0.862	0.865	0.916	0.784

Note 1: Threshold value: Cronbach's Alpha >0.7; CR >0.7 and AVE > 0.5

Note 2: PEU: Perceived Ease of Use; IE: Immersive experience; HM: Hedonic Motivation, and IV: Innovativeness of the Customer

Discriminant Validity

Table no. 4: Fronell - Larcker criterion

	HM	IE	IV	PEU	PI
HM	0.848				
IE	0.439	0.919			
IV	0.617	0.357	0.894		
PEU	0.208	0.205	0.203	0.924	
PI	0.495	0.426	0.484	0.208	0.885

Note: PEU: Perceived Ease of Use; IE: Immersive experience; HM: Hedonic Motivation, and IV: Innovativeness of the Customer

Table no. 5: HTMT

	HM	IE	IV	PEU	PI
HM					
IE	0.512				



IV	0.739	0.402			
PEU	0.244	0.224	0.229		
PI	0.594	0.478	0.554	0.232	

Note: As per Hair Jr. et al. (2017): Threshold values:

- The loading coefficients had to be greater than the cross loads;
- The inter-construct correlations had to be less than the square root of the AVE values
- The latent variable HTMT values had to be lower than 0.85

Note: PEU: Perceived Ease of Use; IE: Immersive experience; HM: Hedonic Motivation, and IV: Innovativeness of the Customer

Table no. 6: Path Coefficient, Mean, SD, P value and t value

	Path Coefficient	Sample mean (M)	Standard deviation	T statistics ((O/STDEV)	P values	Remarks
PEU -> PI	0.463	0.464	0.059	7.847	0.000	H1 Supported
IE -> PI	0.623	0.622	0.058	10.741	0.000	H2 supported
HM -> PI	0.431	0.434	0.063	6.841	0.000	H3 Supported
IV -> PI	0.349	0.349	0.055	6.345	0.000	H4 supported

Table no. 7: Collinearity Statistics (VIF): Outer Model:

	VIF
HM1	1.792
HM2	1.912
HM3	1.606
IE1	3.173
IE2	2.764
IE3	3.191
IV1	3.058
IV2	3.198
IV3	1.846
PEU1	3.256



PEU2	3.189
PEU3	3.081
E1	2.252
E2	2.471
e3	2.009

Note: Threshold value: VIF < 5

Coefficient of Determination

Table no. 8: R square

	R-square	R-square adjusted
PI	0.336	0.335

Note: R square = 0.336 indicates the model test results are substantial level and 33.6% variation in the Patronage Intention is explained by PEU, IE, HM and IV

Threshold Values:

R square: Cohen (1988) suggested R2 values for endogenous latent variables are assessed as follows: 0.26 (substantial), 0.13 (moderate), 0.02 (weak).

F-square

Table no. 9: F-square

	HM	IE	IV	PEU	PI
HM					0.045
IE					0.059
IV					0.057
PEU					0.056

Note: Threshold values: f-square is effect size (≥ 0.02 is small; ≥ 0.15 is medium; ≥ 0.35 is large) (Cohen, 1988).

F-square: From the above table it is evident that the effect size of exogenous contracts (PEU, IE, HM, and IV) on endogenous construct (PI) is between small to medium.

Predictive Relevance of the Model

Table no. 10: Q-square

	Q-square predict
PI	0.322

Note: Threshold Value: Q-square above 0 shows that the model has predictive relevance

Q-square: From the above table it is evident that the model has predictive relevance



Findings

It was found that the majority of the respondents (56.72%) are from the village. More than half the respondents (61.56%) are girls. Most of the respondents are in the age group of 17 to 20 years. The majority of the respondents are studying in Undergraduate courses (69.76%). Most of the respondents are in commerce specialization (59.76%). The majority of the respondents i.e. 79% of the respondents prefer online shopping apps to purchase fashion accessories. The Perceived Ease of Use, Immersive experience, hedonic motivation, and innovativeness of the customer have a positive and significant influence on Patronage intention towards the augmented fashion brand. Additionally, generation Z customers expressed more useful insights on the features they would like to see on the MAR apps of fashion brands.

Managerial Implication

Customers are more inclined to buy the brand and refer it to others because they believe that MAR applications have transformed the way they view the augmented brand. To influence the buying process customers and attract new customers from rural areas, fashion firms' digital marketing managers need to concentrate more on boosting the customer experience via MAR apps. Another intriguing finding of this study is that customers want a feature that displays an image of a model or celebrity wearing the same sunglasses that they are trying on the AR platform of a fashion brand. Through this, they would like to compare themselves with those models/celebrities for better reinforcement of purchase.

Additionally, while customers are using a product, a virtual backdrop needs to be integrated into the AR-try on the platform. The brands should implement the aforementioned insights into the AR try-on feature to improve the customer experience.

Originality

This research contributes to the existing body of literature by providing insights into rural Generation Z consumers' perspectives on the use of MAR apps towards fashion brands. Additionally, it offers helpful guidelines for fashion-related brands for creating consumer-driven augmented reality applications that meet the interests and preferences of young consumers.

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