

## Investigating interactive marketing technologies – adoption of augmented/virtual reality in the Indian context

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**Abstract:** With the rapid technological advancements and growing competitiveness in the market, organisations have started marketing interactive technologies such as augmented reality (AR) and virtual reality (VR) to have a competitive edge. The constant growth of online shopping and digitalisation coupled with growth of interactive technologies enables the consumer to try-on the product virtually thereby improving the online shopping experience. The focus of this study is to investigate the consumer awareness, consumer adoption and the determinants of consumer adoption of AR/VR technologies in the Indian context. The four dimensions that emerged of this study points towards the technology adoption perspective of business owners/entrepreneurs were: a) technology benchmarks; b) technology barriers; c) technology implementation; d) technology applicability. This study would provide insights regarding the AR/VR technology adoption levels of entrepreneurs engaged in various business sectors and challenges associated with the same which would be beneficial to marketers while designing online marketing strategies.

**Keywords:** augmented reality; virtual reality; interactive technology; consumer awareness; consumer adoption; India.

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### 1 Introduction

Owing to the growth of new and updating technologies penetrating the market, the overall functioning of industries has seen a drastic change and has become far more efficient. With the rapid technological advancements and growing competitiveness in the market, organisations have started marketing interactive technologies such as augmented reality (AR) and virtual reality (VR) to have a competitive edge. The constant growth of

online shopping and digitalisation coupled with growth of interactive technologies enables the consumer to try-on the product virtually thereby improving the online shopping experience as well as higher sales. AR/VR can improve consumer experience and excitement, for instance, AR/VR solution allows consumers to visit virtual destinations resulting in consumers making more confident and informed travel decisions (Kore et al., 2018). AR superimposes the digital information and objects over the physical world to generate the enhanced version of the real world. It enables the organisations and online marketers to increase the consumer satisfaction, experience and influence their buying intention (Burke, 1997). AR improves the users experience as well as the interaction with the actual world (Campbell et al., 2018) and online marketers could leverage sales through these interactive technologies. The increase in smartphone ownership and technological advancements has contributed towards the growth and interest in AR technology (Kore et al., 2018). Attaran and Morfin-Manibo (2018) emphasise on how AR/VR technologies have gained popularity in various industry sectors and how AR/VR technologies are utilised in almost every aspect of society, including retail, gaming, manufacturing, construction, healthcare, advertising, training, development, fashion, education, military, sports, and engineering. The consumer awareness of AR/VR is increasing in India gradually which is one of the purposes of this case study where this study would investigate the extent of the consumer awareness of AR/VR in various business sectors.

Digital technologies have begun to usher in an era of customisation through the help of AR/VR, at a much lower cost in both B2C and B2B segments (Statista, 2020). Although the cost of these technologies is decreasing, feasibility of implementation has remained a major challenge due to the fact that in comparison to the traditional methods, these technologies are costly. These interactive technologies will soon be adopted by consumers and would become a major part of consumer's mundane lives. The corporate annual growth rate of VR stands at 48% and that of AR stands at 140% and if businesses do not adopt these technologies they will gradually end up losing lots of potential opportunities (Newman, 2019). With the world undergoing rapid technological changes, AR/VR has taken over the dynamic market, with an increasing number of companies adopting these interactive technologies and as the cost of acquiring these technologies is decreasing, they have become more accessible to companies of all sizes. Hence, it would be crucial to understand the determinants of consumer adoption of AR/VR technologies in the context of Indian business sector.

The main purpose of this research is to investigate the awareness and adoption of AR/VR in various industry sectors. This study has been based in India which is an emerging market. The justification for grounding this study in the Indian context is due to the fact that several studies have quoted India to be one of the fastest growing markets as per PWC (Thomas et al., 2019; Thomas and Kureshi, 2020; Shree et al., 2017; Kureshi and Thomas, 2014, 2020). This study extends the current research on AR/VR by unearthing following set of questions in an emerging market context:

- a What is the consumer awareness of ARVR technologies in various business sectors?
- b What is the consumer adoption of AR/VR technologies in various business sectors?
- c What are the determinants of consumer adoption of AR/VR technologies in the Indian business sector?

These questions would be explored and examined in a descriptive research design setting. The finding and conclusion is discussed in the subsequent sections for practitioners as well as future research perspective.

## **2 Literature review**

### *2.1 Understanding AR/VR*

The term interactive technology includes all the different forms of computer mediated technologies and digital environments (Javornik, 2016) and AR/VR falls under interactive technology. Bamodu and Ye (2013) states that VR is a figure of speech, 'oxymoron' that means "reality that does not exist". Technological innovations and advancements in the last decade in India have been front runners (Thomas and Varia, 2018). AR/VR is also referred as virtual world, artificial reality, artificial worlds, virtual environment and cyberspace. VR arrangements could be divided into three broad segments that are: immersive, non-immersive and semi-immersive. According to Norris et al. (2019), VR generates simulated environments by using software, computers and hardware. The VR industry is expected to accomplish \$19 billion by 2020 (Statista, 2020). AR has been affirmed as an interactive technology that uses virtual objects to generate an environment that provides the users to experience virtually modified real world (Javornik, 2016). In 1950s, the first form of augmented reality was developed by Morton Heilig in cinematography. Till the 1990s, aviation industry, NASA and other research institutes used AR technology to develop digital devices and wearable devices. Initially the AR technology was not fully developed and was not cost effective which made it difficult to for mass consumer adoption and larger scale launch. Eventually, technological advancements reduced the cost, improved mobility of AR and have therefore increased the utility of the technology (Javornik, 2016). Harvard Business School Press (2017) had projected that the major industries which would invest highly in the AR/VR or extended reality in 2020 were automotive, media and telecommunication, retail and consumer industry. Watson (2018) states that AR/VR is increasingly being used in services, manufacturing, sales and marketing, design, operations, training and surgical guidance.

### *2.2 Potential of AR/VR*

The global AR and VR market amounted to \$16.8 billion in 2019, grown at 63.3% (CAGR) from 2018 onwards and is projected to touch \$571.42 billion by 2025 (Allied Market Research, 2019). VR emerged in the 1800s and refers to the designing of an experience such that it seems as it was actually happening in reality and it is not just a technology that is capable of creating a different world but also creates a reality that is lifelike (Harman, 2019). Likewise, AR initially originated in the 1950s and later surfaced in 1968 when a head mounted display making use of augmented reality came into existence (Furht, 2011). Jenkins (2019) asserts that 93% of the enterprises categorised as early adopters that have invested into AR/VR technologies are noticing fruitful and positive impact on their business. However, every technical advancement comes with its own challenges. AR/VR as an interactive technology is still in its development phase. Moreover, as the technology is slowly beginning to acquire its pace on consumer

adoption, there are still lots of challenges which need to be taken into consideration in the long run and thereby it is crucial to deliberate the future context of AR technology while designing solutions (Roesner et al., 2014).

### 2.3 AR/VR implementation

AR/VR technology implementation has several constraints across the industry. In many business sectors AR/VR technology was considered as an expense rather than an investment. Recent technological upgradation and penetration of internet in India has led to successful adoption of smartphones by people thereby leading to development of applications/software that facilitates the way towards AR/VR adoption. This adoption further facilitates the introduction of AR and VR technology on a larger scale, i.e., among the masses. Several multinational companies like Apple, Facebook, Samsung, Magic Leap, Google Inc., HTC, Microsoft Corporation, and Wikitude have increased their investment to make AR/VR technologies to improve their accessibility (Martín -Gutiérrez et al., 2017). Few of the most popular players in India are Aaryavarta, Juego Studio, IndiaNIC Infotech and Yudz Solutions.

### 2.4 Market penetration

The market for AR/VR is anticipated to attain \$160 billion by 2023 (Statista, 2020). The interactive technologies like AR/VR have immense future potential and a huge commercial value if used wisely. For example, three industries in Europe, which have been successfully using AR/VR are education, entertainment, and marketing/media, (Statista, 2020). Large scale businesses have been witnessing tremendous growth in the technology and advanced AR technologies have been tested widely for a couple of years now and the resultant output of the same has created a greater impact on their minds. Recent study has stated that 90% accuracy and 30% reduction in time could be achieved by implementing AR/VR technology (Ratnottar, 2019). AR/VR technologies from the perspective of its applicability and usage has the ability to make organisations self-agile and would act as a coordinated technology helping in automatic connection of the agents to help them coordinate without any social ends. The rapid increase in the usage and development of AR technologies is bound to give rise to the development of self-organised solutions to the common public problems (Devereaux, 2019).

### 2.5 Gaming sector

AR/VR has strongly emerged especially in terms of the gaming industry. There are various gaming companies that have jumped on this technology in order to improve customer experience and get an edge over its competitors. It has given the gaming industry a new identity and has transformed it to a new level. AR has penetrated deeply into the market, more specifically in the gaming and entertainment industry (Ong and Nee, 2013). One of the most significant examples of the same is *Pokemon Go*, which has been one of the most successful AR games in the industry, as its statistics say that it was downloaded more than 500 million times in 2016 and hence popularising location-based gaming in various countries. In this game, people were able to catch hold of the virtual creatures (from the series) in real life locations and therefore, made it more fascinating for the people and with the increased popularity of the game, it was considered as one of

the biggest games in the history. Earlier people use to denote AR/VR with only gaming industry but gradually people have started taking AR/VR as more than just a gaming technology. It has emerged itself beyond gaming into various fields be it fashion or healthcare or education. Several business sectors have started using AR/VR technology in the form of product prototyping techniques, training programs, efficient designing and presentations of projects at affordable rates in order to improve its efficiency in the market.

### *2.6 Manufacturing sector*

The technology of AR/VR provides better ways of interface and conception, where it could be functional in real engineering problems. AR/VR could be utilised to eradicate limitations in the course of information and planning processes. Virtual manufacturing represents a collection of processes like product plan, modelling, simulation, testing and proper evaluation prior to developing the physical prototypes in order to cut time and costs (Shiratuddin and Zulkifli, 2001). AR/VR approach for the businesses is beneficial in reducing the burden of information and the amount of training required for the assembly operators which ultimately leads to saving product assembly time and product lead time. The usage of AR/VR technologies is increasing tremendously in the manufacturing sector, especially in solving problems in manufacturing through the intervention of interactive technologies, for instance research has shown that due to AR/VR there is reduction of error rate by approximately 82% (Ong and Nee, 2013).

### *2.7 Education sector*

In the education industry, the role of AR/VR has increased to greater extent where interactive technology is utilised to teach students in real time and proves significant to attract the young age groups encouraging efficient study. We would surprisingly see that even elementary kids at their young age are engaging with these interactive technologies. Hayward (2018) asserts that products such as merge cube, VR headsets and merge soft-foam VR goggles provide a captivating experience to the users. The AR/VR technology could be utilised to create a whole different world with magical effects. Cheok et al. (2008) describe the usage of AR/VR in classrooms or any other teaching spaces and how it plays a crucial role in enhancing the overall education system, for instance, AR/VR student laboratories could provide advanced learning by establishing mixed reality learning environment to deliver an innovative environment by using pole-zero plots, touch screen visuals and 3D virtual arm motors. The AR/VR applications in the education industry extend to differently able students in terms of greater accessibility and participation thus, delivering a perfect virtual experience for such students (Martín-Gutiérrez et al., 2017).

### *2.8 Marketing sector*

Jacob-John and Ching (2019) focus on the role of AR/VR in the marketing industry, in enhancing the user experience while engaging in the buying experience and focusing on the role of AR/VR technologies in impacting buying behaviour on the millennial. AR/VR has been widely used in the marketing industry in areas such as consumer behaviour, retailing or enhancing the user experience. For instance, the Swedish furniture company

'IKEA' provides AR/VR facility to the users with the help of their app which allows them to virtually place their furniture before making their actual purchase thereby enhancing the user experience. The Indian retail sector is rapidly growing in many fronts whether it is adopting various modern retail formats, especially online (Sinha et al., 2012; Sinha and Thomas, 2012), online bus ticketing (Thomas et al., 2014) and online grocery retailing (Kureshi and Thomas, 2019). AR/VR is utilised as a marketing tool that helps in promoting the retail outlets but also imprints the same in their mind for a longer period of time as the interactive technology provides experience rather than just monotonously giving product or service related information.

## 2.9 *Insurance sector*

In the insurance industry, AR/VR technology can help training on risk handling practices through demonstrations. AR systems are designed in a way that would give trainees in an organisation, a comparatively better vision and eliminate the hazardous part in order to get effective response in training and development in various business sectors. Similarly, in logistics business AR/VR technology can help in reducing the process flow time by helping the staff to navigate the processing stations and for shipment. Likewise, in healthcare industry AR/VR technology can aid in medical training/learning, improved customer interactivity and experience. A large percentage (81%) of respondents worldwide stated that they were just experimenting with AR/VR for workplace learning and development (Statista, 2020). The AR/VR solution platforms help the businesses to build efficient technological infrastructure (Kumar, 2017). AR/VR also has its application in training for manufacturing, medical and construction industry (Norris et al., 2019) where it has proved to be an effective tool for training and ensuring the safety of the employees. AR/VR not only trains the employees but also familiarises the employees with hazardous situations, thus, reducing the negative outcomes through virtualisation (Steffen et al., 2019). In the construction industry, AR/VR has reduced the risk and has made training procedures free of risk with the support of simulators. For instance, the customers can view the product in the early stage of development and can give feedback according to the requirements. In a nutshell, the AR/VR technology has been giving a lot more benefits to the entire construction industry and the people attached to it (Ford, 2019). The usage of computer trials and techniques generated with the help of VR in the mining industry has made the situation of escape and compressed heat less risky with fresh air bases, route marking, taking fire events under control (Carter, 2018).

The above literature review section helps us to better understand the research in the area of AR/VR technologies and the adoption of such interactive technologies in various business sectors as far as information is available in the public domain. The literature and debates on AR/VR technologies are majorly focused around western countries and it is clearly evident that there are limited studies have explored and examined the application of AR/VR technologies in the emerging context. The focus of this study is to investigate the consumer awareness, consumer adoption and determinants of the consumer adoption of AR/VR technologies in the Indian context. Such an insight regarding the awareness and adoption levels of entrepreneurs engaged in various business sectors and the challenges associated with the same would be beneficial to marketers, especially online marketers, while designing their online marketing strategies.

### 3 Research objectives

- Exploring the extent of consumer awareness of AR/VR technologies in various business sectors.
- Examining the consumer adoption of AR/VR technologies in various business sectors.
- Investigating the determinants of consumer adoption of AR/VR technologies in the Indian business sector.

### 4 Research methodology

The main objective of this research was to understand the consumer awareness and consumer adoption of AR/VR technologies in various industries in India. The tool used to generate responses for this study is structured questionnaire, which was designed in line with the research objectives. The survey is designed to understand the characteristics of the population under study and includes collecting responses through questionnaires from entrepreneurs/owners engaged in various industries in India. The samples were selected based on the availability of data and willingness to participate from the following industries: manufacturing, oil and gas, processing, education, healthcare, real estate, marketing and advertising, retail and automotive industry. This study is limited within the geographical bounds of the state of Gujarat. Gujarat was chosen for this study because it is one of the fastest growing states in India as well as a major industrial hub in India. The samples were collected from the following cities in Gujarat: Ahmedabad, Vadodara, Anand, Surat, Mehsana, Gandhinagar, Vapi and Rajkot. The sampling technique used for this study is convenience sampling which is a non-probability sampling technique. The structured questionnaire for this research is based on a 5-point Likert scale modified from the 7-point scale originally developed by Nevin and Houston (1980). The respondents were asked to indicate their agreement with the statements on a 5-point Likert scale.

The questionnaire comprised of two warm-up questions leading to questions on AR/VR technologies. Next, two questions tested the awareness followed by questions on experience of interactive technologies. Awareness was measured using a dichotomous evaluative scale. This was followed by one question about the source of awareness about AR/VR technologies. The next part carried questions to measure the consumer adoption of AR/VR technologies. This consisted of statements such as:

- 1 I feel that AR/VR technology would be difficult for users to get used to
- 2 I believe will that using AR/VR technology give a competitive edge
- 3 I feel that the use of AR/VR technology can lead to privacy concerns
- 4 I believe we will adapt AR/VR technology if our competitors do
- 5 I feel that AR/VR technology is costly for small companies to adopt.

There was a mix of 22 statements (both positive and negative) to examine the research objectives outlined for this study. Finally, demographic details such as gender, 'age of the business owner/entrepreneur', 'size of the business organisation', 'address of the location' and 'percentage of profit invested in technology up gradation' were recorded.

Recognising the fact that many entrepreneurs/owners engaged in various Indian industries were likely to provide socially desirable responses, proper actions were followed (Razalan et al., 2017). The entrepreneurs/owners who were part of the sample for this study were assured anonymity and privacy with respect to their responses (Campbell and Cowton, 2015).

The tools used for data analysis were SPSS software and advanced excel applications. The data collected was encoded into SPSS 26.0 for extracting the factor analysis output and other descriptive data. The primary data for the study was collected through the structured questionnaire regarding consumer awareness and consumer adoption of different industries with respect to AR/VR technologies. The secondary data for our research is collected through various journals, research papers, and reports from databases available online such as Google Scholar, EBSCO business database, JSTOR, and Scopus database. In the secondary research, the focus was to collect information regarding different industries using or related in some way with AR/VR technologies to acquire a larger perspective for carrying out this research study.

## **5 Results**

The questionnaire was designed keeping in mind the research objective to capture the consumer awareness, consumer adoption and the determinants of consumer adoption towards AR/VR technologies. The questionnaire was composed of open ended questions and last part of the questionnaire consisted of demographic questions. The back translation method recommended by Brislin (1986) was followed and the structured questionnaire was translated into Gujarati language and then back translated into English language by two bilingual experts. Eleven Gujarati language professors were requested to provide their remarks on the Gujarati version and the appropriate changes were incorporated. This ensured that vernacular or conversational wording was reduced to minimum (Douglas and Craig, 1983).

A total of 241 responses were collected out of which five responses were discarded due to inefficient and incomplete information. The final sample consisted of 236 questionnaires which were used for the analysis of the data. The questionnaire was manually distributed wherever necessary and rest of the questionnaires were shared through Google forms. The sampling technique convenience sampling was adopted to collect the data and it varied in age and gender. The gender ratio of the survey constituted (90.9%) male and (9.1%) female. The male ratio was higher to the fact that most of the business owners or entrepreneurs were males and few females were there who either inherited the business or started business on their own in the state of Gujarat. Out of the various industries under investigation, a majority of the responses belonged from the manufacturing industry (38.6%) followed by retail (18.7%), and education industry (7.5%).



The consumer awareness of AR/VR technologies was explored in the first stage of the questionnaire. Out of the total 236 responses, significant percentages (63.9%) of the respondents are not familiar with the concept of AR/VR technology. Out the remaining (36.1%) respondents who were familiar with the concept of AR/VR technologies, 67.8% of the respondents were aware as well as they had experienced AR/VR technology. A significant percentage of the respondents were not aware of AR/VR technology and had not experienced any such interactive technology in the past.

To examine the consumer adoption of AR/VR technology in selected industries, it was necessary to understand the perspective of the respondents towards interactive technology. A majority of the respondents (68%) believed that interactive technology was time consuming and difficult to get accustomed. This could be due to the lack of awareness or knowledge regarding the usage/support of technology. They believed that the technology is costly to adapt for small companies and requires continuous investment in maintenance and repairs. However, a sizeable percentage of the respondents (59%) believe that AR/VR technology can provide them a competitive edge and can have a positive impact on the growth of their company. More than half of the respondents (54%) believe that AR/VR technology can provide them new avenues and business opportunities ultimately improving their productivity. Most of the respondents (61%) believe that AR/VR is an efficient tool for workforce up skilling but, only a small percentage (23%) feel that AR/VR offers them an advantage over conventional training methods. A majority of the respondents (76%) think that the usage of AR/VR technology would be limited to certain industries (manufacturing, retail, education and marketing).

There were 36.1% respondents who were familiar with the concept of AR/VR technology as mentioned earlier, only 12.6% respondents were currently using any type of interactive technologies. Within the 12.6% of respondents, the usage of AR/VR technology was restricted to sales, marketing and advertising and other customer engagement functions. The rest 87.4% constituted of 21.3% who were contemplating regarding the adoption of this technology in the near future. Cost of implementation was the prominent reason for not adopting the AR/VR technology. A significant number of the respondents lacked understanding of the benefits of the AR/VR technology adoption and were facing issues in integrating the technology with the existing system in their organisation. The usage of AR/VR technology is found mostly in workforce development, managing operations, and marketing and product/service development. In case of workforce development, 37.9% believed that it helps towards easy access to information and 34.5% believed that it helps in facilitating training by simulation. In case of managing operations, 34.5% believed that it makes proper utilisation of resources and 24.1% agreed that it provided a proper work process flow. In consumer product/service, 29.9% respondent's feel that it becomes easy as you have an option of 'try before you buy' and around 20% of respondents agree to the fact that it enables global reach and increases customer satisfaction. Out of the total companies using this technology or planning to use it, 69% of them say that they did not face any problem while dealing with the AR/VR technology companies. The remaining percentage of respondents (53%) who have faced a problem believe that because of lack of experience in such interactive technological, they find it difficult in striking business deals with the AR/VR technology

companies. A percentage of 34% perceives that the AR/VR technology is costly and comes with difficulties in negotiating IP agreements. Out of the total companies using the AR/VR technology, 36.8% of the respondents who have faced issues said that the AR/VR technology does not meet their expectations and 26.4% reported with privacy and security concerns as an obstacle in implementation of this technology. The companies in the research sample comprised in the range of 50 million and below (62.1%) in terms of their annual revenue generation and they invest a total of 1 to 3% for marketing the product/service. Similarly, 21.8% generated 50 million to 100 million revenue and invested 4 to 6% of their revenue in technology up gradation or in improving the process/system.

The third research objective was met by using factor analysis technique to find out the determinants of consumer adoption of AR/VR technologies in the Indian business sector. Factor analysis is constituent of general linear model and there is an assumption of linear relationship, and absence of multi-collinearity which leads to true correlation amongst the variables and factors. Factor analysis was considered here as a suitable technique due to the fact that it helps when the datasets consists of many variables and few variables are required to be condensed from large number of variables to simplify our understanding. In the factor analysis, the extraction method used was 'principal component analysis' along with coefficient matrix, unrotated component matrix and rotated matrix. The rotation method used for factor extraction was varimax with Kaiser normalisation. Four factors were extracted from the rotated component matrix (see Table 1). The Kaiser-Meyer-Olkin (KMO) measured 0.850 and as the value lies between 0.8 and 1 it implied that the sample was adequate and sufficient enough for factor analysis. The significance level in Bartlett's test of sphericity was 0.000 (less than 0.05) which implied that the data was suitable for factor analysis (see Table 2). The SPSS output lays four factors, and through rotated component matrix, the attributes of each factor have been derived. The attributes with factor loadings above 0.5 on any factor have been considered further in this study to understand the positive influence of factor on the various variables (see Table 3). The factors are labelled based on the various attributes it possesses. The first factor was labelled as 'technology benchmarks'. It comprises 14 attributes related to 'workplace development', 'enhanced productivity', 'provides competitive edge', 'company growth', 'increased business opportunities', 'training', 'workforce up skilling', 'effective marketing', 'improved customer service', 'operational efficiency', 'cost-based decisions', 'useful for product/service development', 'premium deliverables' and 'influence of competitors'. The second factor labelled as 'technology barriers' contains four attributes. The attributes are related to 'privacy/security concerns', 'difficult to use', 'time consuming' and 'costly maintenance'. The third factor labelled as 'technology implementation' contains two attributes that are related to 'one-time lump sum investment' and 'user friendliness'. The last and fourth factor labelled as 'technology applicability' which contains two attributes that are 'limited to certain industries' and 'affordability and cost'.

**Table 1** Factors derived with factor loadings

<i>Factors</i>	<i>Key attributes</i>	<i>Factor loadings</i>
Technology benchmarks		
S16	Workplace development	0.845
S7	Enhanced productivity	0.845
S3	Provides competitive edge	0.842
S9	Company growth	0.839
S11	Increased business opportunities	0.814
S2	Training	0.808
S4	Workforce up skilling	0.798
S17	Effective Marketing	0.765
S19	Improve customer service	0.744
S15	Operational efficiency	0.728
S21	Cost-based decisions	0.645
S18	Useful for product/service development	0.633
S5	Premium deliverables	0.573
S20	Influence of competitors	0.554
Technology barriers		
S13	Privacy/security concerns	0.774
S1	Difficult to use	0.632
S10	Time consuming	0.595
S22	Costly maintenance	0.563
Technology implementation		
S14	One-time investment	0.729
S8	User friendliness	0.694
Technology applicability		
S12	Limited to certain industries	0.731
S6	Affordability and cost	0.707

**Table 2** KMO and Bartlett's test

Kaiser-Meyer-Olkin measure of sampling adequacy.		.850
Bartlett's test of sphericity	Approx. chi-square	1,162.202
	Df	231
	Sig.	.000

**Table 3** Rotated component matrix

	<i>Rotated component matrix<sup>a</sup></i>			
	<i>Component</i>			
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
S16	.845			
S7	.845			
S3	.842			
S9	.839			
S11	.814			
S2	.808			
S4	.798			
S17	.765			
S19	.744			
S15	.728			
S21	.645			
S18	.633			
S5	.573			
S20	.554			
S13		.774		
S1		.632		
S10		.595		
S22		.563		
S14			.729	
S8			.694	
S12				.731
S6				.707

Notes: Extraction method – principal component analysis.

Rotation method – varimax with Kaiser normalisation.

<sup>a</sup>Rotation converged in ten iterations.

## 6 Conclusions

Technology adoption process has been executed in different business sectors for almost over two decades in the Indian context, but systematic study of AR/VR technologies amongst business owners/entrepreneurs representing various industry sectors has barely been carried out. While number of AR/VR technology related variables has been investigated in the western context, not much was examined regarding business owners/entrepreneurs in the emerging context, especially India. This study has been carried out in the Indian context where still lots of questions regarding AR/VR technologies stay unrequited.

The objective of this study was also to examine the change in business orientation regarding AR/VR technology and how it impacts various industries which have adopted such interactive technology when compared to those industries that have not implemented AR/VR practices yet. The major determinants of consumer adoption of AR/VR technologies in the Indian business sector were derived in this research study under four broad dimensions:

- a technology benchmarks
- b technology barriers
- c technology implementation
- d technology applicability.

These factors point towards the perspective of business owners/entrepreneurs representing various industries towards the usage of AR/VR technology.

Majority of the business owners/entrepreneurs were not aware about the AR/VR technology. Those who were aware about such technologies used it and also wanted to try it out in the future. There were substantial majority who even in today's high tech era were quite reluctant and rigid towards any sort of technology change. The business owners/entrepreneurs survive with their own set of assumptions without having sufficient knowledge about the phenomenon which leads to negative perception towards such AR/VR technologies. The main contributor behind such type of behaviour is the lack of awareness about interactive technologies.

The first factor 'technology benchmarks' indicates that the impact of AR/VR technologies on various business sectors. There were various effects shared by the business owners/entrepreneurs with respect to the adoption of AR/VR technologies such as workplace development, enhanced productivity, providing competitive edge, company growth, increased business opportunities, training, workforce up skilling, effective marketing, improved customer service, operational efficiency, cost-based decisions, product/service development, premium deliverables and influence of competitors. Nevertheless, based on the experience of the business owners/entrepreneurs who had adopted this technology, AR/VR technology could be definitely considered as an investment rather than as an expense. The second factor was 'technology barriers' indicated the hurdles faced by the business owners in adopting/implementing the AR/VR technology in their organisation which were related to concerns about privacy, difficulty in using the technology on mundane basis, excessive time required to get accustomed with the interactive technology. Large number of business owner/entrepreneur believes that the usage of AR/VR technology was prone to security concerns. There were business owners who considered AR/VR technology implementation to be rather time consuming and constantly requires investment in maintenance/repairs. There were quite a few who faced issues in integrating this technology with the existing system and hence, never agreed to use the same in their respective businesses.

The third factor was 'technology implementation' which indicates the implementation dimension in the adoption process of AR/VR technologies in the organisation. This shows that the business owners took the technology implementation as a one-time investment opportunity and considered it as quite user friendly. The business owners believed it to cost a fortune but they were confident that AR/VR technology would provide them better returns in future. The fourth factor was 'technology applicability'

which indicates the perceived belief of business owners that AR/VR technology belonged only to a specific market and could not be applicable to pan industry level. The adoption of AR/VR technology has proven beneficial in most of the cases amongst those who had adopted this technology however, small companies with tight budgets considered the technology expensive and hence, lesser applicability. The applicability on a larger level is also dependent upon the factor that such an interactive technology should be affordable.

It is evident from this study that majority of the business owners were not aware of AR/VR technologies. Even though this technology supports various industries acquire efficient operations with their products and services, business owners were willing to adopt AR/VR once it overcomes its limitations in the existing market. Here the word of mouth amongst the business owners might also work for AR/VR owing to the reason that less awareness might lead to lesser rate of adoption. As and when business owners realise the benefits of AR/VR technology, it is more likely that industries would positively consider the technology adoption as an option for the growth of their business. This could be asserted on the basis of the findings of this study due to the fact that more than half of the respondents who were aware about AR/VR technology, were considering the option to adopt the technology in the near future. This study also indicates that the adoption of AR/VR equipped technology has proved to be very beneficial for Indian industries such as manufacturing, education, marketing and advertising, retail, textile and healthcare. Hence, this research study put forwards practical implications for business owners as the findings could facilitate them to manage their business efficiently with AR/VR intervention as it provides them with richer insights of the consumer awareness levels as well as determinants of consumer adoption.

Theoretically, this study complements the existing literature on AR/VR technology. Contrary to the previous literature which had primarily focused on AR/VR from technology perspective, this study deals with the perspective of business owners/entrepreneurs. This research study is distinct in the sense that it focuses on a key stakeholder – business owners/entrepreneurs – in the interactive technology business. This study also adds to the existing literature by providing a timely intervention in the interactive marketing technology sector in India. The findings of this study in emerging context is in line with past studies carried out in western context which found that adoption of AR/VR technologies depends upon experience as well as adequate amount of knowledge/awareness and that manufacturing industries prefer AR/VR technology-based products/services only if cost-savings, cycle time, easily accessible and efficient cut down of bottlenecks is provided (Fast-Berglund et al., 2018). Based on the findings of this study in the world of online marketing, the biggest limitation of online Indian retail stores is that they fail to give their customers the actual experience of the product/service. As a result, the online marketers as well as retailers face numerous challenges to retain consumers while introducing advanced interactive technologies such as AR/VR (Porter and Heppelmann, 2017). Although the Indian consumers are adopting the technology innovations at a rapid pace, still the offline market covers most of the market share. The chances of virtually trying the product is still at a nascent stage in the Indian market which makes both online marketing and online shopping even more complex and ultimately has adversely effects on the conversion rate. The AR/VR technology would further guide the industries to prioritise the various functional tasks and help focus on the volatility of the business environment (McKone et al., 2016).

## 7 Limitations and future scope

This study has quite a few limitations which possibly can be evaluated in future studies on AR/VR technologies. The sample has its limitations in representing the entire universe. The study has only taken limited variables into consideration and more explorations could be undertaken to include more variables such as internet penetration, income disparities, government regulations and policies, and availability of skilled labour. This study was carried out in various cities of one particular state in India and therefore, repetition of this research in other Indian states would yield generalised outcomes. The findings of this study would encourage large scale future investigations which might yield validated outcomes. Another major limitation of this study was the sample size of business owners/entrepreneurs. The respondents, i.e., business owners/entrepreneurs who were highly apprehensive about adoption of AR/VR technologies were less willing to participate in this study. Another limitation of our study is the lack of resources to cover up more industries to get meaningful insights. The sampling technique used can also be a limitation as convenience sampling can at times lead to sampling bias.

The scope of AR/VR technologies is limited to the fact that mobile devices are not complete solutions to interactive technologies as these devices come with a fixed battery life, limited data compilation and thinner displays. These devices are not designed to cater vital services that help conduct operations remotely and efficiently in daily use for various industries that were surveyed for this research study. The scope of AR/VR is also affected when industries like education, gaming, and healthcare do not majorly focus on actual reality and divert attention towards virtually driven procedures by itself. Likewise, over reliance on computers, software and self-acquainted devices could result in lack of experience, personal commands and guiding workers in industries like construction and manufacturing. There is definitely potential for future research that researchers could focus while carrying out research in the domain of AR/VR technologies.

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