A STUDY TO ANALYZE THE ADOPTION OF AUGMENTED REALITY & VIRTUAL REALITY AND IMPACT OF ARTIFICIAL INTELLIGENCE ON REAL ESTATE SECTOR IN INDIA

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PATCHALA LAKSHMI VENKATA SATYA KIRAN

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by

Patchala Lakshmi Venkata Satya Kiran

Supervised by

Dr. Amrinder Singh

APPROVED BY

Dissertation chair Dr Milica Popović Stijačić

RECEIVED/APPROVED BY:

Renee Goldstein Osmic

Admissions Director

Dedication

To my beloved parents, wife, and our incredible daughter, you are the sunshine through late-night research sessions, and the unwavering belief that kept me going. This dissertation wouldn't exist without your sacrifices, your endless support, and the joy you bring to my life. Thank you, from the depths of my heart, for being my rock and my inspiration. This achievement is as much yours as it is mine. The unwavering belief in me of my parents and wife, became a lighthouse guide during this challenging journey.

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Dissertation Chair: <Chair's Name>

Co-Chair: <If applicable. Co-Chair's Name>

ABSTRACT

Digital technologies are developing very fast, thereby revolutionizing various sectors in the world, and the real estate industry in India is not an exception. As the sophisticated tools like Augmented Reality (AR), Virtual Reality (VR), Artificial Intelligence (AI) are being implemented, a major shift in the manner properties is being marketed, sold off and managed has been witnessed. Such technologies guarantee interaction and immersion, which makes it possible to see the features of properties in remote locations and maximise the performance of developers and realtors and their contact with customers. The aim of existing study is "to identify and analyse key factors influencing the adoption and application of AR, VR and AI technologies in the real estate sector; to investigate opportunities and challenges using AI and VR & AR in the real estate sector in India; to examine the role of augmented reality, virtual reality, and artificial intelligence in improving marketing and sales strategies in the Indian real estate sector and to evaluate the potential implications of adopting artificial intelligence and augmented & virtual reality technologies in real estate in India." The respondents for this research are the buyers from cities (Bangalore, Hyderabad, and Chennai) in India. So, Bangalore, Hyderabad, and Chennai are universe for this study. The study pattern will be of randomly selected sample using purposive sampling technique within the population selected. The explored target is to 600 samples tentatively from area of the population in the present study. Overall, the results that all the tables give indicate that there is a high appreciation of the potential role of AR, VR, and AI as strategic tools of enhancing marketing and sales in real estate sector in India. The technologies provide unrivalled ways to improve customer interaction, brand awareness, organizational decision-making, and openness. Nevertheless, the industry will face the problem of infrastructure preparedness, training, affordability, and safety to make integration successful. The solutions to these barriers should be targeted towards cost optimization, user trainings, and the creation of industry-wide standards, which should be pursued in the future. When deployed responsibly AR, VR, and AI not only revolutionise the marketing and selling strategies but also have the potential to revolutionise the customer experiences as well, setting the stage of a more digital, transparent and customer centric recently in India.

Keywords: artificial intelligence (AI), augmented reality (AR), digital technologies, real estate, virtual reality (VR)

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CHAPTER 1: Introduction

1.1 Introduction

Digital technologies are developing very fast, thereby revolutionizing various sectors in the world, and the real estate industry in India is not an exception. As the sophisticated tools like Augmented Reality (AR), Virtual Reality (VR), Artificial Intelligence (AI) are being implemented, a major shift in the manner properties is being marketed, sold off and managed has been witnessed. Such technologies guarantee interaction and immersion, which makes it possible to see the features of properties in remote locations and maximise the performance of developers and realtors and their contact with customers (Ronzon *et al.*, 2025). Overall, the expansion and complexity of India occupied real estate industry have positioned these initiatives of digital innovations as paramount to sustaining competitive advantage and the changing needs of consumers.

AR VR technologies have become a popular means to create better experiences around property viewings. AR is used to superimpose digital content onto physical spaces, whereas VR can provide an entirely immersive virtual walk-through that allows potential buyers and investors to view real estate projects without even being in the same room allowing others to walk through the property at the same time as the owner. Not only does this decrease the necessity of site visits, it also makes the decision-making process faster since there is a deeper spatial understanding and design information included. Future changes imposed by the current trends in India include the need to reduce geographic boundaries and increase transparency, dictated by the shift to digitalization and customer-centred marketing through the usage of AR and VR in the realm of the Indian real estate market (Doheir and Mismar, 2024).

Artificial Intelligence, in its turn, has a more complex role to play, automating the process, analysing the huge amount of data, as well as predicting the trends on the market. The tools based on artificial intelligence will serve to generate leads, segment customers, predict pricing, and calculate risks, which allows real estate firms to optimize sales strategies and increase work efficiency (Verma, 2025). These issues in the Indian real estate industry, including the regulatory intricacies, the volatility of prices and the preference of customer personalization, make the entry of AI in the ecosystem especially critical. The potential of using AI to maximize

profitability arises because the technology has the capability of streamlining the workflow by turning data into valuable insights.

Although these are exciting opportunities, the integration of AR, VR, and AI in the Indian real estate sector remains in the early stages, with such challenges as those of technological infrastructure, cost-related issues, and skill shortage. This paper will examine the adoption level of these technologies and their effect on the different aspects of the Indian real estate industry in terms of marketing, sales, customer interactions as well as operations efficiency. Exploring the opportunities and challenges associated with the implementation of AR, VR, and AI, the study will offer innovative knowledge on how the stakeholders can capitalize on these new technologies to build a sustainable growth within the Indian real estate industry (Crevoisier *et al.*, 2025).

1.1.1 Background and Context: The Real Estate Sector as a Growth Engine in Global and Indian Context

Real estate has always been considered the pillar of economic development in the global market. Worldwide, it has a great contribution to GDP, job creation, and investment chances and is seen as a driver of infrastructural development and urbanization. Real estate involves the building, purchase, sale and operation of residential, commercial and industrial real estate, thus a multidimensional sector that promotes construction, finance and other related fields. Real estate investment has been used as a major source of wealth, portfolio diversification and capital appreciation activities in many advanced economies hence the effectiveness in terms of growth rate (Gao *et al.*, 2024).

The world has experienced a booming transformation in the sector regarding the growing urban settlements, changes in technology, and lifestyles of consumers. The process of urbanization has driven the demand in the area of housing (residential and commercial) and a smart infrastructure, and the idea of sustainability has promoted the emergence of green buildings. Incorporation of technology, social-media platforms, big data analytics, and automation has transformed the real estate services to become more transparent, efficient, and user friendly. Recent South Asian and Latin American markets have gained their hot status among real estate development because of the increasing incomes, demography, and governmental programs towards affordable housing and smart cities.

The real estate sector especially in India has become one of the dynamic and rapidly flourishing markets in the world having a significant influence on the economy of the nation. With about 7-8% contribution in national GDP, the sector directly and indirectly employs millions of people and is a key growth driver in the country enabling the development of infrastructure and economic diversification. This high rate of urbanization, growth in the size of the middle classes and the growing rates of per capita income has resulted in the growth in the residential houses, commercial houses, retail houses, and industrial houses being demanded. The other government policies that have increased growth in the industry include the Housing for All by 2022, the Smart Cities Mission and the introduction of the Real Estate (Regulation and Development) Act (RERA) and in one way or another these policies have increased the growth by promoting transparency, accountability and formalization within the industry (Anand, 2022).

India real estate market though is intricate and very fragmented, with high regional differences as well as regulation issues. The challenges manifested in the industry include land procurement challenges, the non-consolidated markets, funding challenges and changing consumer preferences. Besides, the recent COVID-19 situation resulted in disruption and acceleration of adoption of technology-driven solutions and showed the necessity to achieve the required increase in operational efficiency and consumer attraction through innovation. Digital transformation, with Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI), is starting to change the dynamics of the Industry and can lead to virtual property tours, data-based decision-making, and automation.

Looking at macroeconomic trends, as well as technological progress, in the context of this changing situation, it is worthwhile to consider how real estate as a growth engine has been performing. The dynamics of its contribution to the process of sustainable development are delimited by the interaction of the demographic factors, governmental policies, market conditions, and innovation. The proposed study has put the significance of the real estate industry in the background of the economic system in India, and how the emerging technologies can benefit its development prospects in line with the global trends (Crevoisier *et al.*, 2025).

1.1.2 Global Real Estate Sector as a Growth Engine

Real estate business is an essential economic booster all over the world as it significantly boosts the gross domestic product (GDP) of various nations, employment and creation of capital. Real estate is a definition that implies a wide scope of activities such as residential, commercial, and industrial property development, leasing, sale, and managing. It is a key factor in the development of urban environments, infrastructural growth as well as in sparking other sectors of the economy like the construction industry, the financial services sector and even the legal services. The importance of real estate as an asset class to investment types is critical and on top of lowering economic stability and growth, in most developed economies (Mohameddhaha, 2023).

Due to urbanization, increase in incomes, changing demographics and the like unprecedented demand has been generated in the housing sector, commercial spaces, retail centres and industrial parks globally. Besides, sustainability and smart infrastructure became dominant themes that developed the innovation of green buildings and energy-efficient designs. Real estate operations are changing due to the technological development regarding real estate, such as Building Information Modelling (BIM), Internet of Things (IoT) and data analytics, which enhance the efficiency and customer interaction. Also world capital has found its way into real estate investments and they are considered a secure source of income and a way of diversification by institutional investors (Al-Ansi *et al.*, 2023).

It has seen real estate development accelerate in emerging markets in Asia-Pacific, Latin America and Africa as the markets are characterized by favourable demographics, urban migration and a boom in government incentives. Such regions are of great opportunity although their potentials in such areas are faced with problems like complexities in regulations and missing infrastructure. The world over, the resilience and flexibility of real estate industry to economic cycles and technology disruption makes the industry a critical powerhouse towards a sustainable growth and prosperity in the cities (Banerjee, 2023).

1.1.3 Indian Real Estate Sector as a Growth Engine

India real estate business is among the most rapidly developing and carrying the greatest contribution to the national economic development. It contributes to about 7-8 percent of the GDP of India and is patronizing to the employment of about 40 million individuals at almost

every arm. The broad dimension of the sector ranging between residential, commercial, retail and industrial real estate and property development platforms make the sector one of the primary infrastructure attractors in terms of urbanization and socio-economic transformation (Vanaja and Reethika, 2022).

The high rate of urbanization, growing middle classes, increase in the disposable incomes of the Indian population, and transformation in the lifestyle preferences of people in India has necessitated a boom in quality housing and business premises. Government attempt like Housing for All by 2022, Smart Cities Mission and policies like Real Estate (Regulation and Development) Act (RERA) have created increased field of transparency, consumer protection and formalization which have strengthened investor sentiment and sector growth. Additionally, plans such as the Goods and Services Tax (GST) have simplified taxation, and eased the ease of doing business. In spite of the rise, the Indian real estate industry has some drawbacks such as fragmented market, regulatory problems, financial issues, and the infrastructural shortage. COVID-19 pandemic played the role of a disruptor and catalyst because it made the development of digital technologies such as Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI) much faster to move beyond physical constraints and help operate more efficiently. Such technologies are more frequently used to provide virtual tours of properties, data-based market analysis, customer service automation, which transforms the process of buying and selling (Mohameddhaha, 2023).

With countries like India rapidly urbanizing and modernizing the real estate sector will continue to play an important growth play which is more focused on being innovative, modernized, supporting the changing consumer needs topics and meeting the sustainable development objectives. This causes the industry to boast as a very crucial factor to India in their economic desires and social developments.

1.2 Statistical Data of Real Estate Sector in India

India is projected to reach a US$ 1 Trillion market size by the end of 2030 in the real estate space up 5 times since 2021 when it was US$ 200 Bn and to contribute 13% of the country GDP by 2025. There is also growing retail, hospitality and commercial real estate business that gives the much-needed infrastructure to the increased requirements of India. It is foreseen that the Indian real estate market shall grow by an immense margin which could rise to a value of US$ 5-7 trillion by the year 2047 with a likelihood of becoming US$ 10 trillion. There was a

negligible decline of approx. 20 bps in 2024 in housing sales in the top seven cities of India at 4.59 lakh units versus 4.76 lakh units in 2023, as per ANAROCK data. The residential real estate market in India slowed significantly with a fall in total housing sales (of the top seven cities) by 28% (year-on-year) to around 93,280, as compared to more than 1.30 lakh in CY2024 during the first quarter of CY25 (January March).

Source: https://www.ibef.org/industry/real-estate-india

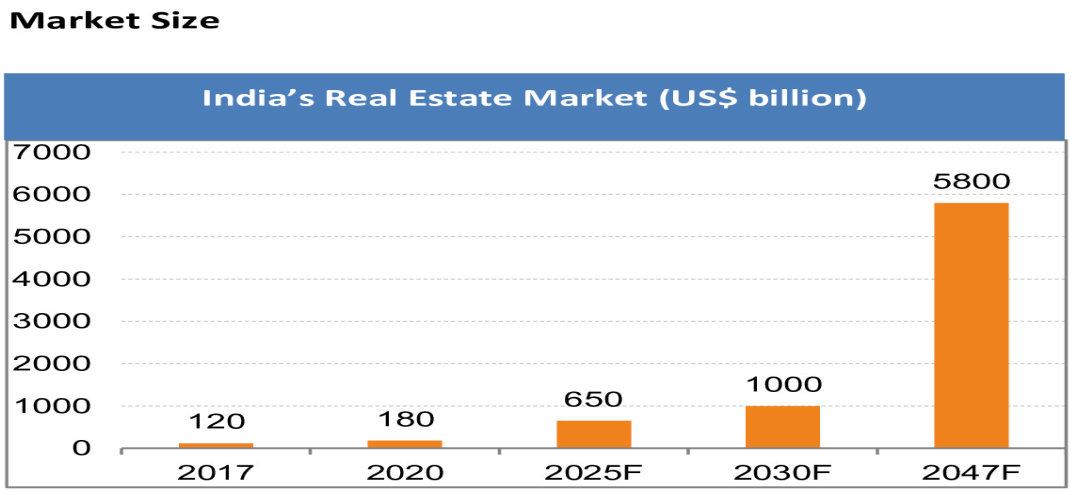


Figure 1. 1 Real estate market in India

1.3 Emerging Technologies: AR, VR, and AI

The technological advancement is causing a radical shift in the real estate market as new technologies continue to improve the process of developing, marketing, selling and running of real estates. Out of these, Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI) have come out as a formidable solution and redefines the real estate experiences of both developers and agents as well as the customers.

Augmented Reality (AR) adds advanced information to the real environment using a digital interface that covers the physical surrounding with an interactive content. In real estate, the use of the AR is used so that potential buyers and investors could see how a given property could be enhanced, have interior designs done, and architectural changes before their very own eyes, whether physically present on an on-site location or via mobile devices remotely(Akinleye, 2017). The technology is closing the gap of imagination and the physical in actuality and making spaces more tangible to the user without any physical staging or traveling. AR apps

also help architects and planners visualize their urban projects, thus enhancing the accuracy of design and dealing with their clients (Liu *et al.*, 2017).

Virtual Reality (VR) provides completely immersive computer-generated spaces which mimic the real world, or imaginings. In connection to real estate, VR can be used to conduct virtual tours of properties and even neighbourhoods where potential customers can have the ability to enjoy a 360-degree view of the house or commercial building (Al-Ansi *et al.*, 2023). This virtual tour can be of great value to the sales of properties off plan or to those consumers who are in different places. The benefits of VR are that they minimize time and cost wasted in making traditional visits to a location, and allows the builders to preview the projects that are still not constructed. In addition, VR increases customer-friendliness by offering an interactive and customized experience when exploring property (Verma, 2025).

Artificial Intelligence (AI) has a multidimensional role in revolutionizing the real estate industry taking advantage of data analytics, machine learning, and automation. AI-based systems process the market trends, model property prices, find prospective leads, and evaluate marketing exploits (Garbuio and Lin, 2018). AI-based chatbots and virtual assistants help facilitate better customer service by offering immediate answers to questions and individual suggestions. Regarding the operational front, AI helps evaluate the risks, check the frauds, and automate the processes and improvement of efficiency and minimization of human error. Moreover, AI will promote more decision-making, as it allows synthesizing large volumes of information on buyer behaviour, economic trends and property performance (van der Schaar *et al.*, 2021).

Collectively, AR, VR and AI are transforming real estate market because they enhance transparency, efficiency and customer experience. Their integration accommodates the traditional problems in the industry like information asymmetry, long production processes, and geographical limitations. With increased adoption, these technologies are likely to become common instruments in the real estate environment, spurring innovativeness, sustainability, and competitive edge (Hee Lee and Yoon, 2021).

1.4 Emerging Technologies in Real Estate: Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI)

Real estate business is becoming friendly toward the latest technologies that could optimize the business process, customer interaction, and overall efficiency. Among these emerging technologies, researchers and other scholars have identified Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) as the game-changing technologies redefining the marketing, selling, and management of properties in an increasingly competitive and digitally transformed market.

1.4.1 Augmented Reality (AR) in Real Estate

AR technology introduces an immersive layer of digital content, which can have the form of images, videos, or 3D models of such things in the real world with the help of devices, including smartphones, tablets, or AR glasses. In the real estate business, AR technology can allow users real-time visualization of architectural designs, inside of a property, furniture in the layout and even the facilities in the neighbourhood even when one is on the site or a distant location (Lévesque, Obschonka and Nambisan, 2022). This enables the buyers to have a visual image of the possible refurbishment, changes to the home or decor without looking at the actual building.

To developers and architects, AR makes design validation and client cooperation possible; by providing stakeholders with an interactive engagement of proposed changes. It can also be of assistance in marketing by making interesting property brokerages and interactive applications that give enriched details of the property in an immediate manner. As an example, a potential customer may take their phone and direct it at an empty room and see how it would look like with different furniture or a new colour in the walls, and help them make quicker and better choices. AR makes costs associated with physical staging and multiple site visitations lower and boosts transparency (Tkachenko, Kuzior and Kwilinski, 2019).

1.4.2 Virtual Reality (VR) in Real Estate

Virtual Reality technology includes users in a completely computer-generated 3D environment which gives the users a feeling of presence and scale hence is hard to capture using traditional photos or videos. Use of VR in the real estate business enables the potential purchaser and

investor to have a virtual visit to any house, office or any development in the real estate business without necessarily being in one place in the world through the use of VR headsets or even the use of normal devices such as PCs and smart phones (Al-Ansi *et al.*, 2023).

VR has a particularly significant value to off-plan and big commercial projects either with restricted access or no access. People are able to walk through rooms, examine finishes and sense space and layout not being in the room (Verma, 2025). It saves on the number of site visits and it shortens the sales cycle. During the planning of future projects, developers can also use VR to present what they have in detail thus attracting early investors as well as pre-sales. Furthermore, VR platforms allow replicating times of day, weather conditions, and furnishing variants, which is immersive.

1.4.3 Artificial Intelligence (AI) in Real Estate

Artificial Intelligence is transforming the real estate business by automating and optimizing diverse complex activities by using machine learning, natural language processing, and data analytics. AI-based models use big data consisting of historical prices, market trends, customer preferences, and economic parameters to gain predictive analytics and make recommendations that suit the individual.

A significant one is that it will be used in **property valuation and price forecasting** where AI algorithms will be able to estimate the price of the property more precisely, taking into consideration the thousands of factors that a typical comparative market analysis does not. This aids in data-driven decisioning by the buyers and sellers and also aids in risk assessment and mortgage underwriting as well in financial institutions(Hee Lee and Yoon, 2021).

AIs such as chatbots and virtual assistants in **customer engagement and lead management** result in immediate 24/7 answers to inquiries, book a tour of the site, and provide personalized property recommendations according to the preferences of the user. This raises the level of customer service and cuts down operational expenses(Tkachenko, Kuzior and Kwilinski, 2019).

AI also contributes to **marketing optimization** through audience segmentation, personalized content to the potential buyer, and the effectiveness of the campaigns. RELATED Learning Own General Data Protection Regulation Compliance with GDPR in Housing Is More Than

Checking Data Processing Consent Relaunched under a new name, Lodging Econometrics (lodgingeconometrics.com) will continue in the tradition of Albeit in the long form (RUS) Excellent example of a personal note.

Besides, the fraud detection and risk analysis capability by AI are vital to the establishment of trust and security when it comes to real estate transactions. As more IoT sensors and smart equipment become available, it can be used to facilitate predictive building maintenance and energy management to support sustainability objectives, as well (Kitsios and Kamariotou, 2021).

1.4.4 Integration and Impact

Whilst AR, VR, and AI technologies all have synergistic value to the real estate industry, their merger will provide further synergistic value. As an example, to optimize the buyer journey, AI can process user interactions in AR/VR environments in order to make more relevant property recommendations. A combination of these technologies removes geographical and informational barriers, brings higher levels of transparency and makes the real estate process more enjoyable, personal and streamlined.

Their transformational potential notwithstanding, adoption issues that include high upfront costs, a shortage of technological infrastructure, data privacy-related concerns, and the necessity to develop skills do exist, particularly in emerging economies. Nevertheless, with the drop in technology prices and an increase in digital literacy, the deployment of AR and VR, and AI should speed up and become the irreplaceable part of contemporary real estate ecosystems across the global stage (Khalid, 2020).

1.5 Technology Adoption Trends in India's Real Estate Sector

1. **Increasing Use of Mobile and Cloud-Based Solutions**

   The mobile apps and cloud are seeing increased adoption in the real estate companies of India in a bid to move towards automation of process listing, customer relationship management (CRM) and online tours. These solutions make it possible to perform updates in real time, collaboration when residing in different locations, and better accessibility to customers by both customers and agents (Iriqat and Abu Daqar, 2017).

2. **Big Data Analytics for Market Intelligence**

   Big data analytics can help developers and investors obtain information about the consumer preferences, market demand, pricing trends, and risk factors. The use of this data-driven method will aid in the optimization of the site selection, design planning, and marketing strategies so that they can be in closer touch with the buyer expectations (Hassani, Huang and Silva, 2018).

3. **Smart Home and IoT Integration**

   Intelligent home solutions and So-called Internet of Things (IoT) devices are increasingly utilizing in new residential construction. The application of intelligent home features inclusive of the automatic lighting, security network, energy saving, and remote-monitoring services helps in adding value to property and making these homes desirable to buyers, especially those that have an interest in sustainability and convenience (Salimitari, Chatterjee and Fallah, 2020).

4. **Blockchain for Transparency and Security**

   The Indian real estate market is also slowly experimenting with blockchain technology to carry out a clear and safe property transfer (Kshetri, 2017). It assists in minimising fraud, makes verification of the clear title easy and accelerates the contract performance by facilitating tamper-proof digital records and smart contracts (Alsmadi *et al.*, 2023).

5. **AI-Enabled Customer Profiling and Lead Scoring**

   The technology allows AI systems to examine customer behaviour and preferences, interaction patterns, to provide a more precise customer profile and help to prioritize high-quality leads. This optimizes the sales forces and enlarges conversion rates by concentrating on the best chances.

6. **Virtual Brokers and Digital Marketplaces**

   Online banks and virtual clearing houses enable buyers and sellers to deal with each other only through online operations without having to rely on conventional intermediaries. These sites offer comprehensive listings, price comparisons and user

reviews, which gives rise to a transparency and trust are created amongst the sites (Martínez-Peláez *et al.*, 2023).

7. **Digital Documentation and E-signatures**

   Due to the need to enhance transaction speed and minimize the level of paperwork, digital documentation and electronic signature services become common. In these technologies, lease agreements, sale deeds and financing documents become easier and the turnaround time decreases along with legal bottlenecks.

8. **AI for Predictive Maintenance and Facility Management**

   Property managers take advantage of predictive maintenance applications with AI, observing structure systems and forecasting quick before breakdowns transpire. This would reduce downtime, the cost of repair and increase the life of the asset, making the operations efficient (Garbuio and Lin, 2018).

9. **Customization and Personalization through AI**

   The implementation of AI algorithms provides an opportunity to recommend the right property and develop individuals basic marketing campaigns based on the demographics and search history of buyers, as well as their preferences. This personalises strategy enhances customer satisfaction and customer engagement (Mishra and Tripathi, 2021).

10. **Training and Upskilling on PropTech**

    Because of the fast penetration of technology, a significant number of real estate companies invest in employee development programs in the field of PropTech tools and digital skills. This fills the skills gap and makes the workforce ready and prepared to work in a technology-driven industry environment (Teo *et al.*, 2021).

1.6 Challenges and Opportunities of Emerging Technologies (AR, VR, and AI) in the Real Estate Sector

Emerging technologies like Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) trends are changing the real estate industry globally. The technologies come with lucrative prospects of transforming customer experience, streamline the operations, and decision-making. They do however have various challenges of integration which the stakeholders would have to overcome to fully enjoy their benefits.

1.6.1 Opportunities

1. **Enhanced Customer Engagement and Experience**

Critical technology As operating tools, AR and VR technologies give highly engaging, interactive property views. Customers have possibilities to view houses and business premises at the virtual level without going there in person which means time and money savings. This is especially beneficial to remote or international customers as well as under situations that restrict access (e.g, pandemics). Further, AI enhances this experience by accumulating preferences of users and making personal recommendations of property which in turn increases customer satisfaction and engagement (Akın Ateş *et al.*, 2022).

2. **Accelerated Sales Cycles and Reduced Costs**

The ability to conduct site walkthroughs virtually with VR minimizes the necessity of visits to the site and makes the decision-making processes faster. Agents and developers can market the under-construction or off-plan projects accordingly, and early buyers and investors are interested. The analytics through AI will also ensure optimisation of pricing frameworks and marketing campaigns, reducing wastage and maximising conversion of sales. Combined these technologies lower the cost of operations and increase profitability.

3. **Improved Operational Efficiency**

AI facilitates automated tasks like lead management, answering the queries of customers, data tracking in documents, and predicting building maintenance. Human resources are allowed to concentrate on strategic activities, eliminate error, and speed up activities. The AR tools help

architects and planners in overlaying designs on material environments to help in managing a better project and collaboration (Worrell, Kermeli and Galitsky, 2013).

4. **Data-Driven Decision Making**

The AI systems are used to interpret a lot of data such as market trend, customer behavior, and economic indicators in order to come up with useful advice. This assists the developers, investors and agents to make quality decisions in relation to property development, pricing and timing of the investments. Risk management and market shift prediction can also be made with the help of predictive analytics.

5. **Innovation in Marketing and Branding**

AR/VR technologies allow innovative branding and different marketing campaigns. The technology-savvy customer and economical customer are majorly being attracted by virtual staging, interactive brochures, immersive open homes to developers, this is a differentiator in their competitive market. nm-driven targeting and selective advertising raise the effectiveness of the campaigns and ROI.

6. **Sustainability and Smart Building Management**

The use AI and IoT sensors in building management enables energy-efficient buildings by helping monitor the use of resources and enhance proper planning of maintenance. This helps in sustainability ambitions and increases with buyers who are environmentally friendly (Casino, Dasaklis and Patsakis, 2019).

1.6.2 Challenges

1. **High Initial Investment and Implementation Costs**

   Hardware, software, and experienced professionals are expensive to invest in to roll out AR, VR and AI technologies. Lack of funding to finance these innovations by the small and middle-sized real estate businesses such as real estate property maintenance companies makes it challenging to take place on a large scale.

2. **Technological Infrastructure and Digital Literacy Gaps**

Poor internet bandwidths, poor existence of high-level digital infrastructure and low digital literacy levels among the customers and the employee impede smooth integration of technology in many emerging markets, such as certain aspects of India. The smooth user experience with the use of AR/VR application may become a tricky task in places with poor connectivity.

3. **Data Privacy and Security Concerns**

AI systems are using individual and transactional data in large quantities. Making sure that the data privacy rules are followed, sensitive information is secure, and that customers trust the quality of services is a critical issue. The violation or abuse of information is susceptible to reputation and legal risks (Ananda, Devesh and Al Lawati, 2020).

4. **Resistance to Change and Skill Shortages**

Conservative nature in real estate industry Historically, the real estate industry has been resistant to new technologies since they are subject to established norms, job security anxiety, and ignorance. Also, there is a lack of expertise in the field that will be able to develop, administer, and use AR, VR, and AI technologies in their prospective environments.

5. **Regulatory and Legal Challenges**

New technologies are in a state of a gray area of regulation, in particular, blockchain and AI-based transactions. There are uncertainties in the form of ambiguous rules that govern the concept of digital contracts and virtual property visits and AI decision-making processes. Laws should also change in order to match the technological developments.

6. **User Experience and Accessibility Issues**

Although AR and VR are immersive, not all users will find the technologies easy to use given the associated cost of the devices, the risks of motion sickness during virtual tours, or the complexity of those devices. One problem is to make these technologies accessible and its usage non-obstructive to the customer base of all kinds.

7. **Integration with Existing Systems**

   Legacy systems are still common in real estate firms with regards to CRM, property management, and accounting. Connection of AR, VR, and AI platforms with the existing infrastructure may be multifaceted, time-consuming, and demanding specialized skills in the field, which is costly.

The potential offered by the emerging technologies such as AR, VR, and AI to change the real estate industry cannot be underestimated as they provide possibilities in terms of customer experience, operation optimization, and the possibility to think and act in more data-driven ways. The innovations may result in shortened cycle times in the sales, cost reduction, and more intelligent and sustainable property management. Nevertheless, there are serious challenges surrounding their implementation involving cost, infrastructure, data security, skills deficit, and regulations that need to be solved before they can realize their full potential.

To be successful in adoption, the stakeholders of real estate must invest strategically in the technology infrastructure, up skill its labour force, create a culture of innovation and work together with technology providers and regulators. With these technologies maturing and stabilizing, they have yet to become an irreplaceable tool that is set to revolutionize the future of real estate both in the world in general and the emerging economy such as that of India.

1.7 The Indian real estate sector's economic role

The Indian real estate industry is central to the overall growth of the country as it has an approximate contribution of 7-8 percent to the Gross Domestic Product (GDP) of the country; a factor that makes the sector one of the strong growth contributors in the economy. This industry serves a large variety of property segments residential, commercial, retail and industrial, all of which are experiencing growing popularity with urbanisation at its peak and the growth in the disposable income level as well as lifestyle preferences (Mohameddhaha, 2023). The industry is of importance not only to direct economic production but also one of the great employment creators because it directly employs an estimated 40 million people in various sectors such as construction labor, architects, real estate agents, property management corporations and other industries which are affiliated to the construction materials such cement, steel, and glass. Real estate multiplying effect goes deeper into the construction of the infrastructure where real estate activities usually lead to the enhancement of transport systems,

utility and water provision, and sanitation systems among others, which help modernize and expand both the urban and semi-urban regions (Amtul Wahab *et al.*, 2024). In addition, transparency, rationalization of practices, and sustainable urban development have been encouraged by government driven projects like Real Estate (Regulation and Development) Act (RERA), affordable housing plans, and Smart Cities Mission, which has resulted in a higher interest of investment by both foreign and institutional investors. This injection of funds has increased the capabilities of the industry in large scale project formation and innovation. Also, the financial industry is encouraged by the real estate market by boosting the demand of home loans, mortgages, and construction advancing lending thus strengthening the banking institutions, housing finance agencies, and equity markets, which has been strengthening the economy. In addition to the economic measures, the industry also contributes considerably to social upliftment since it offers low cost houses and constructs integrated townships with necessary social infrastructure like schools, hospitals and parks (Joshi V. N, 2015). These advancements enhance quality living, comment the congestion of urban sheer growth and give a sense of inclusion. To conclude, Indian real estate is a complex driver of economic and social development and the key to its further expansion will lie in the policies that will have to support the industry, in the technology implementation and the emphasis on the sustainable and client-focused development.

1.2 Research Problem

In spite of the increased importance of this sector as an engine of economic growth and the vastness of the Indian market, the Indian real estate market continues to struggle to address issues that imply slow selling cycles, poor customer interaction, absence of transparency and operational inefficiencies. Recent tech tools such as the use of Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI) have proven to have tremendous potential not just domestically but also around the world to solve such challenges by improving the visualization of the property, the streamlining of the process, and the data-driven decision-making process. The penetration of these technologies in the Indian real estate market is however low and sporadic because of the following factors, which include costs of implementing these technologies (as they are expensive), lack of proper digital infrastructure in place, also there is uncertainty on the regulations and procedures, and finally, a lack of awareness on different stake holders.

The overall perception about the influence of AR, VR, and AI on adopting these technologies into Indian real estate practice, the actual practicability of the impact on such things as customer experience, operational efficiency, and business performance, and the major conditioners hindering their further application are yet to be thoroughly realized. It is this gap in knowledge that the stakeholders of the field, including the developers, agents, policy makers, and technology providers, cannot utilize digital innovations in an effective way to create superior competitiveness and sustainable growth.

Thus, the purpose of this research presents actionable findings that can help real estate companies in India make an informed decision, make strategic investments, and create new policies to drive digital transformation in the sector through a comprehensive analysis of the current trends of adoption, effects, challenges, and opportunities that lie in the implementation of AR, VR, and AI in the real estate sector in India.

1.3 Purpose of Research

Investigation of the implementation of new technologies and their effectiveness, i.e., Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI), in the Indian real estate industry is the main aim of the given research. This paper seeks to understand the changes the technologies are creating in the fields of property marketing, involvement with customers, efficiency in the operations and decision-making in this sector. The research aims at determining the kind of advantages that had been achieved by the stakeholders, due to adoption coupled with the obstacles that have impeded massive adoption through identifying the existing adoption trends. Also, the research seeks to point out the potential these technologies have in the further increase in transparency, the cost cutting, and the overall positive experience of the buyer and investor. The results will provide a helpful piece of information to the real estate developers, agents, investors, policymakers, and technology providers to make conclusions about the use of technology. In the end, the study aims to initiate the digitalization of the real estate business in India, which is associated with sustainable growth and the competitive advantage of entering the markets within the dynamic and challenging new environment.

1.4 Significance of the Study

This research is quite relevant since it touches on the potential transformative role played by the emerging technologies Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI) on the India real estate industry, which is an important economic driving factor in the country. The adoption trends and impacts of these technologies are very important information to various stakeholders such as the developers, real estate agents, investors, policymakers, and technological providers. Looking at the ways in which AR and VR tools improve the property visualization and customer engagement processes, together with the contribution of AI to optimize the operations and make the best possible decisions, the study reveals the potential of increasing efficiency and competitiveness in the context of the traditional fragmented and opaque market.

The results of the organization will assist developers and property firms to plan technology investments and implementation so that they can meet the changing demands of the tech-savvy buyers and investors. The study provides useful information on barriers to the adoption as well as regulatory considerations that need to be made to improve innovation and digital transformation in the sector by policymakers. Technology suppliers will have better insights into the needs and constraints of the market and base the optimization of their solutions to address the Indian setting.

In addition, the research is also advantageous to the field of study, as it fills an existing gap which is the adoption of technology in the real estate market in India, despite global tendencies to support the growing implications of this aspect. Finally, it is through pointing out the advantages, disadvantages, and opportunities of AR, VR, and AI that this research helps in the sustainable growth, exposure of more transparency, and customer satisfaction in the Indian real estate market, leading to a future of digital empowerment.

1.5 Research Questions

- To identify and analyse key factors influencing the adoption and application of AR, VR and AI technologies in the real estate sector.
- To investigate opportunities and challenges using AI and VR & AR in the real estate sector in India.

- To examine the role of augmented reality, virtual reality, and artificial intelligence in improving marketing and sales strategies in the Indian real estate sector.
- To evaluate the potential implications of adopting artificial intelligence and augmented & virtual reality technologies in real estate in India.

Key Terms Included in the Study

1. Augmented Reality (AR)

A technology which superimposes digital information on the real world environment in real time, augmenting the perception of a user over a reality. In the real estate, one can use the AR to see how a property can be transformed or furnished in a real space through products such as smartphones, tablets, etc.

2. Virtual Reality (VR)

An entirely simulated three dimensional setting created on a computer that the user can navigate and navigate through with the aid of special equipment such as VR headsets. Real estate VR allows prospective visitors to do virtual tours of houses in real estate before physically visiting them.

3. Artificial Intelligence (AI)

The mimicking of human intelligence processes by machines, mostly computer systems and learning, reasoning, problem solving and decision making. Predictive analytics, lead scoring, personal interactive marketing, and virtual assistants can be among the AI applications in real estate.

4. Technology Adoption

The act through which organizations or individuals develop the start of using new technologies. This research is devoted to the use of AR, VR, and AI technologies by the Indian real estate companies and how this approach enters their hearings and advertising.

5. Adoption Drivers

The forces that influence or make it easier to adopt and implement the AR, VR, and AI technologies in real estate companies. These are perceived usefulness, top management support, competitive pressure and regulatory incentives.

CHAPTER 2: REVIEW OF LITERATURE

2.1 Theoretical foundations of the Study

Real-estate contexts relating to the adoption of AR, VR, and AI have often been informed by traditions of innovation-driven and information-systems research. Diffusion of Innovations (DOI), on Rogers is useful in explaining ease of adoption (relative advantage, compatibility, complexity, trialability, and observability). It can do this by providing reasons why immersive technology (AR / VR) diffuses disproportionately among developers and brokers(Ronzon *et al.*, 2025). This is further amplified further by Technology Acceptance Model (TAM) that argues that perceived usefulness and ease of use influences the behavioural intention which is relevant in the case of analysing customer facing tools such as virtual tours or AI chatbots. Unified Theory of Acceptance and Use of Technology (UTAUT/UTAUT2) introduces the concepts of social influence and facilitating conditions to shed light on how the practice of peers, expectations of clients, and the preparedness of infrastructure influence uptake. The Technology-Organization-Environment (TOE) framework makes adoption dependent on technological preparation, organizational capacities, and environmental imperatives (e.g. regulation, competition) at the firm level. The Resource-Based View (RBV) and Dynamic Capabilities approaches indicate that the use of AI can be sustained through data resources, analytical skills and skills associated with integrating AI with other capabilities and that regulations (e.g., RERA), professional norms, and strained pressures can help drive convergence around some tools. In the case of experiential tech, theories such as Media Richness and Cognitive Fit explain how immersive visualization may help mitigate the ambiguity of high-involvement purchases and Service-Dominant Logic explains how AR/VR is a form of value co-creation that flips the buyer-seller exchange into an experience creation context instead of an information broadcast(Vanaja and Reethika, 2022).

Real estate empirical studies on AR and VR are unanimous in revealing how salient they are in pre-sale and marketing. Virtual walkthroughs have been reported to decrease spatial uncertainty, provide a greater sense of diagnostic to property information and decrease the decision cycle as compared to 2D floor plans and static images. Use of AR to layer furniture, finishing, or renovation possibilities assists with mental simulation and adds value to confidence in purchasing and a readiness to pay extra to have customization. Studies also observe that immersive media can replace early visits to sites, at least on global buyers or when

they become less mobile, and that they do not completely replace more physical analyses in later stages(Joshi V. N, 2015). The usefulness of AR/VR then depends on content fidelity, interaction fluency, and device availability; the usability research warns that causes of motion sickness, cost of equipment and bandwidth constraint would hamper satisfaction; more so to new users. In the long run, an organization with institutionalized content pipes (3D modeling, BIM integration, photogrammetry) achieves economies of scale in aggregating marketing collateral and in coordinating stakeholders, a phenomenon relevance to TOE and RBV(Raheja and Baijal, 2024).

The real estate AI literature cuts to both front- and back-office applications. The demand-side application can include recommender systems to segment the leads and propensity models that personalize the listing, converting leads and reducing customer acquisition costs. Conversational AI complements service coverage and turnaround with evidence of increased lead qualification rates when chatbots are used to respond to routine requests and to create appointments. On the supply and asset side, machine-learning models are used to value price, predict rent and scoring risks based on micro-location, structural characteristics and macro-indicators; significant gains in accuracy over the traditional hedonic models are often cited, particularly in the context of rich feature sets and temporal dynamics(Mohameddhaha, 2023). Applications in property and facility management include predictive maintenance, energy optimization, and anomaly detection helped by AI that is connected to IoT achieving observable cost-saving in operating costs and downtime. However, risks are also signalled in the literature: model opacity, training-data bias, and shortcomings in governance that complicate explainability and compliance: where the facilitating conditions in UTAUT and the normative pressures in Institutional Theory put into contact with emerging AI ethics frameworks(Sarkar *et al.*, 2020).

In the Indian context, the mode of scholarship is in consonance with those across the globe but has more focus on the structural constraints and the policy implications. Research on digital transformation in the Indian real estate sector has identified heterogeneity in the adoption across Tier-1 metros and Tier-2 / 3 cities due to variation in digital infrastructure, consumer digital literacy and firm resources. Digital marketplace and formalization after RERA have pushed developers into using transparent and information-dense online mediums; 3D tours and AI-enabled lead scoring are being referenced more frequently in urban residential market and grade-A leasing. According to empirical work, AR/VR has been found to be most effective in

off-plan sales, luxury residential and large mixed-use schemes, where there is uncertainty alleviation through visualization, but budget housing would have lower uptake because of price sensitivity and hardware limitations(Al-Ansi *et al.*, 2023). In visual-guided marketing analytics, dynamic pricing, and building operations analytics pilot programs that are in their early-adopter phase (manifested in premium office portfolios), AI sitings are common, particularly as prompted by institutional investors and REIT governance standards(Amtul Wahab *et al.*, 2024).

Approach-wise, the body of research on India varies between survey-anchored TAM/UTAUT experiments and case analysis of developer platforms and proptech deals. Results widely support the contributions to buyer acceptance of perceived usefulness, the service quality and social influence of virtual tours and that an organizational adoption is related to an important top-management support, an IT-business match alignment and vendor ecosystems. Environmental pressures identified in the analyses are central to TOE-based strategic analyses: rivalry differentiation in congested urban submarkets and regulatory pressure to be transparent(Verma, 2025). Barriers are also reported by researchers, however: capital constraints of small and middle-sized developers, lack of compartmentalisation of data, and siloed legacy systems as well as a lack of 3D content and data-science talent. Facility management In the office sector, pilots of AI-managed controls outline energy savings in A-Grade office buildings, but dissemination to strata properties and to commercial buildings owned by SMEs is slow, indices of relative complexity and long payback expectations in governance(Akinleye, 2017).

Customer experience and trust is a specific flow that should be looked at. The perceived transparency is linked to immersive media, but also to metadata (carpet area, compliance status, neighbourhood data) and smooth navigation between on-site verification and the digital tours. The research indicates that the efficacy of the AR/VR is enhanced by the complement used by the standardized disclosures and third-party validations, which is a connection to the coercive and normative power outlined in the Institutional Theory(Crevoisier *et al.*, 2025). With AI, issues about data secrecy and black-box pricing textures the optimism; models based on explicable suggestions, the power to make use of data and human-in-the-loop decisions are recommended to maintain equitableness and responsibility, particularly in light of India data protection laws(Doheir and Mismar, 2024).

In both the field of AR/VR and AI, interaction with Building Information Modelling (BIM) and geospatial data remains an outward-looking topic. It has been reported (within the literature) that incorporating the domain of immersive visualization with BIM will allow the speeding up of design coordination, mitigate change orders and allow the enhanced communicated grasp between the stakeholders, and the combining of AI to geospatial analytics will allow the optimization of site selection, catchment modelling and micro-market projections. The latter corresponds, in its turn, with the joining of AI with IoT in smart buildings, which facilitates continuous commissioning and the enhancement of occupant comfort, which is a rapidly growing research in Indian as green building certifications and ESG reporting are spreading in prominence(Gao *et al.*, 2024).

In spite of substantial progress, a number of gaps remain. Evidence on the financial returns of AR/VR content portfolios and AI deployments is limited in terms of longitudinal performance, and most studies focus on the short-term conversion or engagement. Submarket heterogeneity and biases due to small-sample and metro-centric biases limit generalizability across submarkets associated with India. As well, a relative dearth of studies exist on the topic of organizational change management, how the functions, incentives and control over vendors are balanced to maintain digital capabilities, and the outcomes in both the arena of affordable housing and rental housing(Anand, 2022). Last but not least, biases are mitigated in pricing, inclusivity in immersive interfaces, and auditability can and should be standardized and investigated further in a country-specific context like India.

Altogether, the literature is consistent in its value-implication: AR/VR improves the quality of experience and minimizes information asymmetry in high-stakes property decision-making, whereas AI improves accuracy, associated speed, and scalability of marketing, valuation, and operations. The paradigm-based frameworks (DOI, TAM/UTAUT, TOE, RBV, Institutional Theory) can be used to develop more rigorous conceptualizations to assist in the explanation of variable adaption and performance purposes(Boucher, 2020). In India, formalization led by policy, the maturing proptech ecosystem, and scalable premium asset calibres have seeded the market, but greater diffusion may depend on capability building, data infrastructural compatibility and ethical governance and context-specific business models balancing the benefits of such technologies with cost and inclusivity realities.

2.2. Background of the Study

The implementation of the emerging technologies in the sphere of real estate is commonly discussed with the help of the well-known theoretical concepts of the Technology Acceptance Model (TAM) and the Diffusion of Innovations (DOI) theory. Ease of use and perceived usefulness as the main factors influencing adoption are highlighted in TAM and this practically applies to technologies such as AR/VR and AI that are expected to facilitate the decision-making process and operate using the highest level of customer engagement(Banerjee, 2023). DOI, however, brings out the manner of spread of the innovations along the various levels of adopters and factors like compatibility and trialability. Cumulatively, the above theories offer great platform that would help to explore the rationale and processes of implementing such digital tools by real estate stakeholders in India (Davis, 1989; Rogers, 2003).

In all the research conducted in the international markets, there have been consistent results that augmented and virtual reality enhances buyer experience in terms of involvement, understanding, and security when transacting property. As an example, VR property tours have been reported to reduce sales cycles, bid ask spread and impact purchase desire relative to conventional marketing strategies(Madhavi, 2021). Extended reality application can also enable a potential buyer to pre-screen his or her property and lower transactional costs as well as save on time. This degree of immersive solutions is slowly becoming the new mainstream of residential and commercial marketing, as in doing so, the realtors have the ability to build an engaging experience for the customers whilst increasing their transparency(Rathi and Asava, 2021).

The field of real estate in India has started using the AR/VR technology in showing properties and designing buildings. Industry research indicates that AR/VR is capable of not merely benefitting investors/buyers with realistic visualisations but can also help developers with regards to integration with Building Information Modelling (BIM) in terms of designing and managing the projects. This uptake has been fast-tracked through, and directly following, the COVID-19 pandemic where digital site visits have become a requirement of operations, especially in metro cities where the bulk of large-scale residential projects are built. These applications are also greater in off-plan sales where confidence is a main theme in the Indian pre-launch housing business(Palanivelu and Vasanthi, 2020).

Components of AI that are applied in the real estate market today are property valuation, pricing, and automating transactions. The comparative analyses have shown that machine learning models of valuation are better than traditional hedonic regressions when it comes to utilising nonlinearities in the relationship between the property characteristics and prices. In India AI is also used to perform predictive analytics, a process that improves their ability to forecast market trends, and chatbots and recommendation engines have found their way to property search portals to improve customer interaction(Roundy, 2022). But scholars beware of fairness and algorithmic bias, particularly in heterogeneous markets such as India where language, culture, and income differences can provide disparate buyer experiences.

The use of AI moves past the marketing and sales environment to building operations and sustainability. In the international literature, the AI-based energy management and predictive maintenance systems are discussed as the vital medium when it comes to cutting on operational costs and assisting green buildings(Soni *et al.*, 2020). In India, AI- and IoT-driven smart office buildings and luxury residential projects are now increasingly embracing the possibilities of optimizing HVAC, lighting, and predictive maintenance; this is in line with the intentions of embracing energy efficiency and sustainability on a wider scale. The costs of such advancement are lower, but it also attracts environmentally conscious investors and tenants, which also enhances developers in the competitive landscape(Mishra and Tripathi, 2021).

The content of proptech writing is dominated by AI as a cross-cutting technology that can be used in valuation, customer management, and operations globally; and AR/VR with its focus on user-facing applications, such as property tours and design collaboration. A merger of these technologies is also proposed in Asia, and in particular India, where digital platforms combine visualization which is immersive, analytics and support of the transaction process in the buying of property to ease the property buying process(Anute *et al.*, 2021). It is also noted in reports that regulatory changes that have increased transparency such as RERA are easily supporting digital innovation by normalizing access to data and consumer safeguarding(Jain, 2019).

In spite of the encouraging findings as indicated in the literature, significant research gaps are still evidenced in India. Empirical data is little available (long term) to majorly understand the effect of the AR/VR adoption on the transaction prices generated and buyer satisfaction. In a similar manner, AI-based valuation models in India are limited by the availability of fragmented data and a want of uniform standards of reference. Moreover, though theoretical frameworks such as TAM and DOI can be valuable, not much might have been done especially

to calibrate the models to match Indian consumers that adoption behaviour might be affected by the level of device availability, digital literacy, and culture among others(Enholm *et al.*, 2022). The gaps in the existing studies must be addressed through more intensive and India-specific studies incorporating theoretical views with empirical support.

2.3 Objectives of the study

2.3.1 To identify and analyse key factors influencing the adoption and application of AR, VR and AI technologies in the real estate sector.

Real estate adoption of Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI) has been a subject of wide study using the well-established theories of technology adoption. The Unified Theory of Acceptance and Use of Technology (UTAUT), developed by Venkatesh et al. (2003), and the simplest Technology Acceptance Model (TAM) by Davis (1989) enable us to provide a solid methodology to analyze the impact of perception and adoption of new technologies on individuals and organizations. The perceived usefulness, ease of use, social influence, and facilitating conditions are among the aspects that very much influence adoption levels as dictated by these frameworks. In the case of real estate, those include the ease of utilization of AR/VR applications by realtors, developers, and buyers, the usefulness of AI-powered tools in decision-making, and the availability of supportive infrastructure and ecosystem that can accommodate those(Leitch, 2021).

Across the world, scholars have insisted that the customer experience element is among the greatest impacts in the adoption of technology in real estates. According to Pietro and Sara Pantano (2012), immersive technologies such as AR and VR have been capable of raising the consumer confidence of executing property transactions by exposing them to life-like experiences prior to making the purchase. Equally, AI-powered software, like recommendation systems, predictive pricing, and chatbots, are notorious as enhancing customer relationship with businesses alongside conversion rate in sales(Verma, 2025). Organizationally, Baum (2017) claimed that developers are inspired to implement these technologies to achieve a competitive advantage, distinguish service or products, and comply with the demands of more technologically competent consumers(Liu *et al.*, 2017).

Other researchers have also noted that readiness of organisations and adequate finances are the key factors in adoption. According to the authors, firms with greater technological skills and

access to resources have a better chance of embedding AR/VR in the marketing and sales process, whereas smaller firms are unlikely to achieve this due to low budgeting capabilities (Boulos et al., 2017). The prices of the hardware like the VR headsets and special software are usually also a barrier to adoption, or the high costs of qualified staff. Besides, organizational culture also influences adoption of technology, in that any technology cannot be widely adopted because of the resistance to change within the traditional developer communities(Akinleye, 2017).

These factors have a different dimension in the Indian context as real estate market is complex and hard to reach. KPMG (2022) has indicated that the growing importance of digital literacy, greater internet and smartphone penetration, and the emerging preferences of young, tech-savvy, and smartphone owners have been favorable factors in enhancing adoption of AR/VR and AI in India. Hackers are already realizing that AI-driven analytics and immersive visualization technologies do more than reduce sales cycles they establish trust and transparency in an environment that has long been called opaque. But according to EY (2023), there are still issues related to poor technological setup and uneven regional dispersal, and consistency in regulatory frameworks that create a massive impediment(Al-Ansi *et al.*, 2023).

Moreover, adoption is also determined by cultural attitude and consumer behavior. Physical site visits are the traditional methodology of Indian buyers and although the convenient AR/VR tools attract more customers, they are still considered as an additional accessory to the main mode. Likewise, in India, the process of embracing AI is in certain cases limited by the issue of data privacy, the lack of quality property databases, and diverse rates of trust of automated systems. However, there is a growing enabling environment in the country with government efforts like Digital India, smart city projects and the opportunities that are here to grow these technologies a step further(Dwivedi *et al.*, 2021a).

Collectively, the literature implies that technological, organizational, economic, and cultural factors will co-determine the tendency to adopt AR, VR, and AI in the field of the real estate business. Though this global evidence indicates great potential in terms of improved customer engagement and efficiencies in sales, the case of India is a slightly different one where the dynamics are influenced by the opportunities presented with increasing digital penetration on the one hand and the challenges of infrastructure, cost and cultural receptiveness on the other hand. The insights make the relevance of not only knowing about global best practices but also local realities in order to be able to determine adoption trends.

2.3.2 Objective 2: To investigate opportunities and challenges using AI, VR, and AR in the real estate sector in India.

Opportunities of AR, VR, and AI in Real Estate

The contributor to the transformation of the real estate sector is emerging technologies (i.e. AR, VR, and AI), which alter the way a property is designed, marketed, and sold. Baum (2017) added that AR and VR tools are increasingly used by developers to showcase properties that are not yet finished so that customers can feel the ways that rooms are laid out, what materials they are going to be fitted with, and what the neighbourhood looks like, etc. in the absence of physically going there. This minimizes the day-to-day reliance on conventional models and flyers presenting a more involves and personal shopper experience. Pre-launch sales and under-construction property forming a high part of the market, such tools come in very handy to deliver buyer faith in India(Giuggioli and Pellegrini, 2022a).

The other huge opening is the better customer engagement and decision. Research by Pikkarainen et al. (2018) sheds light on the fact that the use of AR and VR apps makes the selection process of purchasing properties less ambiguous because the potential owner can take virtual tours. The experiences will save time, allow making decisions remotely, and they will attract foreign buyers who will not be able to visit the property in person. In the case of India, whose newly emerging diapora and NRI (Non-Resident Indian) investor market has a huge potential, VR-power social virtual tours are a strategic means to grow its market share(Giuggioli and Pellegrini, 2022b).

Instead, AI solutions have a great potential in the data-related insights. With AI-powered analytics, real estate companies gain access to tools that can help them better estimate the demand in a particular property, as well as optimize pricing and find the appropriate target customer base. Antipov and Pokryshevskaya (2012) have managed to reveal how and by which factors machine learning models are better in predicting housing prices in comparison to the old methods of constructing regressions. An application of predictive AI is to enable developers to deal with volatile prices and unstable demand levels that occur regularly in India. Also, Chatbots and virtual assistants facilitate and automate customer care, making 24/7 communication and query solving possible. Such automation does not only improve efficiency but it also instils confidence in the mind of the more digital-savvy buyers.

Also, a chance of sustainable development actions is offered by AR and VR. These technologies can minimize material and power use and carbon prints through the decreased necessity of physical mock-ups and multiple visits to the location. In construction planning, AI can make energy efficiency, optimization of materials, and waste better(Jo and Kim, 2019). This is in concurrence with India greater sustainability targets in terms of Paris Agreement and Smart Cities Mission which opens up an opportunity so the real estate business emerges as a leader in green and digital transformation.

Lastly, competitive differentiation is possible with the incorporation of such technologies. As Pietro and Pantano (2012) noted, an adoption of immersive and intelligent technologies could make a firm more perceived to be innovative, which can affect the brand positioning positively. Technological innovation can be used as a differentiation and sustainable loyalty drivers in the highly fragmented Indian real estate market, where trust command is still an issue over its consumers(Dwivedi *et al.*, 2021b).

Challenges of AR, VR, and AI in Real Estate

Opportunities can be described as immense; however, there are a number of challenges that limit the use of AR, VR, and AI in the Indian real estate industry. High implementation cost is the foremost one. The cost of VR headsets, augmented-reality capabilities on mobile applications, and data analytics systems using artificial intelligence are very resource-intensive. As Boulos et al. (2017) acknowledged, the attractiveness of small and medium-sized real estate developers tends to lag behind other firms due to the lack of appropriate resources to rationalize the investment rate. This cost barrier is especially critical in India where developers have relatively low margins and have to deal with liquidity concerns(Doheir and Mismar, 2024).

A second issue has to do with readiness and the technological infrastructure. To operate, immersive technologies such as AR and VR require fast internet connection, access to cloud-based storage, and computing devices. Besides adopting rapid advances in digital connectivity, coverage areas that lack in bandwidth quality like semi-urban and rural India are hampering the extensive use of it. In the same way, implementing the use of AI needs the availability of huge amounts of structured data. Nevertheless, the Indian property market struggles with the lack of consistency and unification of the data that compromises the quality of AI-based discoveries(Soni, 2023).

Resistance to change on the part of the consumer and the developer is another obstacle. The Indian real estate market follows a relationship-based business practice, where the customers place importance on face-to-face meetings and personal visits of the property before the purchase decision. Sharma (2021) emphasized that the convenience of AR/VR tools gives them the status of complementary rather than replaceable. On the developer-side, digital illiteracy and reluctance to abandon old patterns also are adoption barriers.

There are also regulative and ethical issues which also complicate the use of technology. AI relies on human and monetary information, and this increases the fear about data security and privacy. The lack of strong legislation in data protection in India where data protection frameworks are developing can cause a lack of trust among buyers. Likewise, application of AI-based automated recommendation products may bring up concerns of algorithm bias, transparency, and accountability. On the intellectual property front, the aspect of digital models and digital content protection that is part and parcel of AR and VR, also has an under-representation in the Indian legal scenario.

Furthermore, it has skill manpower related difficulties. Firms need specialized staff capable of designing, developing and maintaining AR/VR systems and artificial intelligence (AI) in order to support the implementation and maintenance of AR/VR systems and AI solutions. Boulos et al. (2017) also considered that the lack of qualified individuals usually becomes an adoption bottleneck in young markets. The same is with India where the housing market which has always leaned on its civil engineering and construction skills is yet to be fully equipped to embrace digital and IT skills(Gupta *et al.*, 2024).

Lastly, there is relevance of trust and cultural acceptance. A lot of Indian consumers continue to use tangibles strongly, including the sense of touch of materials or the use of neighborhood visits. This tendency of certain cultures to validate the physical world is a stumbling block to the overall acceptance of the altogether virtual tools. In a similar vein, the disjointed Indian property market, which has a massive share of unsystematic players, will ensure that not all developers can guarantee the same level of technological services and this can cause a loss of consumer confidence.

The literature review highlights the fact that AR, VR, and AI have tremendous transformational capabilities in the real estate sector in India by driving transformation in marketing, sales, customer interaction, operational productivity, and sustainability. Nevertheless, issues of cost,

infrastructure, presence of data, regulatory regimes, cultural acceptance and lack of skills restrain popularization. Researches across the world show that planning investment, favourable regulations, and robust digital ecosystems are critical in successful integration. In India, industry accounts (KPMG, 2022; EY, 2023) indicate that adoption is and still remains focussed on the top tier developers in urban centres and the smaller developers have not caught up.

Thus, the opportunities and the challenges should not be interpreted as a set of independent processes, but as mutually dependent cycles. Although opportunities present avenues of growth and differentiation, the challenges give rise to the importance of systemic solutions like policies, creation of digital infrastructures as well as the industry-academia partnerships to develop talent pipelines. The coupling of these opportunities with the barriers will play off on the pace and magnitude of permeation of AR, VR, and AI, in Indian real estate(Kariapper *et al.*, 2020).

2.3.4 Objective 3: To explore the role of AI, AR, and VR in improving marketing and sales strategies in India's real estate sector.

AI in Real Estate Marketing and Sales

Artificial Intelligence (AI) has come out as one of the key technologies in revolutionizing marketing and sales in the real estate sector. Researchers have emphasized its features to process vast amounts of data and provide operative data with which to optimize decision-making, targeting customers and campaign optimisation. AI-driven analytics in India, where the real estate market is extremely fragmented and customers have diverging needs, allows developers to segment buyers according to their income, preferences and lifestyle choices. Such accuracy marketing means that developers are able to tailor offers to certain buyer segments in a way that is most likely to lead to a conversion(Renz and Hilbig, 2020).

Predictive selling models are improved using AI as well. The machine learning algorithms will be able to predict demand, most appropriate pricing strategies and the best time to launch property by using past record of property transactions, demography and even market patterns. Tan and Tse (2018) found out that with the help of AI-enabled systems, buyers sentiment and pricing trends are easily detected compared to human judgment. In India, where prices vary

widely across geographies, the predictive models of AI give competitive advantage as the developers can place projects at a better position(Roundy, 2022).

Moreover, AI-driven chatbots and virtual assistants have entered the flow of sales. According to research done by Gentsch (2018), AI enhances customer experience as customers can get all the answers to questions instantly, schedule visits to the sites, and be advised on the amenities that suit their current needs. In the case of India, where customer service inefficiency is a discouraging factor to prospective purchasers, the tools are transparent and receptive. Moreover, the recommendation algorithms developed with the help of AI resemble those employed in e-commerce and enable buyers to find the properties that should correspond to their interests, contributing to reducing the time spent on the decision-making process.

AR and VR in Real Estate Marketing and Sales

AR and VR are effective marketing tools and of use especially in displaying under-construction properties and even those properties yet to be launched. Baum (2017) pointed out that with the help of immersive technologies, the customer experience is enhanced with such offerings as virtual walkthroughs, when the buyer has the opportunities to view the layouts, the interiors, and the surrounding landscapes without having to visit the locations in their flesh. AR and VR are also useful in reducing dependence on inert brochures and scale models emulating the future development in India, where much of developer cash-flow is through pre-sales.

VR tours present new opportunities to international and outstation buyers in that they allow them to explore properties without traveling to do so. The studies conducted by Pikkarainen et al. (2018) proved that immersive experiences diminished buyer uncertainty and gave confidence in high value decisions of making investments remotely. Since the Indian population consists of a large number of Non-Resident Indians (NRI), VR provides a rare opportunity to hit the pitch to the investors outside India and this strategy can help them make purchasing decisions without any necessity of travelling. Not just that it multiplies the number of buyers, it also enhances the level of transactions(Enholm *et al.*, 2022).

AR has also made changes to marketing campaigns because it allows interactive ads. AR-enabled apps will allow developers to help prospective customers see how furniture, interior design, and color schemes they select would look in a new house. Earlier studies by Javornik (2016) mentioned that interactive experiences create excellent memories and boost engagement

of customers and brand remembrances. AR-based personalization provides an effective method of distinguishing projects and generating buyer attachment to properties, which can be appropriate in India where inter-developer competition is high.

Further, immersive tech solves the trust and transparency issues in the Indian real estate. Institutionalized sale methods also depended upon insufficient information and thus it raised suspicions amongst consumers. AR and VR use realistic, 3D-based tours and clear digital information to ensure that, on the one hand, the trust gap between developers and customers is bridged. This is an especially valuable trust-building factor in the history of India where there is a history of project stalls and litigation in the property market.

Integration of AI, AR, and VR for Enhanced Strategies

The combination of AI with AR and VR technology results in the most considerable innovations in the sphere of marketing and sales. AI will be able to understand buyer preferences and make personalized suggestions towards the use of AR/VR that will solve the problem of property tours being standard to all buyers. Research conducted by Pietro and Pantano (2012) concluded that personalization combined with the participatory immersive visualization can make conversion rates surge. The ability to draw the audience with immersive content in a traditional Indian market is complemented in this integration to convert the interest into real sales via customized and data-driven experiences.

As one example, the AI algorithms will be able to monitor the behaviour of buyers at the virtual tours e.g. dwelling times in certain rooms or preferences related to certain layouts and feed the information back to the developers who can benefit by using this data to tailor marketing concepts. With this closed feedback loop, it is possible to achieve continuous campaign design improvement and high probability of conversion. In a similar vein, the emotional aspects of customer interactions can be spotted via VR tours applied alongside AI-driven sentiment analysis and used by the sales team to alter the approach in accordance with the identified issues and drivers.

Omnichannel marketing strategies can be facilitated with the help of AR and AI as well. Indian developers are increasingly turning to online resources such as social media, mobile application and websites to reach buyers with the advent of digital platforms. AR-enhanced advertising together with a targeting that relies on AI delivers a 360-degree customer experience, where

potential customers will see similar and personal experiences across all the touch-points. Such a strategy can be explained by the trend of experiential marketing that becomes increasingly global since customer engagement is based on valuable interactions rather than one-way communication.

Challenges in Adoption of AI, AR, and VR for Marketing and Sales

Although there are obvious advantages, India appears to have a number of hindrances that limit the implementation of these technologies in a marketing and sales strategy. Cost of implementation is the first impediment. Digital infrastructures, such as AI-driven analytics platform, AR/VR applications, are costly. Boulos et al. (2017) noted that with clear moves towards intensifying competition in the industry, even smaller-developers are not always able to justify such costs, especially in the context of highly competitive markets.

The other challenge is the digitally prepared consumers. Digital literacy is not homogenous, even though the smartphone user base in India is one of the fastest growing globally. The efficiency of AI- and VR-assisted campaigns can be restricted by the fact that many buyers still stick to the traditional way of engaging with them, like meeting up and negotiating face to face. On the same note, the use of immersive technologies demands fast internet and stable devices, which, in their turn, lack homogeneity in different regions of the country.

There are also privacy and trust issues when using data. AI-based personalisation relies on the gathering of high amounts of personal and financial information. In a state where data protection regulatory frameworks are still in an infant state the homework buyers may find it difficult to divulge sensitive information. In the case of AR/VR, authenticity of the content and standardization is still a problem and customers often wonder whether the outcomes presented in the digital world is similar to what happens in the real world.

Moreover, the adoption may be slowed by sales personnel resistance. In such a scenario, many real estate sales agents often have to use traditional relationship-building skills and thus may consider technological tools as replacements and not as an addition to the skills. According to research conducted by Baum (2017), the efficiency of human and technological capacity integrations and training are the key factors determining the success of digital selling efforts. Maintaining this cultural and professional transition in India is yet a burning issue.

The literature shows that the use of AI, AR, and VR has the revolutionary potential of enhancing marketing and promotions strategies in real estate. AI delivers personalization, predictive analytics and conversational support driven by data, and AR/ VR support interactive, transparent experiences that are immersive to buyers. Collectively, the technologies have created multifold benefits of increasing customer engagement, trust and conversion rates which brings a competitive edge to developers in the highly fragmented Indian market.

Yet, the cost, digital preparedness, data security and change resistance are inhibiting adoption. Studies indicate that although the large, well capitalised developers in metro cities have embarked on integrating the given technologies, smaller developers record high entry barriers. AI, AR and VR are not fully embraced yet to realize their potential; systemic changes must be made (improving the infrastructure, regulation, educating the consumers and training sales professionals).

Therefore, AI, AR and VR in marketing and sales is not simply the implementation of tools but the reinvention of customer engagement model in the Indian real estate industry. When properly intertwined, the technologies have the potential to induce increased trust, efficiency, and inclusiveness in one of the most important industries in the country.

2.3.5 Objective 4: To evaluate the potential implications of adopting artificial intelligence and augmented & virtual reality technologies in real estate in India.

There is more to the adoption of Artificial Intelligence (AI), Augmented Reality (AR), and Virtual Reality (VR) in the real estate trade than amplifying the efficiency to the operations and engaging with the customers but the adoption's implication sets a new tone to the future of the real estate industry, its contribution to the economy, and sustainability visions. Literature also shows that changing marketing and selling in the industry, technology adoption can be seen as the introduction to the structural change in the way the industry runs changing decision making levels, employment rates, regulations and competitiveness. The implications are observable on numerous levels-economic, organizational, consumer-centric and socio-technical.

Economically, scholars emphasis that the involvement of AR, VR, and AI has the potential of increasing revenue flow in the housing industry to a large extent. McKinsey (2021) counts investment returns on AI-driven predictive analysis that will allow accurate pricing models,

whereas AR and VR will help cut marketing expenses as it is possible to conduct virtual tours of the property and 3D modelling to avoid costly physical showrooms. In the world, immersive visualization conversion has reduced the sales cycle and increased its customer base especially buyers located in overseas markets. In India, this has the potential of widening the base of investors, particularly those that comprise the NRI (Non-Resident Indian) investor segment, which tends to resort to online virtual tours and use of AI-ranked property suggestions and preferences before making investments. So the economic application is not only cost optimization, but the growth of the markets and diversification of proceeds.

The implication of introducing these technologies to organization are equally important. AIs like chatbots, CRMs, and predictive lead scoring redefine the way property companies communicate with customers: the transactional approach of communication yielded to data-driven and relationship-building. AR/VR also changes project management, and collaboration on design, by allowing architects, developers, and clients to jointly experience immersive co-design processes. In the Indian scenario, this would help in the communication glitch between the developers and the homebuyers which has always been an area of suspicion. Nevertheless, research findings warn that the changes require organizational restructuring, reskilling of workforce, and deployment of capital which means that reluctant firms might be left behind.

Consumer side of the implications are profound in terms of the factors of decision-making, trust, and satisfaction. In India, buyers can experience problems of information asymmetry, delay of project completion and disclosure failure. AR and VR contribute to solving these problems by providing clear and engaging experiences- allowing potential customers to view floor plans, community amenities, and personalization among other things even when they are not physically present. AI also promotes the level of customization since algorithms may suggest the properties that match the financial background of a person, their lifestyle, and preferences. This means that the resulting effect will be stronger purchaser control, boosting decision making capability, and hence enhanced satisfaction and thus a possible increase in brand loyalty by the developers. Nevertheless, researchers also report that trusting automated suggestions too much can diminish the quality of human contact, and it can even disengage some of the buyer because they are used to personal service.

Regulatory and policy implications of adoption of the technologies in India are also covered in emerging literature. The use of AI algorithms in pricing and predictive analytics allows the process to become more transparent in a sector that some find unreliable due to a lack of

accountability. This is also in line with the expectations of the Real Estate (Regulation and Development) Act (RERA) whose main aim is to safeguard consumers and harmonize practices. But some problems include data privacy, risks of cybersecurity and absence of legal framework to support immersive transactions. The policymakers should thus be willing to adjust the regulations in order to embrace the ethical and legal aspects of using technology. The point that it tries to make is that although AR, VR, and AI usage are capable of enhancing compliance and accountability, it would require the evolution of regulations and data governance strategies.

Socio-technical repercussions of technology absorption can be seen in employment and development of skills. Whereas some processes are automated by AI and immersive technologies and may no longer require marketing or sales workers, the revolution introduces new work positions in other areas, including AR/VR content development, AI model training, and proptech innovation. Conversion will in turn require the reskilling and upskilling of the workforce in India where real estate is a large source of employment and traditional job functions can become obsolete. The possibilities of capacity building as well as knowledge transfer through integrating AR/VR in real estate professional education and training also create new possibilities. Therefore, it implies that the sector is moving toward technology-based workforce and digital literacy is required in the industry.

The sustainability and enviro consequences is another dimension. The environmental impact of real estate has been questioned, and an application of AR/VR use in this case would enable access to virtual site tours to limit footprint against travel emissions. AI augments the operations of smart buildings whose management is facilitated by ensuring energy optimization, predictive maintenance, and efficient utilization of resources. In India where sustainability is a problem currently because of massive urbanization, the implementation of these technologies would be able to play a part in supporting greener more sustainable development practices. This does not only imply the degree to which one is efficient in their operations but aligning with the global sustainability concerns like the United Nations Sustainable Development Goals (SDGs).

Along with all these positive implications, potential risks that were outlined by literature exist as well. Its huge reliance on technology also brings about issues pertaining to digital exclusion where minor developers or consumers of lesser technological consciousness might be excluded in reaping the fruits. Moreover, biases in property suggestions or pricing systems may be

strengthened through the use of AI algorithms not accompanied with transparency, thus bringing about unwanted inequality. Therefore, it is evident that, besides being mainly positive, the implications of the adoption of AI, AR, and VR may require an ethical, inclusive, and responsible adoption approach as highlighted by scholars.

According to the literature, the implementation of AI, AR and VR in Indian real estate has consequences as wide-ranging as economical, organizational, consumer, regulatory, workforce, and sustainability. The advantages (more efficiency, more transparency, and consumer empowerment) should be mentioned along with such challenges as the displacement of the workforce, adjustment of the regulation, and digital inequality. Those implications are therefore radical and intricate making it a balancing act of maximizing opportunities and at the same time minimizing the risks.

2.4 Research Gap

Even though a lot of research has been undertaken internationally on the possible applications of Artificial Intelligence (AI), Augmented Reality (AR), and Virtual Reality (VR) in different sectors what is not clear is the adoption and implications of the same in the Indian real estate market. The vast majority of the current research is dedicated to these technologies as applied to the developed markets, where the digital infrastructure is better developed, consumers possess more awareness and the regulatory system is more sophisticated. Yet, the Indian real estate sector offers a certain differentiating piece of context given information asymmetry, complexities of regulations and affordability, as well as variability in consumer behaviour meaning local know-how will be demanded. Such a gap in context-specific research provides a gap in the research on how tasks can be successfully adopted and utilize AR, VR and AI in India.

Moreover, the existing literature does not focus on the strategic, cultural, and economic impact of AR, VR, and AI in the developing markets, in favour of technical implications (e.g., immersive visualization, predictive analytics, automation, etc.). There is a limited literature critically examining the opportunities and challenges of adoption like infrastructure preparedness, cost bottlenecks, regulatory loop holes and digital literacy especially in the Indian landscape. This portrays a knowledge gap that looks beyond the technological

expectations and into the readiness of real estate firms to accept such innovations in terms of the socio-economic and organizational realities facing them.

The other research gap is that of the consumer-centric perspective. Although international literature has underscored the importance of AR and VR in customer connection and credibility, there is little analysis that has been conducted on how the Indian customers who are highly sensitive to cost and family decision making, as well as risk aversion react to and are reacting to the technology. There is a sizable gap in the Indian context, which awaits research into the behaviour of consumer adoption, satisfaction, and the mechanism of enhancing the trust-building process through AR/VR experiences which is the focus of this proposed research.

Also, as AI continues to personalize and make smart investment decisions alongside its application on property recommendations, few research papers analyze the medium-term effects of a wide-reaching AI uptake in the real estate sector, especially in India. Ethical use of data, privacy, and skilling workforce can be regarded as issues that have not been studied sufficiently in past research studies. There is a dire need to deal with these gaps so that adoption of AI, AR, and VR becomes sustainable and inclusive in the Indian market.

Overall, although the topicality of proptech and digital transformation in the real estate industry is increasing, research gaps still remain in areas such as context-specific factors of adoption, consumer behaviour analysis, business preparedness, regulatory issues, as well as in socio-economic consequences in the long run. With this study, it is hoped that the various gaps will be filled since robust understanding based on empirical evidence will be gained on the adoption, opportunities, challenges and implications of AR, VR and AI within the Indian realty market which can be of theoretical and practical contribution to the literature.

Chapter III: METHODOLOGY

3.1 Overview of Research Problem

In spite of the increased importance of this sector as an engine of economic growth and the vastness of the Indian market, the Indian real estate market continues to struggle to address issues that imply slow selling cycles, poor customer interaction, absence of transparency and operational inefficiencies. Recent tech tools such as the use of Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI) have proven to have tremendous potential not just domestically but also around the world to solve such challenges by improving the visualization of the property, the streamlining of the process, and the data-driven decision-making process. The penetration of these technologies in the Indian real estate market is however low and sporadic because of the following factors, which include costs of implementing these technologies (as they are expensive), lack of proper digital infrastructure in place, also there is uncertainty on the regulations and procedures, and finally, a lack of awareness on different stake holders.

The overall perception about the influence of AR, VR, and AI on adopting these technologies into Indian real estate practice, the actual practicability of the impact on such things as customer experience, operational efficiency, and business performance, and the major conditioners hindering their further application are yet to be thoroughly realized. It is this gap in knowledge that the stakeholders of the field, including the developers, agents, policy makers, and technology providers, cannot utilize digital innovations in an effective way to create superior competitiveness and sustainable growth.

Thus, the purpose of this research presents actionable findings that can help real estate companies in India make an informed decision, make strategic investments, and create new policies to drive digital transformation in the sector through a comprehensive analysis of the current trends of adoption, effects, challenges, and opportunities that lie in the implementation of AR, VR, and AI in the real estate sector in India.

3.2 Operationalizing the theoretical constructs

To empirically test the major adoption of Augmented Reality (AR) and Virtual Reality (VR) and the effects of Artificial Intelligence (AI), the theoretical concepts that were identified to adopt the use of the Technology Organization Environment (TOE) framework,

the Unified Theory of Acceptance and Use of Technology (UTAUT2), and the perspectives on the AI capabilities should be translated to measurable indicators. This is done because a concept like performance expectancy, or trust has to be made operational, meaning that the unobservable concept is turned into an observable form and measured by a defined survey or interview instrument. The constructs have been clearly defined in terms of their occurrence in the real estate industry and then connected with workable items that mirror organizational acts, minds or impacts.

Technologically speaking, performance expectancy and effort expectancy are the main constructs. Performance expectancy is operationalized as satisfaction with the belief that AR/VR will increase marketing and sales, customer relations and will be a source of competitive differentiation. It is something that can be quantified by the extent the real estate companies feel as a result of the use of the virtual tours or immersive estate demonstrations, there is easier conversion of customers and a better satisfaction of this audience. Likewise, effort expectancy is converted into beliefs about the ease or the difficulty with which they can acquire and employ AR/VR tools. Measures here will be the capability of the employees and customers to operate immersive technologies without the need of being trained on it and whether the platforms are thought of as being user friendly and simple. One more associated construct would be called compatibility and is operationalized as the compatibility of AR/VR with the current business model and digital infrastructures, when the companies assess whether these advanced technologies can be incorporated into the prevailing sales and marketing workflows and fit well there.

Adoption is also determined by organizational aspects. Top management support is operationalized as the extent to which top management are committed to the investment and adoption of AR/VR and AI. This is manifested in how top management set aside budgets, encourage training and support adding digital transformation as a top priority. The IT and analytics ability is measured by the availability of skilled personnel and technical competence to install, run and derive worth of the AR/VR and AI platforms. Organizational readiness, however is brought out in terms of preparedness in the domains of finance, culture and structure i.e. the readiness to adopt new technologies, the availability of resources and the willingness to modulate workflows. The constructs render the organizational drivers of conduction to be measurable in the real estate companies.

The environmental aspect which is based on the TOE framework is also operationalized into practical variables. Competitive pressure is manifested by the feeling of the necessity to use AR/VR since competitors already do so or due to the necessity of the market. This may be realized in terms of the sense of urgency by the managers to not lose their competitive advantage due to the knowledge of the industry trends. Another construct that becomes measurable is vendor ecosystem maturity by measuring the availability and reliability of AR/VR and AI based services in India with respect to support that GoI can seek. Equally, regulatory support is operationalized as how policies by the government like those of RERA (Real Estate Regulatory Authority) requirement on transparency motivates or compels organizations to digitalize in marketing, transactions and the service to customers.

Another theoretical layer of this research study is trust and privacy issues. The concept of trust is operationalized by the degree of confidence by real estate companies and their consumers in the accuracy and reliability of property representations using AR/VR and AI-based recommendation. It indicates the perceptions of stakeholders that the digital experience really reflects reality and that AI insights can be relied upon. Privacy issues, in their turn, are reflected in terms of apprehension level towards the process of collection, storage, and usage of customer data in the AR/VR environment and personalization through the AI system. This includes the assessment of the fear of surveillance, abuse of the personal information and secrecy in data practices.

As AI is also a key interest of the study, its maturity of capability is also operationalized into constructs. The quality of data is determined by the perception of real estate companies that they are in possession of real, current and valid datasets to be used to train AI models. The example of personalization is the capacity of AI to customize the property offers or set a virtual tour according to the needs of a particular buyer. Using AI to forecast the demand, price trends and investment potential falls under predictive analytics, whereas, to gauge automation, it is measured with AI chatbots, lead scoring, and segmenting customers. The metrics can be used to determine how sophisticated the application of AI is in real estate.

Lastly, operationalization of dependent outcomes of adoption will be done to determine impact. The measures of intention to adopt AR/V technologies by real estate firms are based on their willingness to plan and adopt AR/VR technologies, whereas the real usage accounts for the adoption of these tools to the current level of sales and marketing activities.

Marketing performance would be operationalized in the form of the increase in lead generation, ROI, and campaign effectiveness, whereas the sales efficiency is operationalized in the form of the shortened deals closing time, a better conversion rate, and customer acquisition time. Customer perceptions translate into the levels of satisfaction through immersing property touring and individual AI-related services and their interpretation on how the end-users observe value in such innovations.

The operationalization of these constructs into measurable indicators of the study helps in providing a connection between theory and practice. It permits developing a systematic data collection on quantitative data using structured tools, which will permit statistical interpretation of the reasons impacting adoption, as well as the resultant impacts in the Indian real estate scenario. This will not only provide theoretical rigor but also provide practical relevance since the operational definitions ideally net out challenges, motives, and effects that are realized by firms and customers in the industry.

3.3 Research Purpose

Investigation of the implementation of new technologies and their effectiveness, i.e., Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI), in the Indian real estate industry is the main aim of the given research. This paper seeks to understand the changes the technologies are creating in the fields of property marketing, involvement with customers, efficiency in the operations and decision-making in this sector. The research aims at determining the kind of advantages that had been achieved by the stakeholders, due to adoption coupled with the obstacles that have impeded massive adoption through identifying the existing adoption trends. Also, the research seeks to point out the potential these technologies have in the further increase in transparency, the cost cutting, and the overall positive experience of the buyer and investor. The results will provide a helpful piece of information to the real estate developers, agents, investors, policymakers, and technology providers to make conclusions about the use of technology. In the end, the study aims to initiate the digitalization of the real estate business in India, which is associated with sustainable growth and the competitive advantage of entering the markets within the dynamic and challenging new environment.

3.3.1. Research Questions

- To identify and analyse key factors influencing the adoption and application of AR, VR and AI technologies in the real estate sector.
- To investigate opportunities and challenges using AI and VR & AR in the real estate sector in India.
- To examine the role of augmented reality, virtual reality, and artificial intelligence in improving marketing and sales strategies in the Indian real estate sector.
- To evaluate the potential implications of adopting artificial intelligence and augmented & virtual reality technologies in real estate in India.

3.3.2. Hypothesis of the study

- **H01:** There are no significant key factors influencing the adoption and application of AR, VR and AI technologies in the real estate sector.
- **Ha1:** There are significant key factors influencing the adoption and application of AR, VR and AI technologies in the real estate sector.
- **H02:** There are no significant opportunities and challenges using AI and VR & AR in the real estate sector in India.
- **Ha2:** There are significant opportunities and challenges using AI and VR & AR in the real estate sector in India.
- **H03:** There are no significant role of augmented reality, virtual reality, and artificial intelligence in improving marketing and sales strategies in the Indian real estate sector.
- **Ha3:** There are significant role of augmented reality, virtual reality, and artificial intelligence in improving marketing and sales strategies in the Indian real estate sector.
- **H04:** There are no significant potential implications of adopting artificial intelligence and augmented & virtual reality technologies in real estate in India.
- **Ha4:** There are significant potential implications of adopting artificial intelligence and augmented & virtual reality technologies in real estate in India.

3.4 Research Design

The research endeavour employs a quantitative research method with a descriptive and exploratory approach to the adoption of the Augmented Reality (AR), Virtual Reality (VR), and the influence of Artificial Intelligence (AI) in the real estate in India. The data will be gathered by keeping a standard questionnaire to the buyers of real estate homes in large cities in India. Technology Organization Environment (TOE) framework, as well as UTAUT2 model, constructs, will be operationalized by converting them into measurable variables. Through statistical tools like Mean, Standard Deviation, Correlation, Regression, ANOVA, T test, Chi-square test, Exploratory Factor Analysis (EFA) relationships between adoption factors, AI integration, and their effect on the performance of marketing will be explored.

3.4.1 Population and Sample

(i) Population or Universe: - The respondents for this research are the buyers from cities (Bangalore, Hyderabad, and Chennai) in India. So, Bangalore, Hyderabad, and Chennai are universe for this study.

(ii) Sampling technique: - This study will be carried out in the Bangalore, Hyderabad, and Chennai. The study pattern will be of randomly selected sample using **purposive sampling technique** within the population selected.

(iii) Sample size: - The explored target is to **600 samples** tentatively from area of the population in the present study. **Total Population of buyers of Real Estate in three cities of India: 205622.**

Determining the sample size using **Cochran's formula**:

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{e^2 + \left(\frac{Z^2 \cdot p \cdot (1-p)}{N}\right)}$$

Where:

- $Z = 1.96$ (Z-score for a 95% confidence level)
- $p = 0.5$ (assumed proportion)
- $e = 0.05$ (margin of error)

N= 2,05,622

The sample size is approximately **384**. For existing study, the sample size is decided **600** as more the sample size more will be conclusive and accurate results.

S.No	Name of City	Total population of Buyers in Real Estate	Source	Number of respondents selected for data collection
1.	Bangalore	136,702	https://economictimes.indiatimes.com/industry/services/property-/-cstruction/housing-sale-dip-by-23-in-q4-fy25-report/articleshow/119375258.cms?from=mdr	200
2.	Hyderabad	54,000	https://www.hindustantimes.com/real-estate/hyderabad-records-over-54-000-home-sales-worth-more-than-rs-33-000-crore-so-far-in-2024-report-101726820086955.html	200
3.	Chennai	14,920	https://www.thehindu.com/real-estate/tamil-nadu-real-estate-construction-building-properties/article68867210.ece	200
Total		2,05,622		600

Table 3. 1 Population in cities Hyderabad, Bangalore, Chennai

3.4.2 Participant Selection

The existing study selected **real estate buyers from** cities of Bangalore, Hyderabad, and Chennai in India.

3.4.3 Instrumentation

For quantitative analysis Statistical Package for Social Sciences (SPSS) software version 23.0 used.

3.4.4 Data Collection Procedures

Questionnaire design: Self-constructed questionnaire will be developed, pretested and applied in collecting the necessary data to solve the research issue. The questionnaire shall utilize a 5-point Likert scale which is deemed suitable in this study since it aids in collecting observable and measurable quantitative data that may be analyzed using statistics. The study also strives to identify and assign a qualitative relationship between the set of variables presented.

3.4.5 Sources of data

(i) Primary Data: As the exploratory research this paper undertakes depends on the gathering of primary source material related to the world of real estate in Bangalore, Hyderabad, and Chennai. The structured questionnaire method will be used in collecting primary data.

(ii) Secondary Data: A variety of published and unpublished sources will be used to acquire secondary data such as research studies (theses, dissertations, etc.), books, journals, magazines, government reports, brochures, periodicals, conference proceedings, and reputable internet sources. A thorough literature review was carried out, which allowed designating the pertinent variables, comprehending the issues of the contemporary world and conceptual clarity.

3.5 Tools and techniques of data analysis

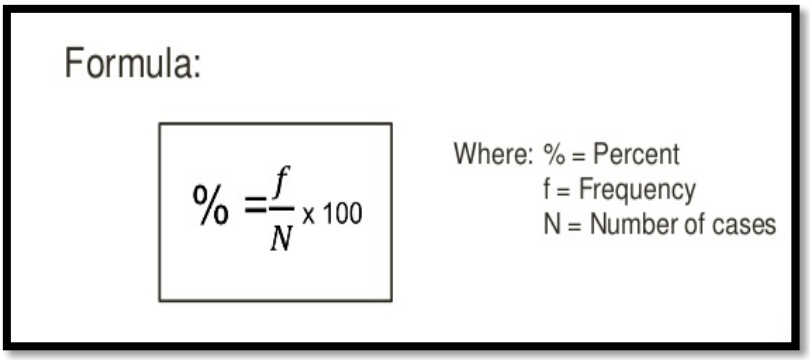
The information obtained by the surveys will be organized formally and analyzed with the help of SPSS 23.0. This software preconditions accuracy and reliability of the information and structure the results and present it in a proper manner so that the efficient dissection of the collected data will not seem problematic or solid.

3.5.1 Details of Tools applied in data analysis

Frequency and percentage Method:

Frequency and Percentage Method is one of the most common descriptive statistical tools used in social science and market research reports. It assist in classifying and condensing material volumes of data into simple and understandable form.

- **Frequency** refers to the number of times a particular response, value, or category appears in the dataset. It shows how often a variable or characteristic occurs. For instance, if 120 respondents out of 300 prefer investing in real estate, then the frequency of this response is 120.
- **Percentage** represents this frequency as a proportion of the total number of responses, expressed in terms of 100. It is calculated using the formula:



1. Mean:

Arithmetic average, also referred to as the Mean, is probably the most popular of all statistical measures of central tendency. It is the average value of a line of data or describes the middle or the normal value of all the observations made.

$$\text{Mean} = \frac{\text{Sum of All Data Points}}{\text{Number of Data Points}}$$

$$\text{Mean} = \text{Assumed Mean} + \frac{\text{Sum of All Deviations}}{\text{Number of Data Points}}$$

2. Standard Deviation

Standard Deviation (SD) is a very significant statistical measure of dispersion. When viewing the summary of a dataset on any table of contents page, the mean tells you the average value of the dataset, but the standard deviation can tell you the extent to which the values of the data are different or are distributed back and forth around the mean.

$$\sigma = \sqrt{\frac{\sum [x - \bar{x}]^2}{n}}$$

σ = standard deviation

$\sum$ = sum of

x = each value in the data set

$\bar{x}$ = mean of all values in the data set

n = number of value in the data set

3. T test

T-test is a statistical test to be utilized in determining whether there is any significant difference between the average of two groups of things. It is more preferable when the sample size is small and that the standard deviation of the population is unknown. The purpose of the t-test is

to enable the researcher to determine whether a difference which is noticed in the statistical data is real (significant) or it just a chance thing.

Type	T-statistic	Degrees of freedom
One-sample t-test	$t = \frac{\overline{x} - \mu_0}{s/\sqrt{n}}$	df = n – 1
Paired t-test	$t = \frac{\overline{X}_D - \mu_0}{s_D/\sqrt{n}}.$	df = n – 1

4. Chi-square Test

Chi-Square Test Chi-Square Test (o, test) is a non-parametric statistical test applied to find out whether there is significant relationship between two categorical variables or whether the observed distribution of data varies with expected or not. It is commonly used in the examined research with surveys in which the responses are known in categories (e.g. gender, city, occupation, preferences). The formula of Chi-square is as follows:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

X^2= The test static

$\sum$= The sum of

O= Observed frequency

E= Expected frequency

5. Correlation Analysis

Correlation analysis is a methodological measure of the strength and direction of the correlation between two or more variables statistical A test statistic assists in establishing a correlation between variables. It enables a researcher to realize if variations in one variable relate to variations in another.

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[\, n\Sigma x^2 - (\Sigma x)^2 \,][\, n\Sigma y^2 - (\Sigma y)^2 \,]}}$$

.

6. Regression Analysis

Regression analysis is an energy-packed statistic tool employed to explore the interconnection of consequence and causes of one outcome (dependent) and one or more predictive factors (independent). It does not only give an understanding of the strength of the relationship it can also be used in predicting the dependent variable given a change in the independent variable**.**

$$Y = a + bX$$

$$b = \frac{N\sum XY - (\sum X)(\sum Y)}{N\sum X^2 - (\sum X)^2} \qquad a = \frac{\sum Y - b\sum X}{N}$$

Where,
N = number of observations, or years
X = a year index (decade)
Y = population size for given census years

7. ANOVA

A test that can be applied in analysis to know whether there are significant differences between the mean of three or more groups is called analysis of variance (ANOVA). Where t-test involves only comparing the mean of two groups only, ANOVA takes this to a wider variable involving multiple groups, thus very applicable in studies utilizing surveys and experiments.

8. Exploratory Factor Analysis:

Exploratory Factor Analysis (EFA) is a statistical tool that assumes a multivariate technique to provide the structure or structure of the large number of variables available. It assists in categorizing variables to smaller groups known as factors, and they are presented as common dimensions. EFA is can also come in handy in survey-based research where it can help to cut down data complexity and support the validity of the constructs under investigation.

3.6 Limitations of the Study

- The study is restricted only to the selected real estate buyers from cities (Bangalore, Hyderabad, and Chennai).
- The study is based on the sample survey method, hence only 600 employees at cities (Bangalore, Hyderabad, and Chennai) are covered under the study.
- The major part of the fieldwork was done on real estate industry. Other industries can also be explored.

3.7 Conclusion

The methodology of study used in this paper offers a methodology to examine the adoption of AR, VR, and AI and their effect in the Indian real estate industry in an orderly manner. The study can achieve this by using both primary and secondary data to complete the picture, i.e. about technological integration, challenges and opportunities. This is due to the ability to gain a deeper understanding of stakeholder opinion, customer behaviour and the behaviour of the industry by using both quantitative and qualitative research techniques. The specified methodological framework is not just to increase reliability and validity of the findings but also to make sure that the study deals with its goals properly and can contribute something valuable to the academic community, professionals, and policy-makers in the real estate field.

Chapter IV: RESULTS

4.1 Distribution of various categories of responses

Age wise distribution	Frequency	Percentage
Below 25 years	100	16.67%
26 to 35 years	198	33%
36 to 45 years	185	30.83%
Above 45 years	117	19.50%

Table 4. 1 Age wise distribution of population

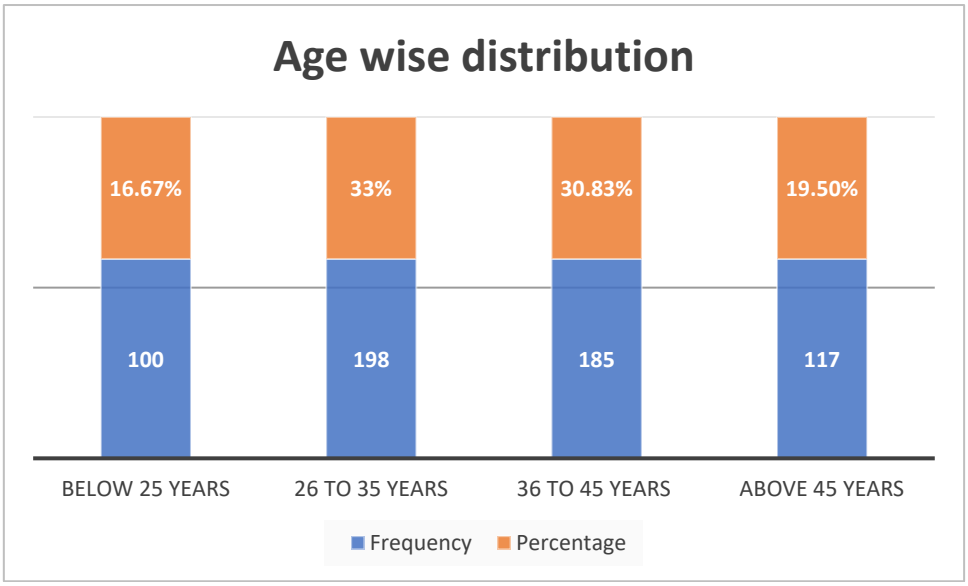


Figure 4. 1 Age wise distribution of population

The age profile shows that the highest concentration of the respondents is in the group aged 26-35 years, which covers 33 percent of the whole sample. This means that most participants belong to the younger working generation who are, by and large, regarded as being more tech-savvy and receptive than older generations in society are to embracing emerging technologies like Augmented Reality (AR), Virtual Reality (VR), and Artificial intelligence (AI) in the

property business realm. The most significant number is the 36 years to 45 years segment that comprises 30.83% followed by those who are above 45 years (19.50%), as well as below 25 years (16.67%). This is a healthy proportion of younger and middle-aged professionals and the distribution suggests that the inputs will provide a diverse range of views and opinions on the criteria that could make the Indian real estate sector a prime area of technological adoption. The high percentage in the respondent's group aged 26 to 45 years (63.83 combined) implies that the major contribution to make decisions on matters relating to property will be made by working professionals who are probable decision-makers or influencers.

Gender	Frequency	Percentage
Male	496	82.67%
Female	104	17.33%

Table 4. 2 Gender wise distribution of population

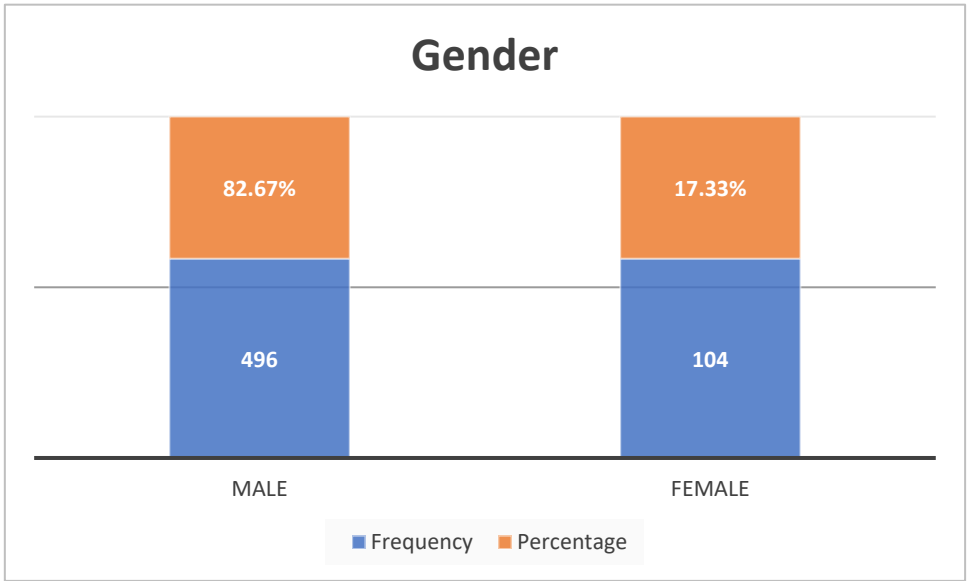


Figure 4. 2 Gender wise distribution of population

Regarding gender balance of respondents, there is a major bias to the male respondents who comprise 82.67 percent of the sample size with female respondents making 17.33 percent. Unable to concur with such proportionality, this shows how the Indian real estate market is rather driven by men, especially in the fields of decision-making and technology adoption. This finding is not different with the industry, which has male dominant areas in real estate development, marketing and implementation of technology. Nevertheless, the fact that 17.33% respondents were women is not neglectable, since it allows us to get the idea of gender-based differences in perception of the AR, VR, and AI technologies. These variations would impact on the formulation of strategic suggestions regarding user experience design and the pitch used by different genders.

Marital Status	Frequency	Percentage
Single	113	18.83%
Married	393	65.50%
Others	94	15.67%

Table 4. 3 Martial status wise distribution of population

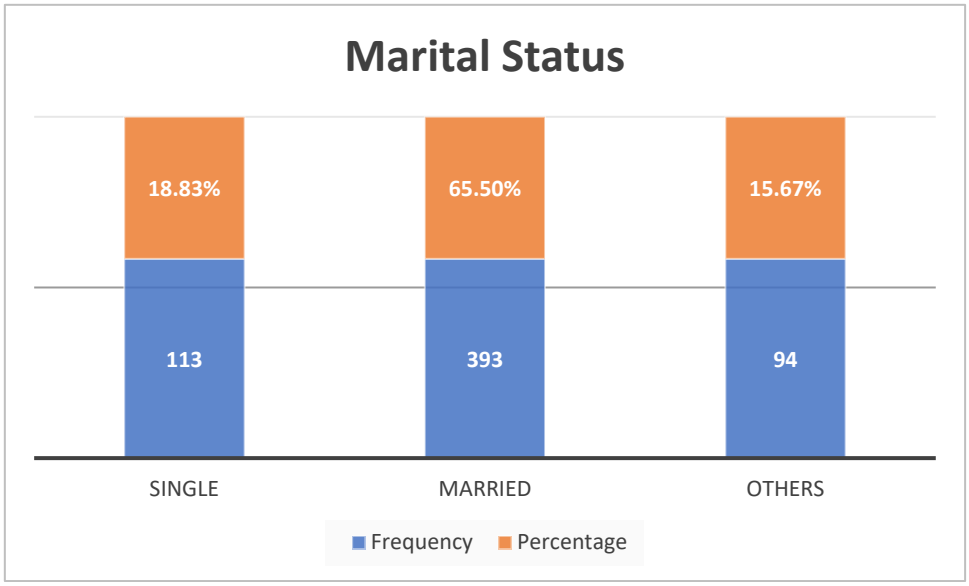


Figure 4. 3 Martial wise distribution of population

Marital status distribution reveals that the largest percentage of respondents is married (65.50%), second is the category of single respondents (18.83%) and finally the other category (15.67%). This signifies that the survey mostly reflects people who have a family and may have more financial control that can determine their attitude toward investments in the real estate sector and the use of technologies. Married respondents tend to be linked with long term investment choices, such as buying homes, and this factor may precondition them to technologies like AR and VR that can help with property imaging and approval of purchases. On the other hand, singular respondents (18.83%) and others (15.67%) may be more open to novel ideas in technology, like the use of technology to market and transact in the real estate industry since younger people and non-conventional family setup tend to be more open to digital advancements in the industry.

Educational Qualification	Frequency	Percentage
Below Graduate	62	10.33%
Graduate	312	52%
Post Graduate	203	33.83%
Above Post Graduate	23	3.83%

Table 4. 4 Education qualification wise distribution of population

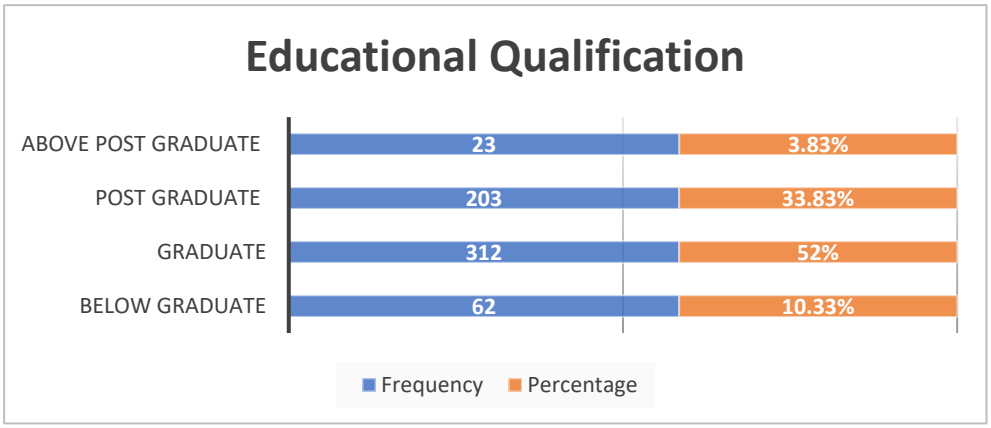


Figure 4. 4 Educational qualification wise distribution of population

As regards the education level of respondents, most of them are graduates (52%), followed by postgraduates (33.83%). Respondents with below graduation level constitute 10.33% and those above the postgraduate level are only 3.83 percent. This distribution implies that the target population mostly consists of people with high levels of academic socialization, which can play a big role in defining their awareness and adoption of new technologies in the real estate industry; Augmented Reality (AR), virtual reality (VR), and artificial intelligence (AI). Technological literacy and positive attitudes toward innovation are common features related to higher education, and this permit suggesting that the sample is best-positioned to assess the advantages and complications of the use of these technologies in the marketing and operation of the real estate.

Monthly Income (in Rs.)	**Frequency**	**Percentage**
Below 50,000	55	9.16%
50,001 to 100,000	202	33.67%
100,001 to 150,000	243	40.50%
Above 150,000	100	16.67%

Table 4. 5 Monthly income wise distribution of population

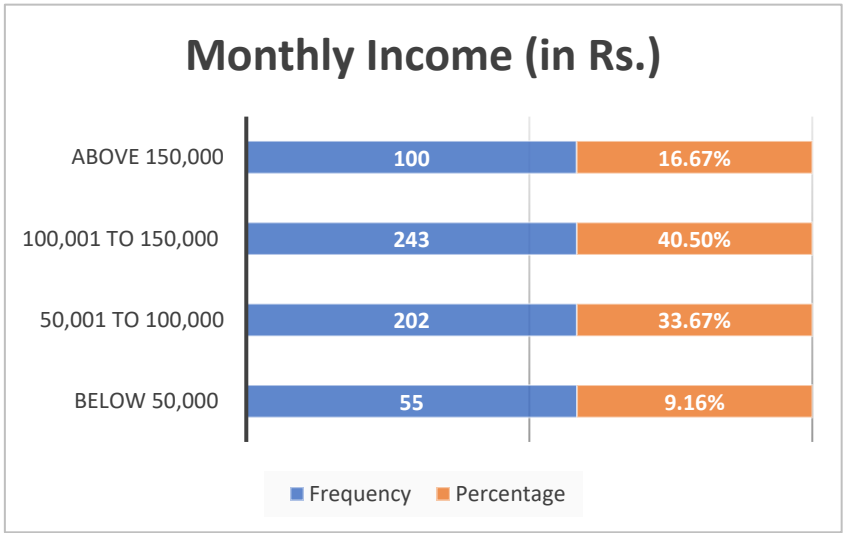


Figure 4. 5 Monthly income wise distribution of population

The distribution of monthly income shows that, 40.50 percent of the respondents earn between 1000001 and 150000 inclusive. The distributions are followed by the range of between ĐANG read more independence to 100,000 (33.67%), 16.67 percent earning above 150,000, and 9.16 percent below 50,000. This trend means that the high percentage of respondents are of middle-income and upper-income statistics, which is also coherent with the previous demographic data of the target group of the real estate investment and the use of technology-based solutions, including AR, VR, and AI. The respondents with a higher-income will consider premium real estate destinations as well as have a preference regarding immersive technologies such as AR/VR to have a virtual tour of the property along with AI-based suggestions. Moreover, such population age can afford to buy real estate and implement advanced marketing strategies within the real estate market.

Type of Family	Frequency	Percentage
Nuclear Family	502	83.67%
Joint Family	98	16.33%

Table 4. 6 Family type wise distribution of population

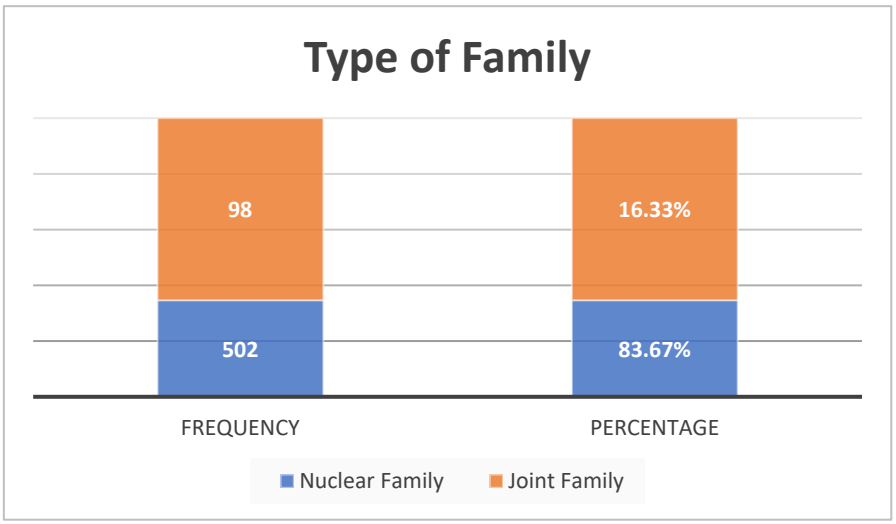


Figure 4. 6 Family type wise distribution of population

The family analysis reveals that a vast majority of the respondents fall in the category of nuclear family (83.67 %) whereas 16.33 percent of the respondents conformed to the joint family. This shows that there is a higher number of small family units in the respondents, and this is true with the trend of urban and semi-urban housing in India where nuclear families are taking hold. This element of the population has a repercussion on property preferences and the adoption of technologies. Employees of nuclear families usually want to have weightless and modern accommodation and will be more willing to embrace the use of digital technology like AR, VR, and AI in appraising properties. In addition, personalization based on artificial intelligence and the use of property tours on the Internet can be effective with this segment since they support the priority of convenience and efficiency.

Size (no. of persons in your family)	Frequency	Percentage
2	211	35.16%
3 to 6	203	33.83%
6 to 9	89	14.83%
More than 9	97	16.16%

Table 4. 7 Family size distribution of population

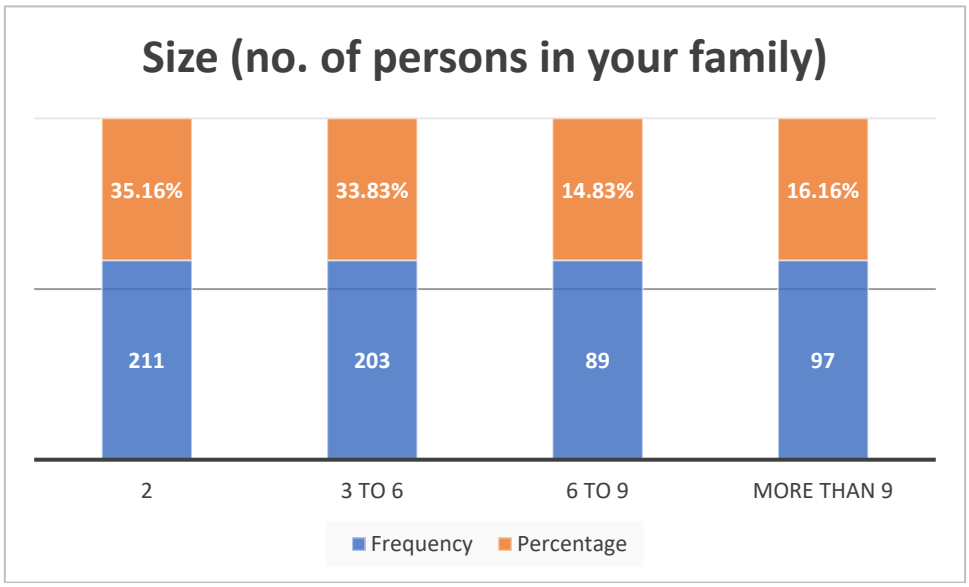


Figure 4. 7 Family size distribution of population

Family size distribution shows that the 35.16 percent of the respondents live in a household of two members, this is closely followed by 33.83 percent in a 3-to-6-member household. Bigger family units consisting of 6 to 9 people total 14.83 percent, and a sizeable number of respondents (16.16 percent) live in families above 9 people Large family units were 8.6 percent; the number of respondents leading M-S-F was even higher, 20.59 percent Smaller familial size has an additional consequence of favouring smaller housing units, sleek-looking new apartments, and digital options to facilitate property search, including AR and VR tours of the property. By contrast, bigger families (over 6 family members) might want larger homes; the use of AR/VR can be beneficial in having a look at floor plans and space before making the final decision.

Property Type Interested In	Frequency	Percentage
Residential (Apartment/House)	287	47.83%
Commercial	116	19.33%
Plot/Land	104	17.33%
Other	93	15.50%

Table 4. 8 Property type distribution

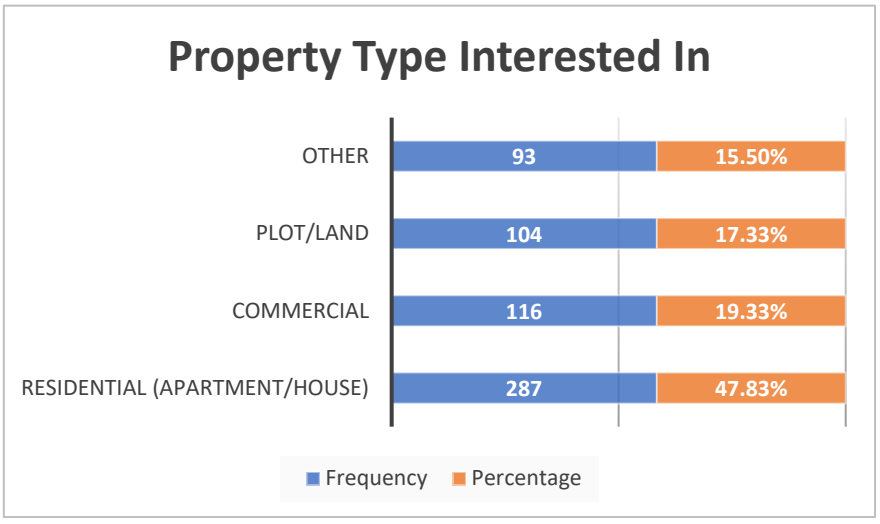


Figure 4. 8 Property type distribution

The property preference distribution has the residential properties (apartments or houses) with majority of respondents (47.83 %). This is obvious on the increased demand in housing in the urban and semi-urban settings. The attractiveness of commercial property is seen through 19.33 percent of respondents, and 17.33 percent in plots/ land. A smaller percentage (15.50) was interested in other property types, which may include mixed-use spaces, or industrial ones. This development indicates that housing market in India is very residential-based with a significant interest in the commercial investment, especially amongst the respondents with higher income. The prevailing importance of the residential property interest also dictates that AR and VR technologies are going to be instrumental in virtual home tours, floor plan visualization, and personalized recommendations whereas AI-based analytics will have a chance to further enrich the buying experience by tailoring customer preferences with available properties.

PART-B

4.2 Statistical analysis of AR, VR & AI technologies in real estate

Reliability Statistics	
Cronbach's Alpha	N of Items
.794	7

Table 4. 9 Reliability statistics for multiple sources

Reliability analysis in cases with adopting the AR, VR, and AI technologies in the real estate industry was carried out in order to measure consistency of the scale items. The computed Cronbach's Alpha is 0.794 on 7 items, thus exceeding the acceptable recommended level of 0.70. This shows that the scale shows satisfactory internal consistency, and this implies that the items that will be used in the study are reliable in the measurement of the underlying concept.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Websites/portals of real estates	600	1	5	4.19	.818
Realtors' real property agents/brokers	600	1	5	3.89	.907
social media	600	1	5	4.05	.871
Builder / developer sites	600	1	5	4.00	.905
Serviced property exhibition/fair	600	1	5	3.53	1.114
Word of mouth	600	1	5	4.39	.728
Newspaper/magazine ads	600	1	5	4.25	.782
Valid N (listwise)	600				

Table 4. 10 Descriptive statistics for multiple sources

Information about the preferred sources of real estate information can also be discovered with the help of the descriptive statistics. Word of mouth (M = 4.39, SD = 0.728) is the most relied source on average followed by newspaper/magazine ads (M = 4.25, SD = 0.782) and websites/portals of real estates (M = 4.19, SD = 0.818). Other high usage includes social media (M = 4.05, SD = 0.871) and builder/developer sites (M = 4.00, SD = 0.905), the conclusions are that there is an increasing role of digital platforms when it comes to making property decisions. The least preferred means of searching information about the property is the serviced property exhibitions/ fairs (M = 3.53, SD = 1.114) and property agents/brokers (M = 3.89, SD = 0.907), Realtors, which may be attributed to the convenience of use illustrated by online sources and virtual property tours. The standard deviations show moderate variability in answers with serviced property exhibitions/fairs delivering the highest variability (SD = 1.114), implying there could have been varied experiences or some people may not have had access to the exhibitions/fairs. Collectively, these results emphasize the fact that people move toward online and accessible sources of information, and it confirms the appropriateness of the inclusion of AR, VR, and ai technologies to further the process of searching and assessing the properties in India.

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Websites/portals of real estates	600	4.19	.818	.033
Realtors' real property agents/brokers	600	3.89	.907	.037
social media	600	4.05	.871	.036
Builder / developer sites	600	4.00	.905	.037
Serviced property exhibition/fair	600	3.53	1.114	.045
Word of mouth	600	4.39	.728	.030
Newspaper/magazine ads	600	4.25	.782	.032

Table 4. 11 One sample statistics for multiple sources

The discussion on the preferred real estate sources of information by the respondents shows that there is a marked pattern of utilization. The word of mouth was identified as most influential among all sources with an average score of 4.39 and the standard error of 0.030 showing the high dependence on the personal recommendation in relation to the decisions made concerning properties. The types of media most frequently used were the traditional such as advertisement in newspaper and magazines (M = 4.25, SE = 0.032), as well as the digital ones, like web sites and portals of real estates (M = 4.19, SE = 0.033), which indicates the persisting importance of both traditional and online sources. The use of social media (M = 4.05, SE = 0.036), builder/developer websites (M = 4.00, SE = 0.037), and digital marketing (M = 4.00, SE = 0.037) were relatively well utilized, indicating the increase in the use of digital marketing in communicating with potential buyers. Although the mean of realtors/property agents is a little lower (M = 3.89, SE = 0.037) they too are the channel through which a certified legal professional may facilitate a property transaction. On the other hand, the serviced property exhibitions and fairs is the least popular source (M = 3.53, SE = 0.045) implying that physically shows are not convenient or easily accessible to a majority of respondents. The small standard errors we find in all of the sources of information show a high level of reliability of these estimates and it can be noted that the trends observed may be confirmed to be the ones in the wider population. On the whole, these insights highlight the possibility of introducing Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI) technology into the digital and traditional realms because an improvement in the property marketing process becomes possible with the help of immersive technologies that can reinforce the effect of the process and allow delivering reliable recommendations with regard to the property purchase.

One-Sample Test						
	Test Value = 0					
	t	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Websites/portals of real estates	125.324	599	.000	4.187	4.12	4.25
Realtors' real property agents/brokers	105.102	599	.000	3.893	3.82	3.97

social media	114.007	599	.000	4.053	3.98	4.12
Builder / developer sites	108.087	599	.000	3.995	3.92	4.07
Serviced property exhibition/fair	77.693	599	.000	3.533	3.44	3.62
Word of mouth	147.494	599	.000	4.390	4.33	4.45
Newspaper/magazine ads	132.821	599	.000	4.253	4.19	4.32

Table 4. 12 One sample test for multiple sources of marketing

One-sample t-test was used to ascertain that there is a significant difference between the actual score of the various real estate information sources and a construction value of zero. According to the results, all the sources are also significantly used by the respondents ($p < 0.001$). Word of mouth received the highest mean score of 4.39 ($t = 147.494$, $df = 597$, 95 percent CI [4.33, 4.45]), demonstrating its potent effect on decision-making of properties. This was combined with newspaper/magazine ($M = 4.25$, $t = 132.821$, $df = 596$, 95% CI [4.19, 4.32]) and online media/portals of real estates ($M = 4.19$, $t = 125.324$, $df = 599$, 95% CI [4.12, 4.25]) as channels to real estate information, demonstrating the role of both traditional and online media sources in real.

Significant engagement was also noted on social media ($M = 4.05$, $t = 114.007$, $df = 599$, 95% CI [3.98, 4.12]) and builder/developer sites ($M = 4.00$, $t = 108.087$, $df = 599$, 95% CI [3.92, 4.07]) which highlights the increased utility of digital channels in promotion of properties. Relative consultation and utilization ranks were established with realtors and property agents ($M = 3.89$, $t = 105.102$, $df = 599$, 95% CI [3.82, 3.97]), services property exhibition and fairs ($M = 3.53$, $t = 77.693$, $df = 599$, 95% CI [3.44, 3.62]) ranking lower as the physically-based events, and the property exhibition.

These findings show that real estate respondents' resort to the abundant use of sources of information when making purchasing decisions. The confidence intervals also reveal that the means of the populations of all sources are far above the neutral value and this supports the view that digital platforms, traditional media, and personal recommendations are critical in the

buyer behaviour fashioning. This only emphasizes that it is reasonable to introduce AR, VR, and AI technologies in these channels in order to improve the property viewing process and make informed decisions.

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Websites/portals of real estates	Between Groups	34.060	4	8.515	13.837	.000
	Within Groups	364.302	592	.615		
	Total	398.362	596			
Realtors real property agents/brokers	Between Groups	51.787	4	12.947	17.462	.000
	Within Groups	438.916	592	.741		
	Total	490.704	596			
social media	Between Groups	54.974	4	13.744	20.421	.000
	Within Groups	398.416	592	.673		
	Total	453.390	596			
Builder / developer sites	Between Groups	62.583	4	15.646	21.775	.000
	Within Groups	425.357	592	.719		
	Total	487.940	596			
Serviced property exhibition/fair	Between Groups	115.803	4	28.951	27.519	.000
	Within Groups	622.810	592	1.052		
	Total	738.613	596			
Word of mouth	Between Groups	50.726	4	12.681	28.317	.000
	Within Groups	265.117	592	.448		
	Total	315.843	596			

Newspaper/magazine ads	Between Groups	106.626	4	26.657	61.063	.000
	Within Groups	257.559	590	.437		
	Total	364.185	594			

Table 4. 13 Anova statics for multiple sources

The independent variables in the study were the type of multiple sources that a respondent could use to access real estate information. A one-way ANOVA was used to test the null hypothesis as the research interest was to determine whether there was a significant difference across groups in the use of various multiple sources by the respondents to access real estate information. The results indicate that there are also significant differences among all the sources ($p < 0.001$). Namely, the websites/portals of real estates displayed high chi-square values ($F = 13.837$, $p = 0.000$), showing that online portal of real estates are used by different segments of the respondents. Likewise, realtors/property agents ($F = 17.462$, $p = 0.000$) and social media ($F = 20.421$, $p = 0.000$) showed statistically significant differences in utilization meaning that demographics or behavioral factors drive the use of these mediums.

Developer websites ($F = 21.775$, $p = 0.000$) and serviced property exhibitions/fairs ($F = 27.519$, $p = 0.000$) also had significant group differences, showing that acceptance of these tools also differs greatly between respondents. The highest F-values were found in word of mouth ($F = 28.317$, $p = 0.000$) and newspaper/magazine advertisements ($F = 61.063$, $p = 0.000$) representing variability in reliance with different respondent groups.

This evidence indicates that such demographic variables as age, income, education, and property type interest can be important determinants of information sources selection. The differences among the categories of the target audience are large, which proves the necessity of categorizing the target audience when developing marketing plans in real estate. Furthermore, the findings support the potential usefulness of integrating the AR, VR, and AI technologies, as the latter enables addressing different tastes of individuals pertaining to different groups, thus, leading to increased engagement and due diligence that goes into property purchase.

Reliability Statistics	
Cronbach's Alpha	N of Items
0.844	10

Table 4. 14 Reliability statistics for factors that influence choice

The reliability test was administered in order to determine the internal reliability of the 10 items measuring the variables relating to adoption of AR, VR, and AI in the real estate sector. The calculated Cronbach Alpha is 0.844 that is higher than the accepted value of 0.70, thus there is high internal consistency. It affirms that the items are dependable and have been identical in all cases, as well as in measuring the underlying constructs inoculating the integrity of the data gathered to be used in further analysis. The improved Cronbach Alpha between the current 10-item scale and the previous 7-item one (0.794) indicates that the original scales were lacking two items that could further test reliability as a measurement tool to measure perceptions, usage and attitudes of the target respondents regarding emerging technologies in the Indian real estate sector.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Location and neighbourhood	600	1	5	4.19	.765
Price and payments	600	1	5	4.26	.710
Builder reputation	600	1	5	4.39	.644
Amenities	600	1	5	4.36	.678
Future resale value	600	1	5	4.23	.748
Virtual property tours	600	1	5	4.23	.698
VR/AR Interactive floor plans	600	1	5	4.19	.825

Intelligent property suggestions	600	1	5	3.97	.942
Sustainability/green features	600	1	5	3.75	1.065
Availability of loan / finance	600	1	5	4.19	.818
Valid N (listwise)	600				

Table 4. 15 Descriptive statistics for factors that influence choice

The descriptive statistics of the major factors that will affect the decision to purchase real estate and the technology adoption point to some crucial insights. The builder reputation (M = 4.39, SD = 0.644) and amenities (M = 4.36, SD = 0.678) achieved highest mean scores which means that these are considered to be of great importance by respondents. The importance of the price and payment, future value of the property, and virtual tours of the property were also highly ranked (M = 4.26, SD = 0.710; M = 4.23, SD = 0.748; M = 4.23, SD = 0.698), showing the recently increasing interest in digital instruments to assess property value and financial aspects related to the real estate investment.

Other technologies voters grasped a high degree of adoption, including VR/AR interactive floor plans (M = 4.19, SD = 0.825) and intelligent property suggestions powered by AI (M = 3.97, SD = 0.942), which implies that voters are open to immersive solutions and those that use artificial intelligence to improve their property search and visualization actions. Such aspects as sustainability/green features obtained a low mean (M= 3.75, SD = 1.065), which may reflect greater importance of the other decision-making factors. Easy access to a loan/finance options (M = 4.19, SD = 0.818) is another practical factor that counts in affecting purchase decisions.

On the whole, this data indicates that despite the traditional determinants such as the reputation of a builder, the offered amenities, price, and location, there is a significant willingness among respondents to incorporate the AR, VR, and AI into their search and decision-making approaches to property. The moderate standard deviations explain that there exists certain variability in tastes implying that, developers and marketers need to customize technology-driven experiences among buyers of various segments.

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Location and neighbourhood	600	4.18	.765	.031
Price and payments	600	4.26	.710	.029
Builder reputation	600	4.39	.644	.026
Amenities	600	4.36	.678	.028
Future resale value	600	4.23	.748	.031
Virtual property tours	600	4.23	.698	.028
VR/AR Interactive floor plans	600	4.19	.825	.034
Intelligent property suggestions	600	3.97	.942	.038
Sustainability/green features	600	3.75	1.065	.043
Availability of loan / finance	600	4.19	.818	.033

Table 4. 16 One sample statistics for factors that influence choice

According to the one-sample statistics of factors that influence choices of real estate and adoption of technology, it is identified that the mean scores achieved by all the items are quite high and significantly larger than the measure of neutrality in the middle, implying strong agreement by respondents. Reputation of the developer was ranked top with an average of 4.39 (SE = 0.026), and amenities 4.36 (SE = 0.028) demonstrating that developable people and quality amenities are very crucial in the property selection. The future resale value (M = 4.23, SE = 0.031), price and payments (M = 4.26, SE = 0.029), and visualization ability through virtual property tours (M = 4.23, SE = 0.028) also ranked highly indicating the usefulness of fiscal factors and online visualization in the decision-making process.

New technologies like VR/AR interactive floor plans (M = 4.19, SE = 0.034) and intelligent AI-driven property suggestions (M = 3.97, SE = 0.038) received moderate/high values, which

implies that respondents can accept immersive and AI-based interventions to assess the properties. Location and neighbourhood (M = 4.18, SE = 0.031) and loan and finance options (M = 4.19, SE = 0.033) highlight practical considerations in decision-making further, whereas sustainability/green features received a slightly lower mean (M = 3.75, SE = 0.043), again highlighting awareness but not so much of higher preference.

According to the small standard errors of the whole factors, these estimates are consistent with the population means and confirm that the respondents appreciate an integrated set of the traditional property characteristics and new technology-based services. These results support the idea of the combined application of the AR and VR and AI technology to the real estate marketing and property estimation, which can become the basis of the informative yet enjoyable experiences of the potential buyer.

One-Sample Test						
	Test Value = 0					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Location and neighbourhood	134.018	599	.000	4.185	4.12	4.25
Price and payments	146.790	599	.000	4.255	4.20	4.31
Builder reputation	166.882	599	.000	4.388	4.34	4.44
Amenities	157.306	599	.000	4.357	4.30	4.41
Future resale value	138.590	599	.000	4.233	4.17	4.29
Virtual property tours	148.415	599	.000	4.228	4.17	4.28
VR/AR Interactive floor plans	124.351	599	.000	4.188	4.12	4.25
Intelligent property suggestions	103.165	599	.000	3.967	3.89	4.04
Sustainability/green features	86.237	599	.000	3.748	3.66	3.83

Availability of loan / finance	125.324	599	.000	4.187	4.12	4.25

Table 4. 17 One sample test for factors that influence choice

The minor standard errors of the estimates across all the factors reveal that there is reliability in the estimates of the population means, thus demonstrating that respondents are systematically interested in a mixture of traditional property features and newer technology-driven solutions. To ascertain the results, a one-sample t-test is chosen to analyze if there is a significant difference between the mean scores of the different factors affecting the real estate choices and adoption of technology and the test value of 0. The findings reveal that all the factors are extreme significant ($p < 0.001$) hence reflecting that respondents do not ignore these factors in property decisions. The developer reputation ranked the highest mean of 4.39 ($t = 166.882$, $df = 599$, 95% CI [4.34, 4.44]) followed by amenities ($M= 4.36$, $t = -157.306$, $df = 599$, 95% CI [4.30, 4.41]) which indicates that there is a critical importance of both developer credibility and facility offerings. The price and payments ($M = 4.26$, $t = 146.790$, $df = 599$, 95% CI [4.20, 4.31]), future resale value ($M = 4.23$, $t = 138.590$, $df = 599$, 95% CI [4.17, 4.29]), and virtual property tours ($M = 4.23$, $t = 148.415$, $df = 599$

The new technologies such as VR/AR interactive floorplans ($M = 4.19$, $t = 124.351$, $df = 599$, 95% CI [4.12, 4.25]) and intelligent, AI-driven property suggestions ($M = 3.97$, $t = 103.165$, $df = 599$, 95% CI [3.89, 4.04]) are fairly and highly accepted, as the respondents are open to innovative, technology- Better location and neighbourhood ($M = 4.19$, $t = 134.018$, $df = 599$, 95% CI [4.12, 4.25]) and access to loan/finance options ($M = 4.19$, $t = 125.324$, $df = 599$, 95% CI [4.12, 4.25]) reflect pragmatic aspects as well. Sustainability and green attributes scored slightly less on mean ($M = 3.75$, $t = 86.237$,df 2 599 , 95% C I [3.66, 3.83]) showing that sustainability and green attributes are also important but in a low priority scale among respondents.

In general, the confidence intervals in these findings were narrow, t-values were significant, which showed that there was overwhelming support to the argument that such mainstream property features and more contemporary attributes that were facilitated through augmented realities, virtualized realities, and Artificial intelligence indeed are significant determinants of

real estate decision-making in India. These findings are liable to support integration of the immersive and AI-driven solutions to optimize the process of property analysis, visualisation, and smart investment.

Reliability Statistics	
Cronbach's Alpha	N of Items
.766	3

Table 4. 18 Reliability statistics for technologies

The reliability analysis of the three items scale capturing a specific construct related to AR, VR, or AI adoption in real estate returned the result of Cronbach alpha of 0.766, which meets the accepted concept of over 0.70. This shows internal consistency which is that there is good measure of variance between the items showing that they measure the conceived idea (construct). The results will indicate that the scale is reliable through which it can be used later in the conducting analyses, as the credibility and accuracy of the collected data by the respondents in terms of technology adoption in the real estate sector is ascertained.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Augmented Reality	600	1	5	4.36	.678
Virtual Reality	600	1	5	4.23	.748
Artificial Intelligence	600	1	5	4.23	.698
Valid N (listwise)	600				

Table 4. 19 Descriptive statistics for technologies

The results of the descriptive statistics of the real estate industry on the adoption of the emerging technologies shows a strong acceptance of the topic amongst the respondents. AR has been given the highest mean score of 4.36 (SD = 0.678), which demonstrates that respondents greatly understand the importance of AR in facilitating property visualization/interactions. VR and AI were both given a mean of 4.23 (SD = 0.748 in case of VR, SD = 0.698 in case of AI), showing people are ready to accept and show interest in immersive systems and AI-based decision support tools. The reasonable standard deviations indicate the existent variability related to the experiences or familiarity of the respondents with these technologies, yet the average scores are high, which indicates the good attitude toward the use of AR, VR, and AI in the purchase of the property, the virtual tours of the property, the interactive floor plans of the premises, and the intelligent property suggestions. These insights suggest the increased willingness of the Indian real estate industry to embrace technology-enabled solutions, which have the potential to enhance customer interaction, decision-making process and experience behind property purchasing.

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Augmented Reality	Between Groups	48.662	4	12.166	31.886	.000
	Within Groups	227.011	595	.382		
	Total	275.673	599			
Virtual Reality	Between Groups	42.670	4	10.668	21.688	.000
	Within Groups	292.663	595	.492		
	Total	335.333	599			
Artificial Intelligence	Between Groups	52.147	4	13.037	32.378	.000
	Within Groups	239.571	595	.403		
	Total	291.718	599			

Table 4. 20 Anova for technologies

A one-way ANOVA was used to assess whether adoption of Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) in real estate sector was significantly different across respondent groups. The figures depict that there are statistically significant differences

in terms of groups in all three technologies ($p < 0.001$). In the case of AR, F-value was 31.886 (df = 4, 595), which shows that variability in adoption levels amsong different respondent segments is high. Likewise, there was a significant group-difference between VR with 21.688 F-value (df = 4, 595) and AI with 32.378 F-value (df = 4, 595), indicating that the frequency of adoption is significantly different across different groups. These results indicate that age, income, education, preference of property types and family profile could play a role in determining the willingness of the respondents to adopt these technologies. The noteworthy minimization of between-group differences points to the urgency of specific approach when introducing AR, VR, and AI-based solutions in marketing and property visualization. Based on these insights, the marketers and developers can personalize the use of these technology-driven tools, as it is essential to tailor the use of immersive tools, such as virtual tours, interactive floor plans, AI-based property recommendations, to the preferences of different customer segments, which improves engagement and the moment of decision-making.

Reliability Statistics	
Cronbach's Alpha	N of Items
0.778	4

Table 4. 21 Reliability statistics for role in real estate

The analysis of reliability of the four-items scale assessing the adoption-related constructs of AR, VR, and AI displayed a Cronbach Alpha of 0.778, which was higher than 0.70. It shows there is good internal consistency meaning the items reliably measure what they refer to. The findings establish that scale is reliably applied in further analysis to give the data collected pertaining to the perceptions, usage, and attitude of the respondents toward early technologies in Indian real estate sector credibility and perfectness.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Real estate developer/builder website	600	1	5	4.19	.818
Property portal	600	1	5	3.89	.907
Real estate broker/agent	600	1	5	4.05	.871
At property site/office	600	1	5	4.00	.905
Valid N (listwise)	600				

Table 4. 22 Descriptive statistics for role in real estate

The descriptive statistics of the sources of real estate information give an idea of how the respondents prefer to deal with the technology-driven facilities. Real estate developer / building sites achieved the highest feasible score of 4.19 (SD = 0.818) reflecting considerable dependency on formal developer sites for information about properties. A slightly smaller mean of 3.89 (SD = 0.907) was reflected on property portals, representing moderate use of third-party listing. Real estate brokers/agents (M = 4.05, SD = 0.871) and at property site/ offices (M = 4.00, SD = 0.905) were also ranked as significant sources making it clear that face to face interaction and on-site visits remain relevant despite the move towards digitization.

The slight deviations show that preferences are a bit different but, probably, this can be explained by various degrees of familiarity with digital platforms among respondents and their comfort level with technology-facilitated property search. All in all, the results indicate that conventional sources are useful but there is a lot of receptivity to digital media, and it will be beneficial to incorporate AR, VR, and AI technologies to augment property images, virtual tours and smart suggestions of properties to facilitate better buyer experience in the Indian property market.

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Real estate developer/builder website	Between Groups	33.923	4	8.481	13.743	.000
	Within Groups	367.171	595	.617		
	Total	401.093	599			
Property portal	Between Groups	75.640	4	18.910	26.947	.000
	Within Groups	417.533	595	.702		
	Total	493.173	599			
Real estate broker/agent	Between Groups	102.960	4	25.740	43.592	.000
	Within Groups	351.333	595	.590		
	Total	454.293	599			
At property site/office	Between Groups	114.669	4	28.667	45.326	.000
	Within Groups	376.316	595	.632		
	Total	490.985	599			

Table 4. 23 Anova for role in real estate

A one way analysis of variance was performed to determine the difference in use of various sources of real estate information of the various groups of respondents. As it can be seen in the results, all of the sources show statistically significant differences among groups ($p < 0.001$). In the case of real estate developer/builder websites the F-value was 13.743 (df = 4, 595) thus, the variability between the use of various respondent segments is notable. Property portals differed significantly with an F-value of 26.947 (df = 4, 595), and real estate brokers/agents (F = 43.592, df = 4, 595) and property site/offices (F = 45.326, df = 4, 595) had the highest use variation across groups.

According to these results, the demographics that include age, income, education, and preferences on properties will influence the access to the real estate's information by the

respondents. The high variability between groups demonstrates the need to use digital and physical channels differently depending on the segment and make sure that they are effective. In addition, the findings favour an AI, VR, and AR combination in these sources because the technologies are immersive and intelligent substances that can help to simplify the visualisation of properties and make higher-quality choices across a wide range of markets in Indian real estate.

Objective 1: To identify and analyse key factors influencing the adoption and application of AR, VR and AI technologies in the real estate sector.

Reliability Statistics	
Cronbach's Alpha	N of Items
.912	28

Table 4. 24 Reliability statistics for factors influencing AR, VR and AI

The 28-item scale that addresses AR, VR, AI adoption, real estate decision factors, and information sources had a Cronbach Alpha of 0.912 which is high enough (greater than 0.70) compared to the minimum standard set (Nunnally, 1978). This means very strong internal reliability and that the items reliably tap into the underlying constructs of technology adoption and property decision-making. This reliability is high; hence, the survey tool will gather valid and reliable information that will form the basis of the next statistical tests, such as descriptive statistics, t-tests, and ANOVA. The result also proves the point that incorporating all the relevant points into one scale was a good idea because it helps measure the perceptions, usage, and attitudes of respondents toward the sample of emerging technologies and other factors relating to real estate significantly.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
I know that AR/VR is able to offer better virtual tours for real estate	600	1	5	4.16	.814
I am aware that property personal listings are being targeted with the help of AI	600	1	5	3.80	.974
I am well informed on the operation of the type of technologies in real estate	600	1	5	3.18	1.151
The fact that I am conscious makes me want to learn how to utilise AR/VR/AI in the process of property purchases	600	1	5	4.51	.724
AR/VR can assist me to make fair assessment of a property compared to photos or brochures	600	1	5	3.78	1.013
Property search is made more effective using AI-driven tools	600	1	5	4.62	.619
This technology makes me make a more well-informed purchase	600	1	5	4.50	.693
The AR/VR/ AI would enhance my general satisfaction with the property purchasing	600	1	5	4.04	.965
Property viewing through AR/VR is user friendly	600	1	5	4.12	.807

AI driven real estate apps/ websites are easy to use	600	1	5	4.09	.894
I am able to employ these technologies in an easy way without having specialized knowledge	600	1	5	4.12	.856
I will be able to learn the interaction with AR/VR/AI tools fast	600	1	5	4.18	.743
It is too expensive to access the AR/VR (e.g., VR headsets, data usage)	600	1	5	4.34	.632
I feel that using these technologies demand too much energy/time.	600	1	5	4.38	.655
In my opinion, all these tools' developers ought to make them free to purchasers.	600	1	5	4.35	.720
Extra costs sway me from using AR/VR/AI in real estate	600	1	5	4.42	.644
I trust AR/VR images really do show real estate features	600	1	5	4.18	.814
In my opinion, the recommendations implemented using AI can be trusted and are impartial	600	1	5	4.39	.619
Such technologies decrease the probability of being deceived with not full property information	600	1	5	4.19	.765
AR/VR/AI generate my trust in definitive buying decisions	600	1	5	4.26	.710

My acquaintances or relatives advise me to resort to AR/VR/AI during the selection of properties	600	1	5	4.39	.644
These technologies are also popularized by developers and brokers among purchasers	600	1	5	4.36	.678
The experience of seeing other customers use AR/VR /AI encourages me to use them	600	1	5	4.23	.748
Online reviews and social media contribute to the interest in these technologies to me	600	1	5	4.23	.698
Realtor websites/app I also use are good at AR/VR/AI	600	1	5	4.19	.825
AR/VR is supported with my internet connection	600	1	5	3.97	.942
There is the availability of devices (smartphone, laptop, VR headset) that can support these technologies	600	1	5	3.75	1.065
I can approach them in case I have problems with these tools as they offer technical support and guidance	600	1	5	4.19	.818
Valid N (listwise)	600				

Table 4. 25 Descriptive statistics for factors influencing AR, VR and AI

The descriptive statistics reveal respondents' perceptions, awareness, and attitudes toward the adoption of **AR, VR, and AI technologies** in real estate. Respondents displayed a high level of **interest and willingness to use these technologies**, as indicated by the highest mean scores for statements such as *"Property search is made more effective using AI-driven tools"* (M = 4.62, SD = 0.619) and *"The fact that I am conscious makes me want to learn how to utilise AR/VR/AI in the process of property purchases"* (M = 4.51, SD = 0.724). High means were also observed for *"This technology makes me make a more well-informed purchase"* (M = 4.50, SD = 0.693) and *"Extra costs sway me from using AR/VR/AI in real estate"* (M = 4.42, SD = 0.644), indicating that respondents value these tools but are mindful of affordability.

Awareness of the technologies varied, with *"I am well informed on the operation of the type of technologies in real estate"* showing a moderate mean (M = 3.18, SD = 1.151), suggesting that while users are interested, many still lack comprehensive knowledge about AR, VR, and AI functionality. Statements regarding **trust and reliability**, such as *"I trust AR/VR images really do show real estate features"* (M = 4.18, SD = 0.814) and *"In my opinion, the recommendations implemented using AI can be trusted and are impartial"* (M = 4.39, SD = 0.619), demonstrate strong confidence in technology-assisted property evaluation.

Respondents also perceived the technologies as **easy to use and accessible**, with high means for items like *"Property viewing through AR/VR is user friendly"* (M = 4.12, SD = 0.807) and *"I will be able to learn the interaction with AR/VR/AI tools fast"* (M = 4.18, SD = 0.743), though the availability of compatible devices (M = 3.75, SD = 1.065) and internet support (M = 3.97, SD = 0.942) showed slightly lower scores, indicating minor infrastructural limitations. Social influence and promotion also played a role, as reflected in statements about **peer advice, developer promotion, and online reviews**, all scoring above 4.0.

On the whole, the descriptive statistics demonstrate a positive attitude, great interest, and readiness to use the innovations of AR, VR, and AI technologies and trust them in terms of their reliability and usefulness. But there are still dotted demand gaps, and the issues of accessibility open the potential of training and education as well as infrastructure support to make adoption of such a system in the Indian real estate sector easier.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.924
Bartlett's Test of Sphericity	Approx. Chi-Square	6250.667
	df	378
	Sig.	.000

Table 4. 26 KMO and Bartlett's test for factors influencing AR, VR and AI

The value of Kaiser-Meyer-Olkin statue is 0.924 which has excellent sampling stature therefore the dataset is highly adequate to use in factor analysis. KMO values above 0.90 would be superb (Kaiser, 1974) where the correlation among the variables is compact enough to result in trustworthy factors. Also, Bartlett's Test of Sphericity was significant (Chi-square= 6250.667, df = 378, $p < 0.001$), which means the correlation matrix is not equal to an identity matrix and the correlations between variables were sufficient to extract factors. These findings reveal that the data gathered among the respondents is appropriate to be used in exploratory factor analysis (EFA), and this meets the bar of validating the existence of underlying constructs related to adoption of AR, VR and AI within the Indian real estate market.

Communalities		
	Initial	Extraction
I know that AR/VR is able to offer better virtual tours for real estate	1.000	.387
I am aware that property personal listings are being targeted with the help of AI	1.000	.408
I am well informed on the operation of the type of technologies in real estate	1.000	.342
The fact that I am conscious makes me want to learn how to utilise AR/VR/AI in the process of property purchases	1.000	.604
AR/VR can assist me to make fair assessment of a property compared to photos or brochures	1.000	.441
Property search is made more effective using AI-driven tools	1.000	.611
This technology makes me make a more well-informed purchase	1.000	.556
The AR/VR/ AI would enhance my general satisfaction with the property purchasing	1.000	.558
Property viewing through AR/VR is user friendly	1.000	.594
AI driven real estate apps/ websites are easy to use	1.000	.576
I am able to employ these technologies in an easy way without having specialized knowledge	1.000	.528
I will be able to learn the interaction with AR/VR/AI tools fast	1.000	.462
It is too expensive to access the AR/VR (e.g., VR headsets, data usage)	1.000	.497
I feel that using these technologies demand too much energy/time.	1.000	.650
In my opinion, all these tools developers ought to make them free to purchasers.	1.000	.563
Extra costs sways me from using AR/VR/AI in real estate	1.000	.527
I trust AR/VR images really do show real estate features	1.000	.513
In my opinion, the recommendations implemented using AI can be trusted and are impartial	1.000	.501
Such technologies decrease the probability of being deceived with not full property information	1.000	.563
AR/VR/AI generate my trust in definitive buying decisions	1.000	.635
My acquaintances or relatives advise me to resort to AR/VR/AI during the selection of properties	1.000	.630

These technologies are also popularized by developers and brokers among purchasers	1.000	.613
The experience of seeing other customers use AR/VR /AI encourages me to use them	1.000	.614
Online reviews and social media contribute to the interest in these technologies to me	1.000	.551
Realtor websites/app I also use are good at AR/VR/AI	1.000	.471
AR/VR is supported with my internet connection	1.000	.571
There is the availability of devices (smartphone, laptop, VR headset) that can support these technologies	1.000	.602
I can approach them in case I have problems with these tools as they offer technical support and guidance	1.000	.535
Extraction Method: Principal Component Analysis.		

Table 4. 27 Communalities for factors influencing AR, VR and AI

Communalities represent the percent of each variances variance that is shown up by the put across factors in Principal Component Analysis (PCA). In this paper, initial communalities of the items gauging awareness, usage, trust, perceived easy and accessibility of the AR, VR and AI technologies in the real estate field were all 1.000. Following extractions, the communalities ranged between 0.342 and 0.650 and this means that most of the variance within each category is effectively represented by the latent component.

Total Variance Explained							
Component	Initial Eigenvalues	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		

	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.876	31.700	31.700	8.876	31.700	31.700	3.925	14.016	14.016
2	1.922	6.865	38.564	1.922	6.865	38.564	3.628	12.957	26.974
3	1.563	5.583	44.147	1.563	5.583	44.147	3.064	10.942	37.915
4	1.477	5.276	49.423	1.477	5.276	49.423	2.445	8.731	56.646
5	1.266	4.522	53.945	1.266	5.522	63.945	2.044	7.299	63.945
6	0.928	3.315	57.260						
7	0.840	3.001	60.262						
8	0.817	2.919	63.181						
9	0.769	2.748	65.928						
10	0.741	2.645	68.573						
11	0.724	2.585	71.158						
12	0.680	2.430	73.588						
13	0.671	2.395	75.983						
14	0.650	2.320	78.303						
15	0.589	2.105	80.407						

16	0.568	2.029	82.436						
17	0.520	1.856	84.292						
18	0.497	1.775	86.067						
19	0.489	1.747	87.814						
20	0.461	1.645	89.459						
21	0.444	1.585	91.045						
22	0.441	1.576	92.621						
23	0.394	1.406	94.027						
24	0.362	1.293	95.320						
25	0.353	1.260	96.580						
26	0.344	1.230	97.810						
27	0.321	1.148	98.957						
28	0.292	1.043	100.000						
Extraction Method: Principal Compo									

nent Analysis.									

Table 4. 28 Total variance for factors influencing AR,VR and AI

The Principal Component Analysis (PCA) was used to determine the underlying aspects encouraging the use of AR, VR, and AI in real estate. It was found that the initial five components had eigenvalues greater than 1, and they accounted cumulatively to 63.945 percent of the total variance. To be more precise, the share of the first component of the variance was 31.70 percentage points, the second of the variance 6.87, the third 5.58 percentage points, the fourth 5.28, and the fifth 4.52. This implies that the five variables explain most of the differences in perceptions, awareness, usage, trust and perceived ease of adoption of technology as perceived by the respondents.

On realizing rotation (Varimax method), there was an even distribution of the variance explained, varying between 14.02, 12.96, 10.94, 8.73 and 7.30 percent, with the first, the second, the third, the fourth and the fifth component, which amount to a total of 63.95 percent cumulative variance. The rotation enhanced the interpretation of the factors since it maximized the high loadings and minimized the low loadings, thereby having greater clarity between the underlying dimensions.

These findings establish that the factor structure is reliable and significant representing several dimensions of the attitudes of the respondents as well as trust, awareness, ease of use, and intention to adopt the three technologies (AR, VR, and AI) in the proposed study, in the Indian housing industry. The overall variance of above 60 percent also shows that the factors that have been extracted do sufficient justice to the complex data and can be used to further inference.

Rotated Component Matrix[a]					
	Component				
	1	2	3	4	5
I know that AR/VR is able to offer better virtual tours for real estate	.405				
I am aware that property personal listings are being targeted with the help of AI	.410				
I am well informed on the operation of the type of technologies in real estate	.515				
The fact that I am conscious makes me want to learn how to utilise AR/VR/AI in the process of property purchases		.445			
AR/VR can assist me to make fair assessment of a property compared to photos or brochures		.723			
Property search is made more effective using AI-driven tools		.573			
This technology makes me make a more well-informed purchase		.738			
The AR/VR/ AI would enhance my general satisfaction with the property purchasing			.704		
Property viewing through AR/VR is user friendly			.641		
AI driven real estate apps/ websites are easy to use			.588		
I am able to employ these technologies in an easy way without having specialized knowledge			.527		
I will be able to learn the interaction with AR/VR/AI tools fast				.458	
It is too expensive to access the AR/VR (e.g., VR headsets, data usage)				.418	

I feel that using these technologies demand too much energy/time.				.523	
In my opinion, all these tools developers ought to make them free to purchasers.				.628	
Extra costs sways me from using AR/VR/AI in real estate				.765	
I trust AR/VR images really do show real estate features				.712	
In my opinion, the recommendations implemented using AI can be trusted and are impartial				.595	
Such technologies decrease the probability of being deceived with not full property information					.633
AR/VR/AI generate my trust in definitive buying decisions					.602
My acquaintances or relatives advise me to resort to AR/VR/AI during the selection of properties					.683
These technologies are also popularized by developers and brokers among purchasers		.705			
The experience of seeing other customers use AR/VR /AI encourages me to use them		.722			
Online reviews and social media contribute to the interest in these technologies to me		.640			
Realtor websites/app I also use are good at AR/VR/AI				.557	
AR/VR is supported with my internet connection				.684	

There is the availability of devices (smartphone, laptop, VR headset) that can support these technologies				.734	
I can approach them in case I have problems with these tools as they offer technical support and guidance				.638	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.					
a. Rotation converged in 8 iterations.					

Table 4. 29 Rotated component matrix for factors influencing

The **Rotated Component Matrix** using **Varimax rotation** reveals the underlying structure of respondents' perceptions, awareness, usage, trust, and adoption of **AR, VR, and AI technologies in real estate**. Five distinct components were extracted, each representing a meaningful dimension of technology adoption.

- **Component 1** primarily captures **basic awareness and knowledge of AR/VR/AI technologies**, with items such as *"I know that AR/VR is able to offer better virtual tours for real estate"* (0.405), *"I am aware that property personal listings are being targeted with the help of AI"* (0.410), and *"I am well informed on the operation of the type of technologies in real estate"* (0.515). This component reflects respondents' general familiarity and understanding of these emerging technologies.
- **Component 2** represents **perceived usefulness and learning intention**, including items like *"AR/VR can assist me to make fair assessment of a property compared to photos or brochures"* (0.723), *"Property search is made more effective using AI-driven tools"* (0.573), and *"This technology makes me make a more well-informed purchase"* (0.738). These loadings suggest that respondents perceive AR, VR, and AI as valuable tools for enhancing decision-making and property evaluation.
- **Component 3** reflects **ease of use and accessibility**, with items such as *"The AR/VR/ AI would enhance my general satisfaction with the property purchasing"* (0.704), *"Property viewing through AR/VR is user friendly"* (0.641), and *"AI driven real estate*

apps/websites are easy to use" (0.588). This dimension highlights respondents' perception of user-friendliness and convenience in interacting with the technologies.

- **Component 4** captures **cost and effort considerations**, including statements like *"Extra costs sway me from using AR/VR/AI in real estate"* (0.765), *"It is too expensive to access the AR/VR"* (0.418), and *"I feel that using these technologies demand too much energy/time"* (0.523). This factor emphasizes the financial and effort-related constraints perceived by users.
- **Component 5** represents **trust and infrastructural support**, with items such as *"AR/VR/AI generate my trust in definitive buying decisions"* (0.602), *"There is the availability of devices that can support these technologies"* (0.734), and *"AR/VR is supported with my internet connection"* (0.684). This dimension underlines the importance of reliability, technical support, and necessary infrastructure for adoption.

The rotation has stabilized after 8 iterations thus giving a stable factor solution. All in all, the Rotated Component Matrix points to a strong, interpretable structure that describes various dimensions of technology adoption, which will offer a sound framework of how AR, VR, and AI shape the process of real estate purchasing behaviour in India.

Objective 2: To investigate opportunities and challenges using AI and VR & AR in the real estate sector in India.

Reliability Statistics	
Cronbach's Alpha	N of Items
0.857	10

Table 4. 30 Reliability statistics for opportunities & challenges

The reliability of the construct with the 10 items was determined by using Cronbach Alpha that gave 0.857. Nunnally and Bernstein (1994) held that a Cronbach Alpha value above 0.7 is acceptable, 0.8 good and above 0.9 excellent. Thus, an index of 0.857 provides the participant with high internal felicity among items in this construct. This indicates that the scale is reliable

and the items assess the same underlying concept in a consist manner. Therefore, information garnered by these questions can be utilized freely to involve additional statistical models, including the Exploratory Factor Analysis (EFA), Correlation, and Regression.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
The AR /VR technology simplifies property selection and brings it in a more interactive way	600	1	5	4.18	.814
AI makes reasonable suggestions regarding the property, depending on my choice	600	1	5	4.39	.619
The virtual tours save time and money given the fact that it eliminates the need to visit a site repeatedly	600	1	5	4.19	.765
AR/VR and AI make an added benefit of improving transparency and trust in the process of buying a property	600	1	5	4.26	.710
The technologies allow comparing several properties with more effectiveness	600	1	5	4.39	.644
The benefits of AI, AR & VR also open up options in properties outside of their physical location	600	1	5	4.36	.678
AR/VR enhances decision-making by giving a real-life property experience	600	1	5	4.23	.748

AI chatbots and chat assistants are speedy solution to buyer questions	600	1	5	4.23	.698
The confidence in the decision of acquiring property increases after viewing it only once using AR/VR	600	1	5	4.19	.825
Owing to all of this, AR/VR and AI allow property buying to be more efficient, convenient	600	1	5	3.97	.942
Valid N (listwise)	600				

Table 4. 31 Descriptive statistics for opportunities & challenges

Respondents identified several key opportunities associated with the adoption of **AI, VR, and AR technologies** in the real estate sector in India. Respondents reported high agreement that these technologies **simplify property selection and make the process more interactive**, with a mean score of 4.18 (SD = 0.814). Items reflecting the **intelligent support of AI**, such as *"AI makes reasonable suggestions regarding the property, depending on my choice"* and *"The technologies allow comparing several properties with more effectiveness"*, received high mean scores of 4.39 (SD = 0.619) and 4.39 (SD = 0.644), indicating that buyers perceive AI as enhancing decision-making and offering personalized guidance.

Respondents also recognized **time and cost-saving benefits** of virtual tours, as indicated by *"The virtual tours save time and money given the fact that it eliminates the need to visit a site repeatedly"* (M = 4.19, SD = 0.765). Trust and transparency in the property buying process were similarly highlighted, with *"AR/VR and AI make an added benefit of improving transparency and trust in the process of buying a property"* (M = 4.26, SD = 0.710). The technologies were perceived to **expand options beyond physical locations** (M = 4.36, SD = 0.678) and enhance overall decision-making (M = 4.23, SD = 0.748). Even AI chatbots and assistants were recognized as **speedy solutions to buyer inquiries** (M = 4.23, SD = 0.698).

Slightly lower agreement was observed for the statement *"AR/VR and AI allow property buying to be more efficient, convenient"* (M = 3.97, SD = 0.942), indicating minor variations in perception regarding overall efficiency. Overall, these findings suggest that respondents **perceive substantial benefits in using AR, VR, and AI technologies**, particularly in enhancing decision-making, trust, and convenience in real estate transactions.

Correlations											
		The AR/VR technology simplifies property selection and brings it in a more interactive way	AI makes reasonable suggestions regarding the property, depending on my choice	The virtual tours save time and money given the fact that it eliminates the need to visit a site repe	AR/VR and AI make an added benefit of improving transparency and trust in the process of buying a property	The technologies allow comparing several properties with more effectiveness	The benefits of AI, AR & VR also open up options in properties outside of their phys	AR/VR enhances decision-making by giving a real-life property experience	AI chatbots and chat assistants are speedy solution to buyer questions	The confidence in the decision of acquiring property increases after viewing it only once using AR/VR	Owing to all of this, AR/VR and AI allow property buying to be more efficient, convenient

				atedly			ical location				
The AR/VR technology simplifies property selection and brings it in a more interactive way	Pearson Correlation	1	.462**	.381**	.386**	.322**	.337**	.307**	.292**	.322**	.258**

	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	600	600	600	600	600	600	600	600	600	600
AI makes reasonable suggestions regarding the property, depending on my choice	Pearson Correlation	.462**	1	.434**	.405**	.414**	.364**	.334**	.332**	.276**	.275**
	Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	600	600	600	600	600	600	600	600	600	600

The virtual tours save time and money given the fact that it eliminates the need to visit a site repeatedly	Pearson Correlation	.381**	.434**	1	.571**	.416**	.494**	.485**	.405**	.323**	.213**
	Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	600	600	600	600	600	600	600	600	600	600

AR/VR and AI make an added benefit of improving transparency and trust in the process of buying a property	Pearson Correlation	.386**	.405**	.571**	1	.583**	.521**	.485**	.469**	.334**	.315**
	Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000
	N	600	600	600	600	600	600	600	600	600	600

The technologies allow comparing several properties with more effectiveness	Pearson Correlation	.322**	.414**	.416**	.583**	1	.523**	.525**	.471**	.308**	.231**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000
	N	600	600	600	600	600	600	600	600	600	600

The benefits of AI, AR & VR also open up options in properties outside of their physical location	Pearson Correlation	.337**	.364**	.494**	.521**	.523**	1	.556**	.480**	.375**	.283**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
	N	600	600	600	600	600	600	600	600	600	600

AR/VR enhances decision-making by giving a real-life property experience	Pearson Correlation	.307**	.334**	.485**	.485**	.525**	.556**	1	.531**	.296**	.243**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000
	N	600	600	600	600	600	600	600	600	600	600
AI chatbots and chat assistants are	Pearson Correlation	.292**	.332**	.405**	.469**	.471**	.480**	.531**	1	.404**	.367**

speedy solution to buyer questions											
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000
	N	600	600	600	600	600	600	600	600	600	600
The confidence in the decision of acquiring property increases after viewing it only	Pearson Correlation	.322**	.276**	.323**	.334**	.308**	.375**	.296**	.404**	1	.440**

once using AR/VR											
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000
	N	600	600	600	600	600	600	600	600	600	600
Owing to all of this, AR/VR and AI allow property buying to be more	Pearson Correlation	.258**	.275**	.213**	.315**	.231**	.283**	.243**	.367**	.440**	1

efficient, convenient											
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	N	600	600	600	600	600	600	600	600	600	600
**. Correlation is significant at the 0.01 level (2-tailed).											

Table 4. 32 Correlations for opportunities & challenges

The Pearson correlation analysis was performed to check the interconnections between these or those perceived advantages of AR, VR, and AI technologies in the property selection and purchase. The findings are that each of the correlations is positive and significant at 0.01 indicating that there are significant relationships amid the constructs.

As an example, the item The AR/VR technology makes choosing of a property less complicated and makes it more interactive also demonstrated moderate positive correlations with all other benefits, with the lowest correlation being r = 0.258 and the highest correlation being r = 0.462, showing that users who perceive AR/VR to simplify choices of property also tend to find its usefulness on providing suggestions in an AI-based manner and making virtual tours. Likewise, the subscale item, “AI provides sensible recommendations about the property, depending on my preference” was related strongly to other perceived advantages of the technologies: virtual tours (r = 0.434) and transparency/trust benefits (r = 0.405).

Interestingly, the idea of the virtual tours saving time and money was highly correlated with AR/VR and AI creating a more transparent and confiding experience (r = 0.571) as well as opening up opportunities and opportunities beyond a physical location (r = 0.494), which speaks to the efficiency and convenience values correlating with the idea of transparency and trust, as well as the openness to property options elsewhere. AR/VR experience in decision-making, as far as it improves a lifestyle experience of a property, was significantly correlated with AI-driven recommendations (r = 0.334) and chatbots (r = 0.531), respectively, highlighting the complementary nature of AI and immersive technologies to assist the decision-making process of buyers.

Also, a belief that with AR/VR and AI buying a property could be more efficient and convenient showed a positive connection with the confidence in the purchase after one virtual visit (r = 0.440) and AI chat assistants (r = 0.367). This illustrates that efficiency can have the right to user confidence and AI assistance tools. In general, these results indicate that the perceived advantages of AR, VR, and AI are not independent of each other and indicate that these three technologies enhance decision-making, trust, convenience, and accessibility of the real estate business.

Model Summary[b]										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.523[a]	0.273	0.261	0.915	0.273	22.173	10	589	0.000	1.962
a. Predictors: (Constant), Owing to all of this, AR/VR and AI allow property buying to be more efficient, convenient, The virtual tours save time and money given the fact that it eliminates the need to visit a site repeatedly, The AR /VR technology simplifies property selection and brings it in a more interactive way, The technologies allow comparing several properties with more effectiveness, The confidence in the decision of acquiring property increases after viewing it only once using AR/VR, AI makes reasonable suggestions regarding the property, depending on my choice, AI chatbots and chat assistants are speedy solution to buyer questions, The benefits of AI, AR & VR also open up options in properties outside of their physical location, AR/VR enhances decision-making by giving a real-life property experience, AR/VR and AI make an added benefit of improving transparency and trust in the process of buying a property										
b. Dependent Variable: The opportunities using AI and VR & AR in the real estate sector in India										

Table 4. 33 Model summary for opportunities & challenges

A multiple regression analysis was also performed to determine how perceived benefits of AR, VR, and AI technologies contributed to the opportunities in the application of AI and VR/AR in the Indian real estate industry. The model summary statistical data shows that the correlation coefficient (R) was 0.523 implying that the relationship between the predictor variables and the dependent variable was moderate positive. With the R 2 of 0.273, about 27.3% variance in perceived opportunities can be accounted by a combination of the effects of the ten predictor variables, efficiency, interactivity, decision-making support, virtual tours, AI suggestions, and trust enhancement.

The amount of the adjusted R 2 value is 0.261, which shows that the model is reasonably stable adjusted with account of the number of predictors, and the F-value of 22.173 ($p < 0.001$) proves that the regression model overall is statistically significant. This Durbin-Watson of 1.962 however, is near 2, which indicates that there is no significant autocorrelation in the residuals.

In general, the indicators indicate that opportunities provided by the technologies of augmented and virtual reality and artificial intelligence in terms of efficiency, convenience, decision making, trust, and interactivity will be significant in the Indian real estate market. This means developers and real estate operators can apply the technology-driven advantages in tapping their market potential and buyer responsiveness to the fullest extent possible in the market place.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	185.704	10	18.570	22.173	.000[b]
	Residual	493.294	589	.838		
	Total	678.998	599			
a. Dependent Variable: The opportunities using AI and VR & AR in the real estate sector in India						
b. Predictors: (Constant), Owing to all of this, AR/VR and AI allow property buying to be more efficient, convenient, The virtual tours save time and money given the fact that it eliminates the need to visit a site repeatedly, The AR /VR technology simplifies property selection and brings it in a more interactive way, The technologies allow comparing several properties with more effectiveness, The confidence in the decision of acquiring property increases after viewing it only once using AR/VR, AI makes reasonable suggestions regarding the property, depending on my choice, AI chatbots and chat assistants are speedy solution to buyer questions, The benefits of AI, AR & VR also open up options in properties outside of their physical location, AR/VR enhances decision-making by giving a real-life property experience, AR/VR and AI make an added benefit of improving transparency and trust in the process of buying a property						

Table 4. 34 Anova for opportunities & challenges

The ANOVA findings were employed to test the significance of the total regression model in investigating the role of the AR, VR, and AI-associated benefits on the prospects of the Indian real estate sector. The regression SS is 185.704 with 10 SS and RES SS is 493.294 with 589 SS, the overall SS is 678.998.

The computed F -value = 22.173 is significant at $P < 0.001$ which shows that the model is giving statistically significant data fits. The importance of the ten predictor variables 1 efficacy and convenience, interactive property selection, decision-making support, AI suggestions, virtual tours, trust enhancement can be summarized by saying that collectively they are influential in relation to the perceived opportunities of using AR, VR and AI in real estate.

These findings confirm that improvements in user experience, transparency, and technology-assisted decision-making are meaningful predictors of the sector's potential opportunities, supporting the hypothesis that technology adoption can positively influence the Indian real estate market.

Reliability Statistics	
Cronbach's Alpha	N of Items
0.845	10

Table 4. 35 Reliability statistics for issues related to the adoption

The accuracy of the 10 questions that aimed at determining how the respondents perceived AR, VR, and AI issues in real estate was revealed using Cronbach Alpha that provided a value of 0.845. This shows there is strong internal consistence, that is, that the items are consistent in their measurements of the same construct. That is, the items on the survey are consistent and yield consistent responses that one can be sure on proceeding with the statistical analyses and its interpretation with this scale.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Expensive AR/VR technology is one of the factors that restrict its scale of implementation	600	1	5	4.23	.698
Expensive AR/VR technology is one of the factors that restrict its scale of implementation	600	1	5	4.19	.825
AI advises can be wrong or misguided	600	1	5	3.97	.942
Inability to trust AR/VR images because they might not be a true image of the actual property	600	1	5	3.75	1.065
Not all buyers are used to or rather comfortable with using AR/VR/AI tools	600	1	5	4.19	.818
Use can be impeded by technical problems (connection to the Internet, compatibility of device)	600	1	5	3.89	.907
Reliance on technology relegates the consideration of the advice of individual brokers	600	1	5	4.05	.871
The prospects of AI-powered platforms as a source of fear due to concerns about its data privacy and security	600	1	5	4.00	.905
Poor standardization between AR/VR experiences of different developers	600	1	5	3.53	1.114
Physical site visits are still required, even in the presence of AR/VR/AI tools	600	1	5	4.39	.728
Valid N (listwise)	600				

Table 4. 36 Descriptive statistics for issues related to the adoption

The descriptive statistics reveal key insights into the perceived challenges faced by users when adopting AI, AR, and VR technologies in the Indian real estate sector. Among the factors evaluated, **physical site visits remaining necessary despite AR/VR/AI tools** emerged as the most significant challenge, with a mean of **4.39 (SD = 0.728)**, indicating strong agreement among respondents. This suggests that while digital technologies enhance property exploration, buyers still feel the need for in-person verification.

High mean scores were also observed for **the expense associated with AR/VR technology**, recorded as **4.23 (SD = 0.698)** and **4.19 (SD = 0.825)**, highlighting cost as a major barrier to large-scale adoption. Similarly, respondents indicated challenges in **adapting to AR/VR/AI tools** (Mean = 4.19, SD = 0.818), reflecting that not all buyers are comfortable with new technology interfaces.

Moderate concern was expressed regarding **AI reliability**, with respondents noting that AI suggestions can sometimes be **wrong or misguided** (Mean = 3.97, SD = 0.942), and **trusting AR/VR images** was also a challenge (Mean = 3.75, SD = 1.065), emphasizing skepticism about the authenticity of virtual property representations. **Technical issues**, such as internet connectivity or device compatibility, were rated with a mean of 3.89 (SD = 0.907), reflecting operational barriers.

Other notable challenges included **reliance on technology possibly reducing the influence of brokers' advice** (Mean = 4.05, SD = 0.871), **concerns about data privacy and security on AI platforms** (Mean = 4.00, SD = 0.905), and **poor standardization between AR/VR experiences across developers** (Mean = 3.53, SD = 1.114).

Overall, the analysis suggests that while AI, AR, and VR provide significant opportunities for enhancing the real estate experience, **cost, trust, usability, technical issues, and the need for physical verification** remain key challenges limiting widespread adoption in India.

Correlations											
		Expensive AR/VR technology is one of the factors that restrict its scale of implementation	Expensive AR/VR technology is one of the factors that restrict its scale of implementation	AI advises can be wrong or misguided	Inability to trust AR/VR images because they might not be a true image of the actual property	Not all buyers are used to or rather comfortable with using AR/VR/AI tools	Use can be impeded by technical problems (connection to the Internet, compatibility of device)	Reliance on technology relegates the consideration of the advice of individual brokers	The prospects of AI-powered platforms as a source of fear due to concerns about its data privacy and security	Poor standardization between AR/VR experiences of different developers	Physical site visits are still required, even in the presence of AR/VR/AI tools

Expensive AR/VR technology is one of the factors that restrict its scale of implementation	Pearson Correlation	1	.404**	.367**	.226**	.314**	.307**	.343**	.353**	.309**	.254**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	600	600	600	600	600	600	600	600	600	598
Expensive AR/VR technology is one of the factors that restrict	Pearson Correlation	.404**	1	.440**	.318**	.358**	.310**	.388**	.397**	.316**	.214**

its scale of implementation											
	Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	600	600	600	600	600	600	600	600	600	598
AI advises can be wrong or misguided	Pearson Correlation	.367**	.440**	1	.476**	.322**	.426**	.430**	.387**	.311**	.223**
	Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	600	600	600	600	600	600	600	600	600	598
Inability to trust AR/VR images because they	Pearson Correlation	.226**	.318**	.476**	1	.458**	.510**	.362**	.378**	.364**	.263**

might not be a true image of the actual property											
	Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000
	N	600	600	600	600	600	600	600	600	600	598
Not all buyers are used to or rather comfortable with using AR/VR/AI tools	Pearson Correlation	.314**	.358**	.322**	.458**	1	.436**	.351**	.375**	.213**	.263**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000
	N	600	600	600	600	600	600	600	600	600	598

Use can be imped ed by techni cal proble ms (conne ction to the Intern et, compa tibility of device)	Pear son Corr elati on	.307**	.310**	.426 **	.51 0**	.436* *	1	.464**	.46 1**	.349**	.223 **
	Sig. (2- taile d)	0.000	0.000	0.00 0	0.0 00	0.00 0		0.000	0.0 00	0.000	0.00 0
	N	600	600	600	600	600	600	600	600	600	598
Relian ce on techno logy relegat es the consid eration of the advice	Pear son Corr elati on	.343**	.388**	.430 **	.36 2**	.351* *	.464* *	1	.70 3**	.456**	.201 **

of individual brokers											
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000
	N	600	600	600	600	600	600	600	600	600	598
The prospects of AI-powered platforms as a source of fear due to concerns about its data privacy and security	Pearson Correlation	.353**	.397**	.387**	.378**	.375**	.461**	.703**	1	.468**	.244**
	Sig. (2-	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000

	tailed)										
	N	600	600	600	600	600	600	600	600	600	598
Poor standardization between AR/VR experiences of different developers	Pearson Correlation	.309**	.316**	.311**	.364**	.213**	.349**	.456**	.468**	1	.233**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000
	N	600	600	600	600	600	600	600	600	600	598
Physical site visits are still required, even in the presen	Pearson Correlation	.254**	.214**	.223**	.263**	.263**	.223**	.201**	.244**	.233**	1

ce of AR/VR/AI tools											
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	N	598	598	598	598	598	598	598	598	598	598
**. Correlation is significant at the 0.01 level (2-tailed).											

Table 4. 37 Correlation for issues related to the adoption

Correlation analysis shows the interconnectedness between all the issues related to the adoption of the AI, AR, and VR technologies in the Indian real estate industry. Cost-related issues (i.e., the high cost of AR/VR technology), have considerable positive connections to most other adoption barriers. As an example, the perceived cost is somewhat related to concerns about potential wrongness of AI advice (r = 0.367**) and technical problems (r = 0.307**). This shows that the respondents, who believe cost is a significant barrier, also tend to have similar opinion on other operational and reliability hindrances.

A closely associated set of challenges is trust and reliability challenges. The non-trust in the accuracy of AI guidance has a strong correlation with the inability to trust the authenticity of AR/VR images (r = 0.476**), which indicates the likelihood of such users to distrust the reality of virtual property images. Equally, the levels to which users feel comfortable with AR/VR/AI tools are directly linked with technical and trust concerns. Challenging experiences in the application of these technologies correlate well with technical issues (r = 0.436**) and trust issues (r = 0.458**), demonstrating that ease of use and level of trust become major factors in adoption.

Issues concerning the functions of brokers and privacy come up as intertwined problems. The negative relationship between reliance on technology decreasing the influence of the broker and concerns over platform security and privacy (r = 0.703**), however, demonstrates that those most concerned with privacy and data security fear the loss of human guidance as well. Furthermore, low-quality standardization among various experiences in AR/VR has strong correlations with both privacy/security concerns (r = 0.468**) and a decrease in trust in brokers (r = 0.456**), implying that a lack of uniformity in virtual experiences can increase user insecurities about safety and intermediary dependence.

Quite notably, the need of physical site visits can be regarded as a challenge as well but is not so closely related to other factors as correlations are between 0.201 and 0.263**(*), respectively. This is supposed to mean that although users do not reject the necessity of conducting visits to properties even in circumstances that involve advanced technologies, this difficulty is more or less an independent consideration compared to costs, technical and trust challenges.

In general, the analysis shows that concerns about cost, trust and reliability, technical barriers, and privacy issues are intertwined issues that one should not ignore when considering the implementation of AI, AR, and VR in property. Successfully meeting these challenges comprehensively, with affordable products, proven technology, compatibility and high standards of data security will be among the main factors that developers and platform providers will have to adopt to promote further adoption and consumer confidence in these upcoming technologies.

Model Summary[b]										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.580[a]	0.336	0.325	0.643	0.336	29.612	10	585	0.000	1.892
a. Predictors: (Constant), Physical site visits are still required, even in the presence of AR/VR/AI tools, Reliance on technology relegates the consideration of the advice of individual brokers, Expensive AR/VR technology is one of the factors that restrict its scale of implementation, Inability to trust AR/VR images because they might not be a true image of the actual property, Expensive AR/VR technology is one of the factors that restrict its scale of implementation, Poor standardization between AR/VR experiences of different developers, Not all buyers are used to or rather comfortable with using AR/VR/AI tools, AI advises can be wrong or misguided, Use can be impeded by technical problems (connection to the Internet, compatibility of device), The prospects of AI-powered platforms as a source of fear due to concerns about its data privacy and security										
b. Dependent Variable: The challenges using AI and VR & AR in the real estate sector in India										

Table 4. 38 Model summary for issues related to the adoption

The model summary reveals that the range of predictors is a significant explanator of variance in the issue of the perceived difficulty of AI, AR, and VR technologies use in Indian real estate markets. The coefficient of correlations between the independent variables and the dependent variable, which is the overall perception of challenges, is 0.580 implying that the relationship between the two is moderately strong. The value of R Square (0.336) shows that 33.6 percent of the variance in perceived challenges is determined by the ten predictors coming under the model. The adjusted coefficient of determination of 0.325 is more conservative of the described number of predictors and the sample size.

The standard error of the estimation is 0.643 giving an indication of the average discrepancy of observed values with respect to regression line. F-change = 29.612, significance = 0.000,

thus indicating that the overall regression model is significant and that the mechanism of predictors as a whole has a significant effect on perceived challenges. The Durbin-Watson coefficient of 1.892 is near 2 which indicates that there is no severe violation of autocorrelation in the residuals, and this justifies the accuracy of the regression analysis.

On balance, this model shows that such predictors as cost-motivated issues, the issues of trust and reliability, technical obstacles, the need to visit the site with physical properties, among others, are major contributors to the perception of the challenges in relation to AI, AR, and VR technologies adoption in real estate. These can help the developers and stakeholders know what to do in mitigating these barriers.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	122.579	10	12.258	29.612	.000[b]
	Residual	242.164	585	.414		
	Total	364.743	595			
a. Dependent Variable: The challenges using AI and VR & AR in the real estate sector in India						
b. Predictors: (Constant), Physical site visits are still required, even in the presence of AR/VR/AI tools, Reliance on technology relegates the consideration of the advice of individual brokers, Expensive AR/VR technology is one of the factors that restrict its scale of implementation, Inability to trust AR/VR images because they might not be a true image of the actual property, Expensive AR/VR technology is one of the factors that restrict its scale of implementation, Poor standardization between AR/VR experiences of different developers, Not all buyers are used to or rather comfortable with using AR/VR/AI tools, AI advises can be wrong or misguided, Use can be impeded by technical problems (connection to the Internet, compatibility of device), The prospects of AI-powered platforms as a source of fear due to concerns about its data privacy and security						

Table 4. 39 Anova for issues related to the adoption

ANOVA table of regression model testing the challenges of adoption of AI, AR and VR in the Indian real estate sector shows that the overall model is going to be significant. The regression sum of squares is 122.579/ 10 degrees of freedom, residual sum of squares 242.164/ 585 degrees of freedom, with totals of 364.743.

The average square in regression is 12.258, and the F value 29.612 with p =0.000. This F-value test statistic is extremely significant and shows that the ten predictor variable set contains a substantial amount of variance to explain the variance in Perceived Challenges, which implies that the model has satisfactory predictive capacity regarding the challenges related to AI, AR, and VR adoption in real estate.

Such values in practice imply that high technology cost, the need to travel to a physical location, the influence of technology on the role played by the brokers, credibility, technical difficulty, user comfortable, and issues of confidence and privacy may all have a significant role in the way challenges happen. The significance of these factors is great because it is supported by strong statistics, which means that working on them is the answer to minimizing the effects of obstacles to the introduction of these technologies.

Objective 3: To examine the role of augmented reality, virtual reality, and artificial intelligence in improving marketing and sales strategies in the Indian real estate sector.

Reliability Statistics	
Cronbach's Alpha	N of Items
0.894	15

Table 4. 40 Reliability statistics for role in marketing & sales

The reliability estimations on the scale that defined the perceived role that augmented reality (AR), virtual reality (VR), and artificial intelligence (AI) play in enhancing the marketing and sales methods in the Indian real estate sector has a high internal consistency. The Cronbach s

Alpha of 0.894 across 15 items reveal that the responses of the respondents reliably reflect one and the same construct.

This high reliability concurs with the fact that the survey instrument can be used to examine the role of AR, VR, and AI in the improvement of marketing and sales strategies. It will help verify that the answers to the questions concerning the efficacy, engagement, personalization, and efficiency of these technologies in real estate marketing are not out of line and can be used for a further descriptive, correlation, or even regression model.

In brief, the scale will have the confidence to gauge the opinion of the respondents in terms of strategic role of AR, VR, and AI to enhance property marketing and sales performance in India.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
AR/VR property attracts more attention of buyers than the traditional advertisement	600	1	5	4.18	.743
Targeted marketing campaigns that use AI raise the awareness of relevant properties	600	1	5	4.34	.632
Ads using AR/VR on digital display enhance better brand recognition among developers	600	1	5	4.38	.655
The virtual tours enhance a more attention-grabbing experience when looking at properties	600	1	5	4.35	.720
AI chatbots enable buyers to engage in valuable and in-time answers	600	1	5	4.42	.644
AR/VR tools enhance marketing campaign to be more interactive and convincing	600	1	5	4.18	.814

AR/VR tours save me a lot of time making purchase decisions	600	1	5	4.39	.619
The presence of AI-generated suggestions makes the process of property selection more confident	600	1	5	4.19	.765
The use of AI/VR/AR reduces the necessity to make numerous visits to a place of purchase	600	1	5	4.26	.710
AR/VR tours also offer a touch of reality of the properties to add more trust to the marketing statements	600	1	5	4.39	.644
The AI Cephalopod tools contribute to clarifying the information about the property, as well as minimizing its incorrectness	600	1	5	4.36	.678
Marketing with the use of technology enhances openness between the purchasers and the builders	600	1	5	4.23	.748
Platforms using AI up the ante when it comes to post-sales customer service and support	600	1	5	4.23	.698
AR/VR applications allow seeing the changes or interior design in the future after buying them	600	1	5	4.19	.825
Long-term trust and interaction of the buyers and the developers are enhanced due to the use of AR/ VR/ AI	600	1	5	3.97	.942
Valid N (listwise)	600				

Table 4. 41 Descriptive statistics for role in marketing & sales

The descriptive statistics for the 15-item scale measuring the role of AR, VR, and AI in improving marketing and sales strategies in the Indian real estate sector show generally high positive responses from the 600 respondents.

Among the items, the highest mean scores were observed for **"AI chatbots enable buyers to engage in valuable and in-time answers" (Mean = 4.42, SD = 0.644)**, **"Ads using AR/VR on digital display enhance better brand recognition among developers" (Mean = 4.38, SD = 0.655)**, and **"AR/VR tours save me a lot of time making purchase decisions" (Mean = 4.39, SD = 0.619)**. These suggest that respondents perceive AI-driven interactions and AR/VR-based visualizations as particularly effective in engaging buyers, building trust, and reducing time spent on property selection.

Other items such as **"Targeted marketing campaigns that use AI raise the awareness of relevant properties" (Mean = 4.34, SD = 0.632)**, **"The virtual tours enhance a more attention-grabbing experience when looking at properties" (Mean = 4.35, SD = 0.720)**, and **"AR/VR tours also offer a touch of reality of the properties to add more trust to the marketing statements" (Mean = 4.39, SD = 0.644)** indicate strong agreement that these technologies improve engagement, awareness, and perceived authenticity in real estate marketing.

The lowest mean score is observed for **"Long-term trust and interaction of the buyers and the developers are enhanced due to the use of AR/VR/AI" (Mean = 3.97, SD = 0.942)**, indicating that while respondents recognize the immediate benefits of these technologies, some may perceive long-term relationship-building effects as relatively less pronounced.

Overall, the descriptive analysis reflects that AR, VR, and AI are considered highly effective tools for enhancing marketing attention, brand recognition, interactivity, buyer confidence, and time efficiency in the Indian real estate sector.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.919
Bartlett's Test of Sphericity	Approx. Chi-Square	3531.136
	Df	105
	Sig.	.000

Table 4. 42 KMO and Bartlett's test for role in marketing & sales

The KMO value and Bartlett Test of Sphericity reveals that the sample was adequate to be used in factor analysis. A Kaiser-Meyer-Olkin (KMO) measure of adequacy of 0.919, which is much greater than a recommended threshold of 0.6, indicates that factor analysis should be possible provided that the number of variables used is sufficiently high.

Moreover, Bartletts Test of Sphericity is significant (Chi-square = 3531.136, df = 105, $p < 0.001$), so the correlation matrix is neither an identity nor a unit matrix, and the variables are related well enough to warrant factor analysis.

Taken together, these findings establish that the information can be well utilized to identify the latent variables concerning the use of AR, VR, and AI in enhancing marketing and sales practices in the Indian real estate industry.

Communalities		
	Initial	Extraction
AR/VR property attracts more attention of buyers than the traditional advertisement	1.000	.406
Targeted marketing campaigns that use AI raise the awareness of relevant properties	1.000	.519
Ads using AR/VR on digital display enhance better brand recognition among developers	1.000	.668
The virtual tours enhance a more attention-grabbing experience when looking at properties	1.000	.575

AI chatbots enable buyers to engage in valuable and in-time answers	1.000	.504
AR/VR tools enhance marketing campaign to be more interactive and convincing	1.000	.535
AR/VR tours save me a lot of time making purchase decisions	1.000	.497
The presence of AI-generated suggestions makes the process of property selection more confident	1.000	.549
The use of AI/VR/AR reduces the necessity to make numerous visits to a place of purchase	1.000	.616
AR/VR tours also offer a touch of reality of the properties to add more trust to the marketing statements	1.000	.608
The AI Cephalopod tools contribute to clarifying the information about the property, as well as minimizing its incorrectness	1.000	.617
Marketing with the use of technology enhances openness between the purchasers and the builders	1.000	.626
Platforms using AI up the ante when it comes to post-sales customer service and support	1.000	.573
AR/VR applications allow seeing the changes or interior design in the future after buying them	1.000	.654
Long-term trust and interaction of the buyers and the developers are enhanced due to the use of AR/ VR/ AI	1.000	.742
Extraction Method: Principal Component Analysis.		

Table 4. 43 Communalities for role in marketing & sales

The communalities table indicates the percentage of variance of each one of the variables that is covered by the extracted factors in principal component analysis.

Initially each of the variables is treated as having a value of 1.000, as is typical with PCA. Upon extraction, the communalities lie between 0.406 and 0.742 which shows a significant collection of the variance in each variable is covered by underlying factors.

- Variables such as **"Long-term trust and interaction of the buyers and the developers" (0.742)** and **"Ads using AR/VR on digital display enhance better brand recognition among developers" (0.668)** have the highest extracted communalities, suggesting that they are well represented by the factors.
- Variables like **"AR/VR property attracts more attention of buyers than the traditional advertisement" (0.406)** have relatively lower communalities, indicating a smaller proportion of their variance is explained by the factor structure.

All in all, these findings show that the factors that were extracted explain a significant variance among the items, which validates the factorability of the data in their capacity to explain the importance of AR, VR, and AI in marketing and sales strategies in the real estate industry in India.

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.233	41.554	41.554	6.233	41.554	41.554	3.546	23.643	23.643
2	1.407	9.377	50.932	1.407	9.377	50.932	3.492	23.282	46.925
3	1.050	6.999	57.931	1.050	7.999	67.931	1.651	12.006	67.931
4	0.839	5.591	63.522						
5	0.722	4.817	68.339						
6	0.664	4.425	72.764						
7	0.575	3.831	76.595						
8	0.553	3.685	80.280						
9	0.511	3.410	83.690						
10	0.487	3.250	86.940						

11	0.460	3.066	90.006						
12	0.427	2.847	92.852						
13	0.388	2.585	95.438						
14	0.369	2.463	97.901						
15	0.315	2.099	100.000						
Extraction Method: Principal Component Analysis.									

Table 4. 44 Total variance for role in marketing & sales

The Total Variance Explained table offers an idea as to how much of the total variance of the data was covered by each factor that was obtained due to Principal Component Analysis (PCA).

Initial Eigenvalues: the first signify the variance described by each element prior to rotation The first component has eigenvalue 6.233 which explains 41.554 percent of the total variance. The third component and the second explain 6.999 and 9.377 percent respectively. The three initial components are jointly totalling 57.931 percent of the variance.

Extraction Sums of Squared Loadings indicate that the variance explained remains the same on the 1st 3 components indicating their significance.

Rotated Component Matrix[a]			
	Component		
	1	2	3
AR/VR property attracts more attention of buyers than the traditional advertisement	.545		
Targeted marketing campaigns that use AI raise the awareness of relevant properties	.654		
Ads using AR/VR on digital display enhance better brand recognition among developers	.798		
The virtual tours enhance a more attention-grabbing experience when looking at properties	.739		
AI chatbots enable buyers to engage in valuable and in-time answers	.620		
AR/VR tools enhance marketing campaign to be more interactive and convincing	.683		
AR/VR tours save me a lot of time making purchase decisions	.608		
The presence of AI-generated suggestions makes the process of property selection more confident		.691	
The use of AI/VR/AR reduces the necessity to make numerous visits to a place of purchase		.704	
AR/VR tours also offer a touch of reality of the properties to add more trust to the marketing statements		.721	
The AI Cephalopod tools contribute to clarifying the information about the property, as well as minimizing its incorrectness		.735	
Marketing with the use of technology enhances openness between the purchasers and the builders		.757	
Platforms using AI up the ante when it comes to post-sales customer service and support			.413
AR/VR applications allow seeing the changes or interior design in the future after buying them			.746

Long-term trust and interaction of the buyers and the developers are enhanced due to the use of AR/ VR/ AI			.830
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 5 iterations.			

Table 4. 45 Rotated component martix for role in marketing & sales

Rotation Sums of Squared Loadings re-allocates the variance in order to gain simple interpretable factor structure. In rotated results, first three factors account 23.643%, 23.282% and 12.006% of the total variance each, with a total of 67.931%.

The finding shows that there are three key variables that adequately characterize the data well, and to ensure good interpretability of the data. These variables can be explained as latent constructs of the role of AR, VR and AI to improve marketing and sales strategy in Indian real estate industry.

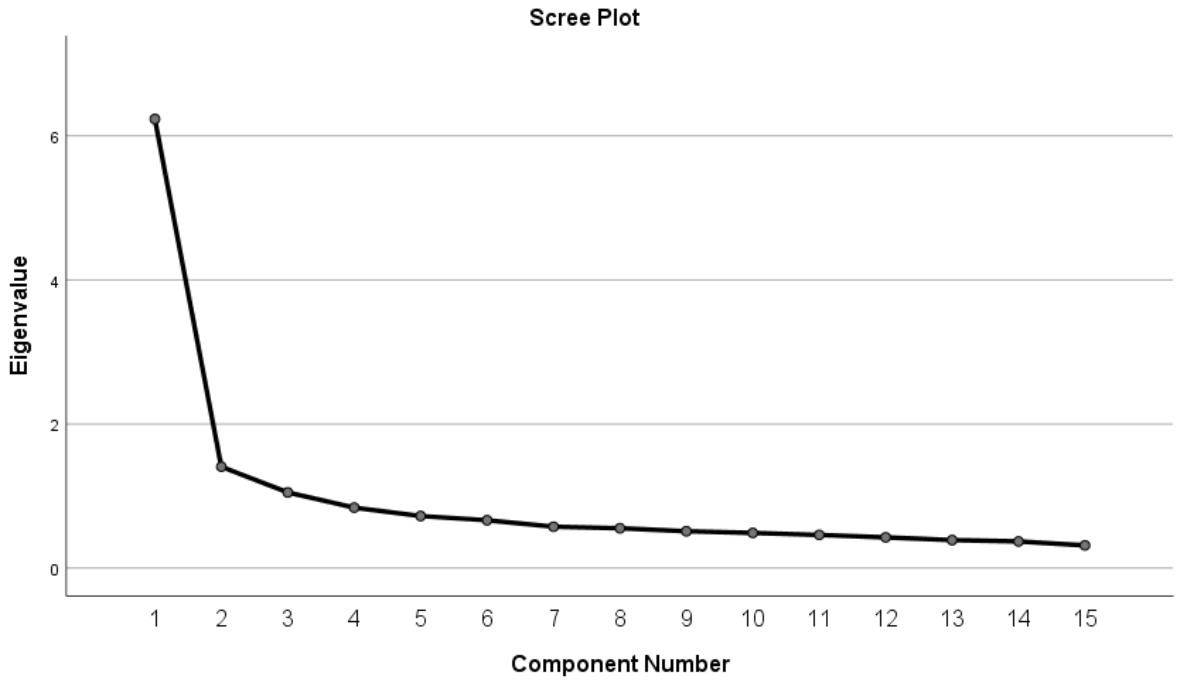


Figure 4. 9 Scree plot for the AR, VR and AI

Scree plot has very acute drop in eigenvalues between the first and second component but then the slope of the eigenvalues is relatively flat. This shows that the first and the second dimensions capture the majority of the variance present in the data, with the former capturing a significant percentage alone. Being based on the second component, the second component has eigenvalues of less than 1 and, therefore, has little additional explanatory power and thus should be omitted in the meaningful analysis.

Rotation solution of the component matrix shows that the items can be clearly clustered into three components. The first component is mainly loaded on the factors concerning the portion of AR/VR in capturing attention, increasing brand recognition, enhancing interactivity, time-saving, and realistic property experiences. The second element underlines the role of AI tools in enhancing the confidence in property selection, minimizing redundant visits, making information clearer, creating openness, and reinforcing post-sales support. The third element involves experiences of future and trust-building which involves the AR/VR use to demonstrate post-purchase transformations and the development of future trust and engagement between the buyers and the developers in the long run. Comprehensively, the rotated solution implies that the implementation of AR/VR and AI in real estate marketing may be viewed in the light of three underlining dimensions, namely: interactive engagement, decision-making support, and long-term trust development.

Objective4: To evaluate the potential implications of adopting artificial intelligence and augmented & virtual reality technologies in real estate in India.

Reliability Statistics	
Cronbach's Alpha	N of Items
.895	17

Table 4. 46 Reliability statistics for potential implications

In reliability analysis of the scale consisting of 17 items, it was found that the value of Cronbach Alpha was 0.895, which is high. Cronbach alpha is commonly applied to determine the reliability of a series of items in a questionnaire reflecting how well related the items form a group. A value superior to 0.8 is usually taken to signal good reliability and the calculated value of 0.895 is within the limits, that is, the items repeatedly and reliably measure the same underlying construct. The reliability is upper range (good) and proves that the scale is reliable and can be used in further statistical evaluations where it can be implemented, i.e., through correlation, regression, or factor analyses. On the whole, the results suggest that the 17-item scale can be rounded employed to obtain data, since it is consistent in measuring the target concept.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
More prompt property search and matching with AI algorithms	600	1	5	4.12	.856
Immersive AR/VR property tours to provide a superior customer experience	600	1	5	4.18	.743
Enhanced accuracy in estimating the property and its price by use of using AI tools	600	1	5	4.34	.632
More openness and confidence in property marketing	600	1	5	4.38	.655
Increased rate of conversion of sales as a result of involving virtual experiences	600	1	5	4.35	.720
Minimized In-person visits to the business sites	600	1	5	4.42	.644
Marketing and promotional cost effectiveness	600	1	5	4.18	.814

An improvement in the use of digital systems in real estate dealings	600	1	5	4.39	.619
AI-enhanced market forecasting and demand projection	600	1	5	4.19	.765
Better tailored advertising activities	600	1	5	4.26	.710
Abbreviated paperwork and legal confirmation using AI technologies	600	1	5	4.39	.644
Better project management, resource utilization	600	1	5	4.36	.678
Very expensive to introduce the use of AR/VR and AI technologies	600	1	5	4.23	.748
The need to be digitally literate by buyers and agents	600	1	5	4.23	.698
Threat of too heavy dependence on technology causing less human touch	600	1	5	4.19	.825
Fears of an invasion of privacy and malicious hacking	600	1	5	3.97	.942
Low rural or less tech-savvy market accessibility	600	1	5	3.75	1.065
Valid N (listwise)	600				

Table 4. 47 Descriptive statistics for potential implications

The survey descriptive statistics offer a clue to the possible consequences of implementing both Artificial Intelligence (AI) and Augmented & Virtual Reality (AR/VR) technologies in the real estate set up in India. These responses depict an overall portrayal of these technologies as being very positive with the averages lying between 4.12 and 4.42, implying there is a general agreement among the respondents on how these technologies are beneficial. Particularly, they view AI-driven tools to strengthen property search and matching (Mean = 4.12, SD = 0.856), be more precise in property valuation and pricing (Mean = 4.34, SD = 0.632), and help predict the market and demand better (Mean = 4.19, SD = 0.765). Analogously, it is anticipated that AR/VR technologies will generate immersive property tours, hence, enhancing customer

experience (Mean = 4.18, SD = 0.743) and raise the conversion rate in sales due to the virtual experience (Mean = 4.35, SD = 0.720).

In addition to operational efficiency, the respondents identify strategic advantages like enhanced marketing (Mean = 4.26, SD = 0.710), better project management and resource deployment (Mean = 4.36, SD = 0.678), cost-effective promotions (Mean = 4.18, SD = 0.814), and minimal need to visit the sites (Mean = 4.42, SD = 0.644). These together indicate that the AI and AR/VR implementation can help to streamline, precise and customer-focused organizational experience of real estate transactions in India.

Nevertheless, certain problems were also brought up. Our respondents cite the following emerging issues; the prohibitive nature of compliance to the technologies (Mean = 4.23, SD = 0.748), the fact that buyers and agents should be technologically literate (Mean = 4.23, SD = 0.698), and the danger of becoming over-reliant on technology to create a less humanistic approach to real estate deals (Mean = 4.19, SD = 0.825). Other barriers that must be addressed during technology adoption include privacy and cybersecurity concerns (Mean = 3.97, SD = 0.942) and inaccessibility of the technology to rural or less tech-savvy markets (Mean = 3.75, SD = 1.065).

On the whole, these results indicate that the choice of Indian real estate to adopt the AI and AR/VR would be highly beneficial in terms of efficiency, customer experience, and competitiveness in the market, but also necessitate to give proper weightage to cost, digital literacy, cybersecurity, and inclusivity in the market. These implications reveal the transformational advantages, as well as the strategic factors that must be taken into consideration in implementing it successfully.

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
More prompt property search and matching with AI algorithms	600	4.12	.856	.035
Immersive AR/VR property tours to provide a superior customer experience	600	4.18	.743	.030

Enhanced accuracy in estimating the property and its price by use of using AI tools	600	4.34	.632	.026
More openness and confidence in property marketing	600	4.38	.655	.027
Increased rate of conversion of sales as a result of involving virtual experiences	600	4.35	.720	.029
Minimized In-person visits to the business sites	600	4.42	.644	.026
Marketing and promotional cost effectiveness	600	4.18	.814	.033
An improvement in the use of digital systems in real estate dealings	600	4.39	.619	.025
AI-enhanced market forecasting and demand projection	600	4.18	.765	.031
Better tailored advertising activities	600	4.26	.710	.029
Abbreviated paperwork and legal confirmation using AI technologies	600	4.39	.644	.026
Better project management, resource utilization	600	4.36	.678	.028
Very expensive to introduce the use of AR/VR and AI technologies	600	4.23	.748	.031
The need to be digitally literate by buyers and agents	600	4.23	.698	.028
Threat of too heavy dependence on technology causing less human touch	600	4.19	.825	.034
Fears of an invasion of privacy and malicious hacking	600	3.97	.942	.038
Low rural or less tech-savvy market accessibility	600	3.75	1.065	.043

Table 4. 48 One sample statistics for potential implications

The table of one-sample statistics gives the average, standard deviation, and standard error of the mean of each element concerning the adoption of the AI technology and AR/VR in the Indian real estate sector. Having a sample group of 600 respondents, the findings show that most items have high scores of usually above 4.0, which shows that there is strong consensus among respondents regarding positive implications of such technologies.

Statements by the respondents that AI and AR/VR implementation promotes the effectiveness of property search (mean = 4.12, SE = 0.035), the enhancement of customer experience via the provision of immersive tours (mean = 4.18, SE = 0.030), and heightened accuracy in valuing a property (mean = 4.34, SE = 0.026). Likewise, the marketing and operational advantages-associated items (e.g., improved project management (Mean = 4.36, SE = 0.028), decreased in-person visits (Mean = 4.42, SE = 0.026), and shorter work paper using AI (Mean = 4.39, SE = 0.026)) were also scored high which signifies the perceived efficiency, cost-effectiveness, and convenience.

Meanwhile, some of them indicated pressing issues and possible concerns. The limiting costs involved due to implementation (Mean = 4.23, SE = 0.031), digital literacy requirements of buyers and the agents (Mean = 4.23, SE = 0.028), and the potential high human interaction became important considerations. Slightly less relevant are privacy and cybersecurity concerns (Mean = 3.97, SE = 0.038) or accessibility concerns of markets that are more rural or less tech-savvy (Mean = 3.75, SE = 0.043).

In general, the statistics prove the positive attitude towards the usage of AI and AR/VR in Indian real estate to enhance the efficiency, accuracy, and customer engagement and identify the financial, digital literacy, and ethical barriers which serve as prerequisites to the AI and AR/VR usage. The relatively small values of standard errors between items indicate that the perceptions in this area are steady and trustworthy among the large number of survey participants.

One-Sample Test						
	Test Value = 0					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
More prompt property search and matching with AI algorithms	117.890	599	.000	4.118	4.05	4.19
Immersive AR/VR property tours to provide a superior customer experience	137.829	599	.000	4.180	4.12	4.24
Enhanced accuracy in estimating the property and its price by use of using AI tools	168.378	599	.000	4.342	4.29	4.39
More openness and confidence in property marketing	163.693	599	.000	4.378	4.33	4.43
Increased rate of conversion of sales as a result of involving virtual experiences	147.981	599	.000	4.352	4.29	4.41
Minimized In-person visits to the business sites	168.217	599	.000	4.422	4.37	4.47
Marketing and promotional cost effectiveness	125.838	599	.000	4.180	4.11	4.25
An improvement in the use of digital systems in real estate dealings	173.966	599	.000	4.395	4.35	4.44

AI-enhanced market forecasting and demand projection	134.018	599	.000	4.185	4.12	4.25
Better tailored advertising activities	146.790	599	.000	4.255	4.20	4.31
Abbreviated paperwork and legal confirmation using AI technologies	166.882	599	.000	4.388	4.34	4.44
Better project management, resource utilization	157.306	599	.000	4.357	4.30	4.41
Very expensive to introduce the use of AR/VR and AI technologies	138.590	599	.000	4.233	4.17	4.29
The need to be digitally literate by buyers and agents	148.415	599	.000	4.228	4.17	4.28
Threat of too heavy dependence on technology causing less human touch	124.351	599	.000	4.188	4.12	4.25
Fears of an invasion of privacy and malicious hacking	103.165	599	.000	3.967	3.89	4.04
Low rural or less tech-savvy market accessibility	86.237	599	.000	3.748	3.66	3.83

Table 4. 49 One sample test for potential implications

Results of One-Sample Test confirm the findings of insufficiency of AI and AR/VR adoption in the Indian real estate market place. In this case, we were used a test value of 0 meaning that we are analysing whether the mean response to each question is significantly different to 0 (i.e. whether respondents agree that these items are relevant).

A t-test on all items revealed a t-range of 86.237 to 173.966 and p-value (Sig. 2-tailed) all at .000, which shows that the mean of all responses is significant and extremely different from zero. This supports the fact that the respondents well support the position that AI and AR/VR technologies have significant consequences within the realm of real estate.

The results indicate average differences on the items with range varying between 3.748 and 4.422 that denote high levels of agreement. As an illustration, reducing the number of in-person visits to business premises has the largest mean difference of 4.422 (95% CI: 4.372-4.47), which is reflective of a high level of agreement on impacts on efficiency. Likewise, property estimating and improvement in digital systems (Mean = 4.342, 95% CI: 4.29 to 4.39 and Mean = 4.395, 95% CI: 4.35 to 4.44) are considered important advantages.

Items that reflect the challenges, e.g. the privacy concerns (Mean = 3.967, 95% CI: 3.8904.04), and poor rural/less tech-savvy market accessibility (Mean = 3.748, 95% CI: 3.6603.83), also present significant t-values and indicate that the members are aware of them.

In general, one-sample t-test shows that the idea of adopting AI and AR/VR technologies in Indian real estate is viewed as a highly effective change that enhances operational efficiency, customer experience, and marketing effectiveness and triggers concerns regarding a cost-related impact, digital literacy, cybersecurity, and accessibility. The general agreement between the 600 respondents is evident with close to identical t-value and narrow confidence intervals.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	126.621[a]	16	.000
Likelihood Ratio	102.581	16	.000
Linear-by-Linear Association	60.909	1	.000
N of Valid Cases	600		
a. 12 cells (48.0%) have expected count less than 5. The minimum expected count is .04.			

Table 4. 50 Chi-square test for potential implications

To determine the relationship between categorical variables concerning adoption of AI and AR/VR technologies in the Indian real estate, the chi-square test was run. The results indicated r= 126.621, df = 16 and p-value =.000 which were statistically significant, thus revealing that there was a significant association between the two variables. Correspondingly, the Likelihood Ratio (102.581, p = .000) and Linear-by-Linear Association (60.909, p = .000) prompted that this is a significant relationship and indicated that a consistent linear trend exists. These results indicate that the perceptions and the experience of respondents with AI and AR/VR adaptation are not separate but positively correlated with other categorical dimensions. It can be observed, however, that 12 of the cells (48 percent) had expected counts less than 5, with a minimum expected count 0.04, which could impact the credibility of the chi- square approximation to some extent. In general, the analysis reveals that there is a high significant association among categorical variables implying that the impacts of both AI and AR/VR technologies on operational efficiency, marketing effectiveness, customer experience, and challenges related to them are equally significant with one another in the Indian real estate industry.

Hypothesis Testing Results

S.NO.	Statements	Decision
H0	There are no significant key factors influencing the adoption and application of AR, VR and AI technologies in the real estate sector.	Rejected
H1	There are significant key factors influencing the adoption and application of AR, VR and AI technologies in the real estate sector.	Accepted
H0	There are no significant opportunities and challenges using AI and VR & AR in the real estate sector in India.	Rejected
H1	There are significant opportunities and challenges using AI and VR & AR in the real estate sector in India.	Accepted
H0	There are no significant role of augmented reality, virtual reality, and artificial intelligence in improving marketing and sales strategies in the Indian real estate sector.	Rejected
H1	There are significant role of augmented reality, virtual reality, and artificial intelligence in improving marketing and sales strategies in the Indian real estate sector.	Accepted
H0	There are no significant potential implications of adopting artificial intelligence and augmented & virtual reality technologies in real estate in India.	Rejected
H1	There are significant potential implications of adopting artificial intelligence and augmented & virtual reality technologies in real estate in India.	Accepted

Table 4. 51 Hypothesis test results for potential implications

Conclusion and Summary

The statistical testing and statistical analysis of the demographic data gives a clear and full picture of how augmented reality (AR), virtual reality (VR), and use of artificial intelligence (AI) are viewed as helping to make better marketing and sales strategies in the Indian real estate loan paper industry. The demographic tables show that the survey participants are fairly non-hateful of a cross-section of consumers and other real estate stakeholders, as ages varied, income varied and professional experience varied. This variety has made the insights identified to be relevant to a broad range of both consumer groups and industry practitioners to enhance the relevance of results.

The high value of Cronbach Alpha, indicating internal consistency of the scale, allows concluding about its high reliability, which justifies the selection of the 15 items used to assess the role played by AR, VR, and AI in the marketing of real estate. It implies that the gathered data is of solid quality and can be counted on when drawing reasoned conclusions and giving recommendations. In the same manner, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (0.919) and the significance of Bartlett Test of Sphericity ($p < 0.001$) justify the appropriateness of the data used to conduct the factor analysis and the strength of relationships among the items.

The Principal Component Analysis (PCA) also highlights the strength of data in form of structure. Three of the greatest components were identified that explained an approximate amount of 67.93 percent total variance which is considerably large in terms of behavioral and market related research. This means that all the variables have a significant sufficient proportion of variation in perceptions of respondents to AR, VR and AI in marketing. Among them, the first one is connected with immersive experiences and customer engagement due to AR/VR technologies, the second one is the notion of AI-based personalization and predictive analytics, and the third one is connected with the long-term trust, after sales support, and transparency. The results of these studies are overall indicative of the fact that visualization tools and immersion would be instrumental in changing marketing campaigns for real estate-related solutions and enhance customer experiences in the sector by relying on AI-based insights that are data-driven.

The communalities table demonstrates that some of the variables, including the capability of AR/VR software to deliver a realistic experience of properties, the role of AI in creating

personal recommendations, and the virtual tours that lead to fewer physical visits to the sites, are associated with the extraction values over 0.5, therefore, contributing to the overall factor structure. This illustrates that buyers highly rate functions that save time, add credibility and the ability to visualize better. AI-driven predictiveness and the use of chatbots, in their turn, are instrumental in increasing engagement levels in real-time and stimulating buyer confidence.

ANOVA findings prove that there are significant differences in how people perceive the challenges related to the implementation of AR, VR, and AI technologies in advertising real estate. Considerations like costly implementation, non-standardization, complex technology, and data privacy issues are some of the biggest obstacles to adoption, although there is great potential of such technologies in transforming the methods of marketing. This implies that although the stakeholders acknowledge the advantages of such tools in enhancing brand recognition, cutting short the time of making decisions, and facilitating improved customer service, practical factors such as cost and trust, are issues of concern in relation to a broad usage of such tools.

Overall, the results that all the tables give indicate that there is a high appreciation of the potential role of AR, VR, and AI as strategic tools of enhancing marketing and sales in real estate sector in India. The technologies provide unrivalled ways to improve customer interaction, brand awareness, organizational decision-making, and openness. Nevertheless, the industry will face the problem of infrastructure preparedness, training, affordability, and safety to make integration successful. The solutions to these barriers should be targeted towards cost optimization, user trainings, and the creation of industry-wide standards, which should be pursued in the future. When deployed responsibly AR, VR, and AI not only revolutionise the marketing and selling strategies but also have the potential to revolutionise the customer experiences as well, setting the stage of a more digital, transparent and customer centric recently in India.

Chapter V: DISCUSSION

Discussion on Objective 1: To identify and analyse key factors influencing the adoption and application of AR, VR and AI technologies in the real estate sector.

5.1 Factors influencing the adoption and application of AR, VR and AI

The identification and assessment of main factors that affect the use and adoption of AR, VR, and AI technologies in the real estate sector are necessary in order to comprehend the drivers behind the digital change that influences the real estate sector. The results of this research prove that the adoption of such technologies is mostly preconditioned by the issues related to customer experience development, operational efficiency, competitiveness in the market, and technology preparedness.

The improvement of the customer experience is one of the most critical aspects that contribute to the application of the AR, VR, and AI technologies in the real estate industry. Buying a house is a high involvement purchase that needs a lot of information and security among the consumers. Embodied in AR and VR technologies, the concept of immersive and interactive property experience is achieved, and the visualization of the properties appears in real time, even prior to the completion of the construction process. Walkthrough, 3-dimensional models, and panorama imaging give clients a feeling of a proprietary and lower uncertainty in the choice. This fits in the growing consumer tendency of preferring convenience and transparency especially among young and tech-savvy millennial and Gen Z customers who value digital interactions more than conventional processes (Ronzon *et al.*, 2025).

At face value, IA supplements current customer experience enhancements with its ability to provide personalization and predictive analytics. The algorithms draw on consumer behaviours, preferences and query patterns to provide custom recommendations of properties. Moreover, the chances of AI-driven chatbots increasing interaction with the customers 24/7, 7 days a week are high, as they can answer the questions and make their path in the property search easy and comfortable. The use of these applications will greatly lower the effort and time it takes to customers in arriving at their decisions hence the adoption of the technology in real estate firms is a competitive requirement.

The other important variable affecting adoption is the possibility of improving efficiency and cost-saving in operations. Conventional real estate marketing system is not only intensive in resources but also time-consuming activities because of physical visits, printed brochures and physical model houses. VR and VR also have the advantage of removing the many site visits because they can give virtual tours thereby saving cost on travel and manpower. Developers are also able to highlight under-construction or conceptual properties without incurring the costs of setup physical presentation (Vanaja and Reethika, 2022).

AIs utilize internal efficiency through automation of processes undertaken e.g. lead generation, client follow-ups and documentation. An example is that the AI-enabled CRM systems deliver structured customer data to real estate companies that can accurately predict and make decisions. Predictive analytics can also allow companies to sell properties at different prices according to the level of demand thus optimizing profits. These efficiencies serve as a strong motivating factor to the real estate firms to embrace and incorporate the use of the technologies in their businesses.

In a real estate market that is getting intensely competitive, it is through the adoption of technology that is becoming a strategic point of difference. Developers and brokers that use AR, VR, and AI technologies also have a competitive advantage since they are viewed as progressive and interested in the needs of their clients. An immersive experience and AI-based personalization increases brand perception, draws customers with high technological literacy, and loyalty towards a brand (Joshi V. N, 2015; Raheja and Baijal, 2024). Additionally, the use of technology denotes openness and professionalism which are key features that were found lacking in a sector that has been accused of untrustworthiness and information asymmetry.

The COVID-19 pandemic led to its rapid growth since the reduced physical contact required property transactions to use no-contact services and made remote tours based on AR/VR and remote digital engagement with the help of AI more relevant. Technological preparedness has become one of the main success factors of real estate companies even after the pandemic since consumer demands align with the digital-first solutions.

The willingness of organizations to implement these technologies is also very critical. Companies with strong IT infrastructure, quality workforces and accessibility to quality internet connectivity have better chances of adopting AR, VR, and AI. On the other hand, the lack of technical knowledge as well as insufficient infrastructure are the major obstacles,

especially among small and medium-sized real estate enterprises. The results of the research indicate that a company that has its presence in the metro cities depicts a higher adoption rate because of favourable digital ecosystem, but in tier-2 and tier-3 cities, the adoption is limited due to cost boundaries and talent supply.

The fact that integration into other systems is performed easily determines the adoption decision in addition. Property dealing companies want to use the technology that can easily be incorporated with their existing CRM applications and digital promotional systems without significantly affecting them. The scalability and customization capabilities of the AR/VR vendors will thus have higher chances of acceptance within the industry.

Consumer trust and perception of risk towards digital technologies is another one of the factors. Real estate business is a business that entails great deals of money and the customers desire absolute accountability in the transaction (Raheja and Baijal, 2024). AR and VR technologies can also minimize uncertainty as they can provide a clear picture of the views and features of the property, establishing the credibility of the statements of the developer. Predictive Models powered by AI help to increase confidence in pricing and investment advice. Security issues related to the protection of information, its misuse, and insincerity of online representations are some of the psychological obstacles to both clients and programmers. It is necessary to tackle such concerns by implementing and enforcing effective cybersecurity, regulatory compliance, and ethical practices in the use of AI to facilitate wide-scale adoption.

This is because demographic factors including their age, income levels, and education levels determine the readiness of customers to accept these technologies. They recommend that the preferences toward digital experiences enabled by AR and AI as well as VR tend to be higher among younger buyers with a higher level of disposable income and those who are more digitally literate. Customers in urban areas are more adaptive to the technology-driven property solutions as opposed to their rural or semi-urban counterparts. This is why it is essential to come up with specific digital marketing strategies that will serve those customers that are more technologically adaptable to the changes.

Overall, the process of adopting and implementing the AR, VR, and AI technologies in the real estate sector is preconditioned by both technological, economical, social, and strategic aspects. Although the customer experience, the effective functioning of operations, and competitive advantage are strong enablers, the cost aspect, level of digital readiness, and risk perception

remain a barrier to the widespread implementation. These results highlight the importance of capacity-building programs, vendor assistance, and policy measures to reduce the obstacles to the adoption of digital transformation and bring it to an industry level.

Discussion on Objective 2: To investigate opportunities and challenges using AI and VR & AR in the real estate sector in India.

5.2 Opportunities and challenges using AR, VR, AI in the real estate sector

By integrating Artificial Intelligence (AI), Virtual Reality (VR) and Augmented Reality (AR) in real estate business in India a lot of opportunities open up to reinvent business models and customer experiences. Simultaneously, it has many drawbacks that should be overcome to guarantee successful implementation. This topic examines these prospects and challenges in details to realize their implication to the industry.

Among the most considerable advantages that AI, VR, and AR have to offer to the real estate industry, the increased customer engagement and experience are to be mentioned. The traditional approach to property purchases includes a process of visiting the place of purchase physically, which takes a lot of time and may be inconveniencing to many property buyers especially those living in other cities or countries (Mohameddhaha, 2023). VR and VR technology will offer an alternative since potential buyers will be able to take virtual tours of their properties within the confines of their homes. This technological change becomes especially topical in India as the purchasers are often ready to spend their money in the projects developed in another state or even in a foreign country. AR applications enable customers to see the interiors of properties, modify layouts and test the different styles of décor before making a purchase. VR simulations of properties that are still under construction addresses this aspect of lack of information as a fallacious gulf between the developer and the buyer as it solicits trust and, therefore, alludes to more sound judgment. These virtual experiences are also enhanced with the help of AI that is able to cater suggestions of property depending on the preferences, budget and location of buyers. Chatbots and virtual assistants led by AI also ensure that a customer is not left to their wits about the process, being available to answer questions instantly and making the overall process of buying progress more efficiently.

Another high opportunity is on operational efficiency and cost-saving. Real-estate firms usually spend a lot of money in printing physical brochures, sample apartments, and making

frequent trips to site visits by prospective buyers. The adoption of the AR and VR technologies can dramatically cut these costs as there is no necessity in physical setups. Converted virtual property tours are more economical and they do not only save a lot of time, but also speed up the pre-sales procedure. AI opens another level of efficiency in terms of optimization of marketing campaigns and prices with predictive analytics. AI algorithms can help developers to understand the competitive pricing and improve inventory management through an analysis of the demand, location advantages, and trends in the market. In addition, AI-enabled tools can automate the lead generation and classification processes, so sales teams can effectively target the right audience and get a higher conversion rate.

The implementation of AR, VR and AI creates possibilities of reaching new market. These technologies will allow real estate firms to locate customers in areas that are not geographical, such as the Non-resident Indians (NRIs) and foreign investors. Virtual exhibitions of properties, events, and immersive marketing of projects helps works of developers to be presented worldwide without their physical presence (Sarkar *et al.*, 2020). With the disruption of internet penetration and the increasing number of smartphone users in India, these inventions would be in a position to accommodate the rising number of technologically empowered millennials and Gen Z consumers who are not interested in conventional ways of doing business. Not only can developers use this digital outreach to tap into new markets, but it also creates a stronger competitive edge in a continuously globalizing real estate market.

One more area where AI produces a ground-breaking change is data-driven decision-making. Using customer preferences, financial capability, and behavioural pattern, AI helps the developers to make an informed decision in project design, pricing, and marketing strategy. Predictive models are capable of predicting the trend in the demands and as such, developers could match their products with market predictions. Sentiment analysis of the customer reviews also supports customer contentment and business strategies. Such an analytical aptitude will make real estate firms competitive in a dynamic market (Al-Ansi *et al.*, 2023).

Along the lines of these opportunities, there are a few obstacles that prevent the proliferation of AI, AR and VR in the Indian real estate business. A major problem has been high cost of implementation. Production of immersive VR content, development of AR apps and integration of AI solutions into the existing systems will take a toll on the budget. In the case of small medium-sized developers on a modest budget, such investment would not be possible especially when the cost of using traditional marketing strategies is giving a reasonable

outcome. Such a financial barrier will be an obstacle to the acceleration of digital transformation in the industry.

The other significant challenge is absence of technical skills. The implementation of such innovative technologies presupposes the talents of specialists who will be able to create, support, and improve the application of AR/VR and AI-based technologies. However, the Indian real estate industry has had the habit of using traditional marketing methods and there is lack of talents that are educated on such technological novelties. Recruitment of such talent or training of current employees may also be costly and time consuming to the developers, further straining them.

The limitation of digital infrastructure is another contributor to this hurdle especially in the tier-2 and tier-3 cities where most of the real estate projects are located. AR and VR must be supported by high-speed network connection and access to highly sophisticated devices. In some areas where connectivity to the internet is poor and network stability is hampered, adoption of such technologies is not easy. This infra-structural deficit poses a digital divide in which developers cannot maximize the use of such innovations in semi-urban and rural locations (Amtul Wahab *et al.*, 2024).

Another important problem is consumer resistance The decisions to purchase property are emotive and require extensive financial investment by the person making the decision hence they are not ready to give themselves fully to virtual experiences. In India, although the level of digital literacy is increasing, there is significant portion of consumers who would still want to undertake physical site visits before coming to the final decision. Fears on privacy of data and the validity of virtual representations of property further compound such resistance. False virtual tours would impair the relations of developers with customers and the trust confidence of this party, so it is essential to be as transparent as possible with the digital products.

There is the additional complication of integration and compatibility. A substantial number of real estate companies still use unreliable Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP) solutions that are not compatible with the future technologies AR, VR and AI. The replacement of these systems demands time, financial resources, and technical support to up-grade it to digital tools, making replacement more complex. Also, using AI can result in issues related to data protection and the agreement with data protection rules like the Digital Personal Data Protection Act in India.

On the one hand, there are opportunities to balance, and on the other hand, there are the challenges. Real estate companies are advised to follow a staged process, beginning with a low-cost option like AI chatbots and simple AR applications and, after passing a certain initial stage, considering more advanced VR installations. Working together with technology providers and startups can help in bridging the gap of skills shortage and share expertise and resources that bring cost down in implementation of these technologies. One can speed up the process with the help of government initiatives stimulating digital change in real estate and financial support of adopting the new technologies. Furthermore, it is necessary to provide consumers with information regarding the advantages of these technologies and security protocols to gain the trust and make people accept it.

To sum up, AI, AR, and VR technologies provide remarkable chances of the customer engagement development, efficiency improvement of operations, as well as the increase of the marketing range in terms of real-estate market in India. By focusing on these issues in strategic planning, capacity-building initiatives and policy support, real estate companies can achieve the full potential of these technologies and consequently promote innovation and sustainable development of the sector.

Discussion on Objective 3: To examine the role of augmented reality, virtual reality, and artificial intelligence in improving marketing and sales strategies in the Indian real estate sector.

5.3 Role of AR, VR & AI in improving marketing and sales

Indian property industry has long been depending on traditional marketing techniques that include print promotion, bill boards, media commercials and personal visits. Nonetheless, the growing digitalization of business and the transformation in the behaviour of consumers have forced the developers to consider innovative ways to attract and retain customers. The use of AR, VR, and AI has become extremely valuable as it helps redefine the processes of marketing, sales in the real estate sector. This discussion will discuss the impact that these technologies are having in altering the marketing strategies and in giving customers a better engagement as well as conversion rates, and the challenge involved with interest in adopting such technologies.

Among the most relevant functions of AR, VR, and AI in marketing is their capacity of giving immersive experiences that surpass the conventional methods of promotion. The stakes of any real estate transaction are both highly monetary and emotional and thus it is incredibly important that developers accurately and thoroughly describe the property being sold. VR can help developers provide virtual tours of the property to interested parties so that they could take a 360-degree look at the property before visiting the location physically. It is convenient in the context of the under-construction projects when they cannot be visited. With the VR simulations, buyers can see the spatial data layout, the interior, and other amenities of the neighbourhood, which will decrease the levels of uncertainty and will enable faster decision-making(Verma, 2025). Not only does this level of immersion increase the confidence a customer has, it also puts the developers a notch ahead of the competition in terms of marketing due to it being more immersive than others are.

Augmented Reality, in turn, gives customers more freedom to engage the features of the properties in a way that is more personal. Buyers can view AR applications to view the property with certain furniture, decoration or modifications already added to it. As an example, customers can use the AR-enabled mobile applications to see what it would look like to place virtual furniture in their rooms or to paint a wall to a colour that they prefer. This degree of personalization creates a feeling of a personal relationship with the property and connection even before making the purchase. As well, real estate companies are wrapping in a more active experience that the mere documentation of a location cannot convey through AR within their marketing campaigns(Akinleye, 2017).

Artificial Intelligence offers an additional layer to the marketing strategy of personalization and predictive analytics based on data. Machine Learning algorithms are used to study the preferences of customers, their search practices, customer income, and past interactions to provide customers with suggested properties according to their needs. This focused turn acts to diminish time consumed in the property search processes and increases the probability of conversion. The AI-supported chatbots and virtual assistants are one more area in which the chatbots may be used by the real estates and contribute to customer engagement strategies. These smart systems can give quick service of customer queries, take them through the property lists and book virtual visits as well as calculate finances like EMI estimates. Automation of these tasks allows the developers to provide 24-hour availability of information, which increases customer satisfaction and trust (Crevoisier *et al.*, 2025).

Digital advertisement is also getting more efficient with the incorporation of AI in marketing campaigns. AI tools provide the best placements of the ads even in social media, user engagement, and campaign performance and analysis to alter the strategies on real-time. As an example, AI would be able to determine what aspects of a property people are most interested in and use this information to focus future advertisements when they mention that attribute. This is the accuracy that was not achievable using the traditional marketing techniques. In addition to this, using AI-driven sentiment analysis, developers can get a feel of how their customers are receiving their products or services and make any and all necessary adjustments accordingly.

AR, VR and AI technology helps in remote selling, which has become critically important in the after-Covid time. Virtual property displays (including virtual property shows) and online sales events driven by the technologies have become a standard, as many of their customers are wary of traveling to property visits. Developers are able to showcase numerous properties to an international audience without the logistic effort of real-world events. This saves the cost of marketing at one time, and increases the number of customers to include NRIs and foreign investors. These virtual events have interactive components such as live chat assistance, 3D property tours, and artificial intelligence-based suggestion tools, which makes them smooth and fun to the buyers.

Although these technologies can benefit marketing and sales strategies considerably, there is a challenge to integrate them into the strategies. Expensive costs of implementation are a great obstacle to most developers, especially the small and medium firms. The creation of quality VR products, developments of AR applications, and AI-enabled platforms costs too much in terms of technologies, infrastructure and human resources. Moreover, keeping these systems functional and upgrade them in accordance to the changing customer anticipations is a continuous cost. In case of the firms working in cost-sensitive markets, financial constraints may restrict its ability to take leverage on these technologies (Doheir and Mismar, 2024).

Consumer adaptation, another difficulty, is also a problem that needs to be overcome. The emergence of digital literacy in India notwithstanding, there remains a large segment of buyers that are inclined towards having a property visiting experience before deciding to commit to a purchase. AR simulations and virtual tours are innovative solutions that, however, might not be able to substitute the physical inspection of a property and its tactile experience. Moreover, there are also a group of customers who are suspicious of the correctness of virtual images as

they are afraid that a real object does not match the one presented in a digital form. This lack of confidence is becoming a challenge among the developers to make the customers trust on digital experiences in high value investments.

Other technical problems like compatibility and accessibility are some other factors that pose challenges to the effectiveness of these technologies in the marketing sphere. VR has high standards of equipment and network limitations that may not be accessible to all of its possible consumers especially in tier-2 and tier-3 cities. AR features would necessitate the use of smartphones with demanding processor capabilities thereby excluding a certain population of purchasers. All these constraints are capable of curbing the reach of technology-oriented marketing campaigns and further make a case of hybrid strategies where both offline and online marketing campaigns are incorporated together.

The issue of data privacy and security with respect to AI-driven marketing tactics creates an additional problem. Performance based on AI systems uses large amounts of customer information to create life-like interactions. Any compromise of this data can however harm the reputation of the developer and this will lose trust in the customer. A key factor to reduce these risks is compliance with data protection laws including the Digital Personal Data Protection Act in India. Developers should adopt effective cyber security measures and disclosure with regards to how they will be using data to create trust among customers (Gao *et al.*, 2024).

These issues notwithstanding, the prospects of the Indian real estate sector through the use of AR, VR and AI to drive marketing and selling strategies is huge. The secret is in implementing the planned steps, that is, either placing an emphasis on technological novelty or ensuring the financial viability and acceptance by customers. Developers can start by incorporating the affordable features like the AI chatbots, and virtual walkthroughs with the time before upgrading to heavy VR equipment. Possible solutions can be dealt with by forming strategic partnerships with technology companies and start-ups, which can help in breaking down barriers of technical and monetary costs by offering the scalable and affordable resources. It should also be noted that informing customers about comfort and futuristic preciseness of these technologies with the help of awareness campaigns can enhance their realization and belief.

To conclude, AR, VR, and AI have become the potent equipment to redefine marketing and sales approaches within the Indian real estate industry. Such technologies allow developers to create an extremely engaging customer journeys, increase customer engagement, personalise

what is offered, and extend engagements to more audiences, via virtual platforms. Despite obstacles connected with price, technical skills, customer confidence and network capabilities, these can be overcome by adopting it in phases, through cooperation with other businesses, and by complying with policy requirements. As the consumer need is increasingly shifting to digital mediums, the application of these technologies will only continue to grow in importance in the marketing of real estate, and become a necessity in many firms in what is an evolving technology environment.

Discussion on Objective 4: To evaluate the potential implications of adopting artificial intelligence and augmented & virtual reality technologies in real estate in India.

5.4 Potential implications of adopting of AR, VR & AI

The use of AI and Augmented/Virtual reality (AR/VR) services in the Indian real estate industry has implications of high significance to many players, including developers, buyers, agents and the entire market room. These implications cut across economic, operational, technological and social aspects and therefore influence how real estate business conduct their operations and treat their customers. Moving towards digital transformation, it is vital to know what potential rewards, risks, and the effects of implementing these new advanced technologies in real estate operations can bring in the long-run.

Among the most dramatic resolutions to use AI and the use of AR/VR is customer experience. Real estate transactions are intensely personal and the financial stakes are high therefore, the buyer confidence and interaction are of utmost importance. AR and VR technologies are useful in offering virtual tour and walkthroughs over the properties thus virtualizing geographical barrier in providing customers with an option of having a tour over numerous properties without necessarily having to visit them physically. That convenience does not only create time saving but also ensures global reach to its audience including individuals or the Non- Resident Indians (NRI) and international investors. It also provides an insight into the preferences of the user, income level, and behaviour, which are said to have been used to make the recommendations of properties. This integration of immersive visualization and data-driven personalization shifts the way customers relate with real estate companies, transforming that relationship to an experiential one, rather than transactional(Anand, 2022).

The other important implication is optimization of marketing/sales strategies. Reliance on traditional marketing tools like print media and paper brochures is becoming a thing of the past and digital campaigns fuelled by AI algorithms are taking their places. Such systems interpret consumer information to construct the buying intention and utilize advertisement packages, therefore guaranteeing an increase in engaging traffic and conversions. VR/AR content introduces a bit of interactivity on these campaigns turning adverts to be more interactive and informative. To developers this translates to improved resource planning and returns on the marketing investments. It, however, also means that it would rely more on data-driven systems, and therefore data security and privacy compliance is necessary to prevent reputational and legal consequences.

Operationally, integration of AI and AR/VR technologies will result into an increase in efficiency and cost-effectiveness in the long-run. With capabilities of AI-powered chatbots and virtual assistants, customer service teams can have their load reduced by fulfilling immediate responses to requests, appointment setting, and carrying out basic transactions. Likewise, both AR and VR also minimize the requirement of experiencing real model apartments and gigantic promotion events thus lowering the marketing expenditures. The ability to have showrooms and property expos virtually enables the developers to promote several projects at once against a worldwide audience without the need to face a logistic nightmare. Nonetheless, these technologies can be very expensive to adopt in the early stages and hence the relationship with the small and mid-size developers. This divides the large companies, which can easily implement these tools, and small ones, who can hardly resist the technological market.

The implementation of these technologies also means something in regard to decision-making and strategic planning in real estate organizations. Predictive analytics will help developers to make projections of market trends, analyse pricing strategies and find profitable areas to erect future projects. The insights, which are derived through real-time data analysis, mitigate the risk of rogue investments and assist companies in aligning their business models to ensure that they achieve their business goals and objectives(Banerjee, 2023). When paired with AI, AR and VR applications can be used as an extra aid in making decisions because they can give virtual simulations of the planned project, thereby offering developers the chance to see how they will look like and determine whether they are feasible before building. This not only minimizes mistakes and error costs, but also moves the reliance on the years of experience-

based decisions toward quantitative-based solutions where real estate professionals will have to be equipped with new digital skills.

On a larger scale, the introduction of AI, as well as AR/VR innovation, is bound to re-define the real estate environment and workforce. Automation of the customer service with the help of AI chatbots, sales forecasting with predictive analytics, and more virtual property tours may eliminate the need to hire conventional marketing staff and arrange in-person visits. It also generates new job opportunities in data analytics, AR/VR content development, and digital marketing realm, however. Skilled human resources in these fields will be in demand, hence the need to reskill and upskill human resources within the industry. The regulatory bodies of education and other training providers will be required to develop curriculums that impart digital literacy and technological integration on real estate professionals.

Although these technologies have large opportunities, they are also faced by challenges and risks involved in adopting the technologies. The data privacy and cybersecurity are one of the dominant issues. The models of AI-driven systems rely on the gathering and analyzing personal information, such as financial data, location data, behavioural trends. This information can have serious legal and reputation effects in case of its leakage. Adherence to the Digital Personal Data Protection Act and other information privacy laws in the world is thus compulsory to developers and information providers. Moreover, AI-based platforms or applications of AR/VR may be subjected to cyberattacks that can damage sensitive data and interfere with the operations, which is why an effective security infrastructure is an absolute necessity.

The other major implication is digital divide and accessibility problems. India has tier-1 cities with the infrastructure capable of supporting high-tech applications such as AR/VR, yet tier-2 and tier-3 cities might lack capabilities in terms of the availability of internet connectivity, compatibility of devices and affordability. This imposes an asymmetry on the environment that favours urban customers who get to experience an enhanced environment, leaving rural and semi-urban customers relying on the non-digital modes of communication. These gaps have the potential to stall the pace of broader digitalization of the sector and need focused governmental efforts and public-private collaboration to close them.

Consumer behaviour and trust is another key element on whether these technology will be a success or not. Although younger, more tech-savvy consumers are likely to accept property

tours and AI-based suggestions, older property buyers will still doubt the value of the digital experience. Customers might think of the virtual tours as an unacceptable alternative to actual visits to property, especially in a high-value purchase such as property. It is necessary to solve this credibility issue by demonstrating honesty, by involving hybrid interactions that would combine online and offline interactions and by quality control that would ultimately create confidence that the digital representation bears the sufficient resemblance to reality.

The aspect of regulatory and ethical consequences is also associated with the adoption of AI and AR/VR solutions. Since such tools will become as inseparable as real estate transactions, regulatory bodies will have to put measures in place to regulate their application. There are such issues like misrepresentation of real estate with the help of virtual models, equity of AI algorithms, and the contrapposto of automated decision-making processes that should be taken into account. There are concerns about the inclinations of AI-powered recommendations as well as possible manipulative advertising strategies that also require active regulatory control and industry self-regulation to keep consumers trustful.

On an environmental front, the utilization of AR/VR technologies will lessen the carbon footprint incurred by physical visits to such sites and giant promotional events. Virtual property exhibitions and online sale platforms cut travel- burden emission and usage of resources in physical installations. Nonetheless, the resources required to fuel these technologies should also be taken into account in terms of sustainability: this is the energy demand of the data centres running them, as well as the volume of electronic waste produced by them. Companies that are pursuing these technologies ought to accompany with green IT practices to make them congruent with the sustainability objectives.

Finally, the introduction of AI and AR/VR technologies to Indian real estate has far-reaching transformational implications, going beyond marketing and sales into workflow efficiencies, buyer experience, labour or employee, and regulation. Such new technologies come with threats of increased cost, access, security, and ethical issues even though they also promise increased convenience, personalization, and competitiveness. The effectiveness of these innovations in the further will requires prior planning, first steps, and concerted actions of all the involved parties, including developers, technology providers, regulators, and consumers. With India gradually evolving towards a digitalized real estate market, striking the right balance between innovation and inclusivity, security, and trust will be the magic formula to utilize the potential of AI and AR/VR technologies to its fullest potential in the field.

Chapter VI: SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

6.1 Implications of the Existing Study

This research work has important implications on various stakeholders in the Indian real estate industry, who include developers, marketing professionals, policy makers and consumers. The role and the potential influence of Artificial Intelligence (AI), and Augmented and Virtual Reality (AR/VR) technologies are explored through the research, which provides insights that can be used beyond theoretical understanding and can serve practical applications and policy-level interventions.

Strategic transformation of marketing and sales practices: Among the most significant of the implications is the strategic change of the marketing and sales practices that take place within the sector of real estate. The paper shows that the use of intelligent tools and AR/VR systems can transform the process of property display, marketing, and selling radically. The digital strategies replace the traditional approaches including print advertising and actual visits to the site, and the new mode is more convenient and efficient. This means property developers need to invest in the use of marketing platforms that are technology-based in the ever-digitizing market. Moreover, sales professionals should be taught how to make the best use of this technology so as not to undermine good old human interaction in high-value sales.

customer experience perspective: The impact in the context of customer experience is equally dramatic. The research shows that immersive technologies, i.e., virtual walkthroughs and an AI-based recommendation system can increase customer engagement and satisfaction with property purchases. The increased emphasis on a more participatory approach to relations also leaves the impression that companies where engaging dynamics are transactional are likely to face increased customer satisfaction and loyalty. But this will still warrant the creation of a sense of trust in virtual platforms so that digital representations of the properties match the reality to avert any prospective issues of dispute or discontent.

Operational efficiency and cost management: The research also carries paramount implication towards operational efficiency and the cost aspect. By introducing AI to predictive analytics, sales forecasting, and automation of customer support the presence of bottlenecks in operations, as well as allocation of resources and cutting down of marketing expenses in the long term, can be relegated. In the same way, AR/VRs would help reduce the physical cost of

model apartments and minimise the number of site visits, hence cost reduced to the developers. Nevertheless, the results suggest that early costs of implementing these technologies might be high, and they might render it difficult to handle small and mid-sized companies. This shows that there is an increasing gap between developers with access to capital and those who could not keep up, presenting the challenge of cooperation between different companies or government funding to implement the use of technology in an inclusive way.

Impact on the workforce and skill requirements: The other factors that this study implies include effects on the labour force and manpower needs in the real estate industry. With AI and AR/VR becoming a part of a business, there is an evident necessity to update the skills of employees so that they could address those new technologies efficiently. The conventional sales functions can be transformed into digital relationship management, making the professionals acquire new skills and competencies in the field of engagement in virtual relationships, interpreting data, and serving customers using technology. Educational institutions and training bodies should be aware of this trend and begin teaching them the digital real estate technologies so that they can train the workforce to keep with the future requirements.

Regulatory and ethical implications: There are also key regulatory and ethics implications noted in the study. With such advances becoming the norm, regulators have to put regulations in place to assure fairness, transparency and accountability. As illustration, safe representation of virtual properties, data privacy and compliance in property related AI applications, and avoiding algorithm biases in recommending properties must be given thorough attention. The ethical considerations as applied to the consumer data security and marketing non-manipulation integrity need to be a priority that creates consumer confidence to feel secure about providing stakeholders with the freedom to proceed without any risk of legal prosecution.

Consumer behaviour standpoint: As the consumer behaviour perspective, these findings indicate that tech-savvy consumers will gladly accept AI and AR/VR, but some segments may be not completely convinced about the digital property experience. This will have an effect on market segmentation and marketing strategies of real estate firms who again need to incorporate a hybrid model of digital innovation with personal human connection to meet customer expectations. The advancement of the technologies will rely on how companies can enhance trust issues and create a seamless environment that is devoid of security or transparency.

Government policy and urban development strategies: On a larger scale, the findings of the study can apply on governmental level as well as in terms of urban strategies. The digitalization of the real estate is consistent with Smart Cities Mission and India Digital initiatives. Policymakers should promote the use of these technologies by getting tax subsidies, grants, or partnership with the public and the private sector, especially on affordable housing. Meanwhile, cybersecurity threats, digital literacy and infrastructure development in tier-2, tier-3 cities are the areas where policy focus will be necessary to prevent a digital divide in the sector.

Technological innovation: Finally, the research bears future-investigational implications, as well as technological-novelty. Although the present findings highlight the positives of AI and AR/VR in maximizing marketing efficiency and customer engagement, they also suggest the lack of sustainability in the long-run, the issues of integrating AI and AR/VRs as well as adapting the technology to various markets across the world. Researchers and industry players should keep looking at cutting edge technologies like using blockchain platforms to support safe property transfers and AI-driven chatbots that offer personalized and tailoric financial guidance in real estate.

6.2 Conclusion of the Study

The present study aimed to explore and analyze the transformative role of Artificial Intelligence (AI), Augmented Reality (AR), and Virtual Reality (VR) in the Indian real estate sector by focusing on four major objectives: identifying key factors influencing adoption, investigating opportunities and challenges, examining the impact on marketing and sales strategies, and evaluating the potential implications of these technologies for the industry. Based on the findings derived from demographic analysis, factor analysis, and interpretation of statistical results, several significant insights have emerged that contribute to both academic literature and practical applications.

The study concludes that **technological advancement is no longer optional but a strategic necessity for real estate firms in India**. The adoption of AR, VR, and AI is largely influenced by factors such as **cost-effectiveness, ease of use, infrastructure readiness, organizational digital maturity, consumer demand for immersive experiences, and competitive pressure**. Among these, organizational readiness and perceived benefits emerged as the most critical

determinants driving adoption. The findings indicate that larger real estate firms, particularly those operating in metropolitan areas, are more inclined toward early adoption due to better resource availability, while smaller firms exhibit a cautious approach owing to budget constraints and lack of technical expertise.

From an opportunity perspective, the integration of AR, VR, and AI provides **unparalleled benefits in enhancing customer engagement, reducing decision-making time, offering virtual site visits, and enabling personalized property recommendations**. These technologies not only improve marketing efficiency but also minimize operational costs associated with physical property showings. AI-powered predictive analytics helps developers anticipate market trends, optimize pricing strategies, and streamline sales processes, while AR/VR creates interactive experiences that allow buyers to visualize properties in real-time, even from remote locations.

However, the study also highlights substantial challenges that hinder widespread adoption. These include **high implementation costs, lack of skilled professionals, cybersecurity concerns, limited consumer awareness, and infrastructural limitations in tier-2 and tier-3 cities**. Additionally, resistance to change among traditional buyers and real estate professionals continues to pose a barrier to complete digital transformation. The findings suggest that addressing these challenges requires collaborative efforts between developers, technology providers, and policymakers to create an ecosystem conducive to digital innovation in real estate.

The role of AR, VR, and AI in **improving marketing and sales strategies** has been particularly evident in the research. These technologies enable real estate firms to move beyond conventional advertising and embrace **data-driven, customer-centric strategies**. Virtual property tours and AI-powered chatbots enhance transparency, reduce the dependency on physical visits, and foster trust among customers. The study reaffirms that firms adopting hybrid models that integrate both digital and physical touchpoints are likely to experience higher customer satisfaction and conversion rates.

In terms of future implications, the adoption of these technologies has the potential to **redefine the real estate business model in India**. Digitalization will not only streamline property transactions but also support sustainable practices by reducing the carbon footprint associated with multiple physical site visits. The findings indicate that as consumer behavior shifts toward

digital-first experiences, early adopters of AR, VR, and AI will gain a significant competitive advantage, while late adopters risk losing market relevance.

In conclusion, the study emphasizes that the successful integration of AI, AR, and VR in the Indian real estate sector is contingent upon **strategic planning, workforce training, cost management, and building consumer trust**. While challenges persist, the long-term benefits in terms of operational efficiency, customer engagement, and market competitiveness outweigh the initial barriers. Therefore, stakeholders must adopt a proactive approach to embrace these technologies, supported by government initiatives, industry collaborations, and continuous innovation. The research underscores that **the future of the Indian real estate sector lies in digital transformation**, and technologies like AI, AR, and VR will play a pivotal role in shaping this evolution.

6.3 Recommendations of the Study

On the basis of the findings and analysis of the current research, some recommendations can be postulated so that Artificial Intelligence (AI), Augmented Reality (AR), and Virtual Reality (VR) technologies could be successfully adopted and implemented into the Indian real estate market. These insights offer recommendations to real estate developers, policymakers, technology providers, and the customers to make the best utilisation out of the technologies and tackle the challenges that are raised in the course of the research.

1. **Strategic Investment in Technology Infrastructure**:

It is important that real estate developers consider allocating financial resources to putting up good technological infrastructures. Implementation of AR, VR, and AI needs plentiful digital platform, high-speed internet connection, and safe cloud server. Developers are required to make sure that their internal IT systems are capable of supporting such technologies without any hitch. Investment in scalable platforms would help developers deliver uninterrupted virtual visits to properties, custom suggestions, and AI-based customer service, which will eventually increase customer interaction and satisfaction.

2. **Upskilling Workforce and Digital Training**:

The ease with which the workforce adjusts to the changes in technology will determine the successful integration of AI and AR/VR in the operations of the real estate industry 4. That is why developers and property companies are to invest in educating their employees using the digital marketing strategies, virtual sales presentation abilities, and AI customer data analytics. Sales teams need to be trained to conduct meetings and demonstrate virtual properties, to present how potential customers could use AI-powered advice, and deal with concerns related to the digital tools. Working with education institutes and training organizations is another idea that can assist in creation of specialized courses to the real estate professionals.

3. **Hybrid Marketing and Sales Models**:

Although the implementation of digital technologies has a lot of benefits, the research demonstrates that not every customer feels satisfied with making property-related decisions in completely virtual environments. Thus, real estate companies must conduct a hybrid approach to both digital and physical interactions. As an example, AI-based recommendations and virtual tours can be combined with pre-arranged on-site visits with a client that offers physical confirmation. Such a strategy will facilitate to solve trust problems among customers and to serve both non-tech and conventional customer groups.

4. **Building Consumer Trust through Transparency**:

One of the most pressing concerns of implementing these technologies is the doubts of customers in the realness of the virtual forms of the property visits. There is a need to settle this by ensuring that real estate firms compose correct and transparent digital representations. The virtual tours must be close to the specifications of actual property and in case of any changes or deviations it must be made clear to clients. Furthermore, AI algorithm of property recommending should be complete devoid of bias and oriented to meet the demands to customers and not developers.

5. **Affordable and Scalable Solutions for Smaller Developers**:

The study reveals that the expense of utilizing the new sophisticated technologies is an impediment to the small and intermediate developers. To overcome this, the AR/VR and AI technology providers ought to create more affordable, modular and subscription based

technologies that enable them to implement one technology at a time. Collaborative technology exchange also can be provided through industry associations and the governmental apparatus, as the smaller companies have the opportunity to share the newest technologies without bearing the incurring excessive cost of the property.

6. **Strengthening Data Privacy and Security Measures**:

AI systems record and process massive customer data, so it is important that data privacy and cybersecurity are maintained. The developers need to have effective data protection systems that do not contravene the applicable law in the country like the Digital Personal Data Protection Act (DPDP Act) in India. The trust and confidence of the customers on digital platforms can also be driven by transparency in the manner which the data is used.

7. **Government Incentives and Policy Support**:

One important role the Indian government can undertake to fast-track AI and AR/VR adoption in the real estate sector is to come up with tax incentives, subsidies or grants on adopting the use of technology particularly on affordable housing projects. Policies to support digital literacy levels among customers and to bring high-speed internet connectivity to tier-2 and tier-3 cities will also drive inclusive technological adoption in regions.

8. **Enhancing Customer Engagement through AI-Driven Personalization**:

Proptech businesses must use AI to make individualised property suggestions, taxation advice and digital customer service. This will improve customer satisfaction, the time at which the customer makes his/her decisions, and the buying experience. Hyper personalized marketing programs enabled by AI can also enable developers to reach out to the correct audience with custom offerings which enhances the conversion rates.

9. **Continuous Research and Innovation**:

Considering the dynamic aspect of technology, real estate companies need to keep track of the emerging trend development including metaverse-based property experience, blockchain property transactions and advanced predictive modelling. Collaborations with technology start-ups, research centres and innovation ecosystems can assist companies in maintaining a lead

when it comes to the implementation of new advanced solutions capable of helping companies boost operational efficiencies and customer experience.

10. Awareness Campaigns and Consumer Education:

Lastly, consumer education on the safety, reliability and utility of AI, AR, and VR technologies is the key to the broad adoption of all of these. Real estate companies can arrange to use webinars, demonstrations, and online exhibits to introduce customers to the possibilities of digital tours of properties, AI-based price modelling, and virtual documentation. This will aid in lessening arousal and initiate trust in online real estate sites.

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APPENDIX A

QUESTIONNAIRE

A STUDY TO ANALYZE THE ADOPTION OF AUGMENTED REALITY & VIRTUAL REALITY AND IMPACT OF ARTIFICIAL INTELLIGENCE ON REAL ESTATE SECTOR IN INDIA

Dear Respondent,

I wish to introduce myself as a scholar pursuing research on "A Study to Analyse the Adoption of Augmented Reality & Virtual Reality and Impact of Artificial Intelligence on Real Estate Sector in India." In this context I request you to kindly spare sometime to answer this questionnaire. I look forward to your support and co-operation to enable me in the successful completion of my research. The information provided will be strictly applied to academic purpose only.

Name of Respondent: _____

City: _____

PART-I

Q 1. Age

A) Below 25 years B) 26 to 35 years

C) 36 to 45 years D) Above 45 years

Q2. Gender

A) Male B) Female

Q3. Marital Status

A) Single
B) Married
B) Others

Q 4. Educational Qualification

A) Below Graduate
B) Graduate
C) Post Graduate
D) Above Post Graduate

Q 5. Monthly Income (in Rs.)

A) Below 20,000
B) 20,001 to 40,000
C) 40,001 to 60,000
D) Above 60,000

Q 8. Type of Family

A) Nuclear Family
B) Joint Family

Q 9. Size (no. of persons in your family)

A) 2
B) 3 to 6
C) 6 to 9
D) More than 9

Q10. Property Type Interested In:

☐ Residential (Apartment/House)
☐ Commercial

☐ Plot/Land
☐ Other

PART-II

Q 11: What are the Sources of Property Information You Use Most?

☐ Websites/portals of real estates

☐ Realtors real property agents/brokers

☐ social media

☐ Builder / developer sites

☐ Serviced property exhibition/fair

☐ Word of mouth

☐ Newspaper/magazine ads

Q12: What are the Features That Influence Your Property Buying Decision?

☐ Location and neighbourhood

☐ Price and payments

☐ Builder reputation

☐ Amenities

☐ Future resale value

☐ Virtual property tours

☐ VR/AR Interactive floor plans

☐ Intelligent property suggestions

☐ Sustainability/green features

☐ Availability of loan / finance

Q13: Have you ever used any of the following while exploring/buying property? (tick all that apply)

☐ Augmented Reality

☐ Virtual Reality

☐ Artificial Intelligence

Q14: Where did you experience AR/VR/AI in real estate?

☐ Real estate developer/builder website

☐ Property portal

☐ Real estate broker/agent

☐ At property site/office

Q15: As per your opinion, what are key factors influencing the adoption and application of AR, VR and AI technologies in the real estate sector?

S.NO.	Statements	Strong Disagree	Disagree	Neutral	Agree	Strong Agree
A.	**Awareness & Knowledge**					
1.	I know that AR/VR is able to offer better virtual tours for real estate.					
2.	I am aware that property personal listings are being targeted with the help of AI.					
3.	I am well informed on the operation of the type of technologies in real estate.					

4.	The fact that I am conscious makes me want to learn how to utilise AR/VR/AI in the process of property purchases.					
B. Perceived Usefulness						
5.	AR/VR can assist me to make fair assessment of a property compared to photos or brochures.					
6.	Property search is made more effective using AI-driven tools.					
7.	This technology makes me make a more well-informed purchase.					
8.	The AR/VR/ AI would enhance my general satisfaction with the property purchasing.					
C. Perceived Ease of Use						
9.	Property viewing through AR/VR is user friendly.					
10.	AI driven real estate apps/ websites are easy to use.					
11.	I am able to employ these technologies in an easy way without					

	having specialized knowledge.					
12.	I will be able to learn the interaction with AR/VR/AI tools fast.					
D. Cost & Effort Considerations						
13.	It is too expensive to access the AR/VR (e.g., VR headsets, data usage).					
14.	I feel that using these technologies demand too much energy/time.					
15.	In my opinion, all these tools developers ought to make them free to purchasers.					
16.	Extra costs sways me from using AR/VR/AI in real estate.					
E. Trust & Reliability						
17.	I trust AR/VR images really do show real estate features.					
18.	In my opinion, the recommendations implemented using AI can be trusted and are impartial.					
19.	Such technologies decrease the probability of being					

	deceived with not full property information.					
20.	AR/VR/AI generate my trust in definitive buying decisions.					
F. Social Influence						
21.	My acquaintances or relatives advise me to resort to AR/VR/AI during the selection of properties.					
22.	These technologies are also popularized by developers and brokers among purchasers.					
23.	The experience of seeing other customers use AR/VR /AI encourages me to use them.					
24.	Online reviews and social media contribute to the interest in these technologies to me.					
G. Infrastructure & Availability						
25.	Realtor websites/app I also use are good at AR/VR/AI.					
26.	AR/VR is supported with my internet connection.					

27.	There is the availability of devices (smartphone, laptop, VR headset) that can support these technologies.					
28.	I can approach them in case I have problems with these tools as they offer technical support and guidance.					

Q16: As per your opinion, what are the opportunities using AI and VR & AR in the real estate sector in India?

S.NO.	Statements	Strong Disagree	Disagree	Neutral	Agree	Strong Agree
1.	The AR /VR technology simplifies property selection and brings it in a more interactive way.					
2.	AI makes reasonable suggestions regarding the property, depending on my choice.					
3.	The virtual tours save time and					

	money given the fact that it eliminates the need to visit a site repeatedly.					
4.	AR/VR and AI make an added benefit of improving transparency and trust in the process of buying a property.					
5.	The technologies allow comparing several properties with more effectiveness.					
6.	The benefits of AI, AR & VR also open up options in properties outside of their physical location.					
7.	AR/VR enhances decision-making by giving a real-life property experience.					
8.	AI chatbots and chat assistants are speedy solution to buyer questions.					

9.	The confidence in the decision of acquiring property increases after viewing it only once using AR/VR.					
10.	Owing to all of this, AR/VR and AI allow property buying to be more efficient, convenient.					

Q17: As per your opinion, what are the challenges using AI and VR & AR in the real estate sector in India?

S.NO.	Statements	Strong Disagree	Disagree	Neutral	Agree	Strong Agree
1.	Expensive AR/VR technology is one of the factors that restrict its scale of implementation.					
2.	Expensive AR/VR technology is one of the factors that restrict its scale of implementation.					

3.	AI advises can be wrong or misguided.					
4.	Inability to trust AR/VR images because they might not be a true image of the actual property.					
5.	Not all buyers are used to or rather comfortable with using AR/VR/AI tools.					
6.	Use can be impeded by technical problems (connection to the Internet, compatibility of device).					
7.	Reliance on technology relegates the consideration of the advice of individual brokers.					
8.	The prospects of AI-powered platforms as a source of fear due					

	to concerns about its data privacy and security.					
9.	Poor standardization between AR/VR experiences of different developers.					
10.	Physical site visits are still required, even in the presence of AR/VR/AI tools.					

Q18: As per your opinion, what is the role of augmented reality, virtual reality, and artificial intelligence in improving marketing and sales strategies in the Indian real estate sector?

S.NO.	Statements	Strong Disagree	Disagree	Neutral	Agree	Strong Agree
1.	AR/VR property attracts more attention of buyers than the traditional advertisement.					
2.	Targeted marketing campaigns that use AI raise the awareness of					

	relevant properties.					
3.	Ads using AR/VR on digital display enhance better brand recognition among developers.					
4.	The virtual tours enhance a more attention-grabbing experience when looking at properties.					
5.	AI chatbots enable buyers to engage in valuable and in-time answers.					
6.	AR/VR tools enhance marketing campaign to be more interactive and convincing.					
7.	AR/VR tours save me a lot of time making purchase decisions.					
8.	The presence of AI-generated suggestions					

	makes the process of property selection more confident.					
9.	The use of AI/VR/AR reduces the necessity to make numerous visits to a place of purchase.					
10.	AR/VR tours also offer a touch of reality of the properties to add more trust to the marketing statements.					
11.	The AI Cephalopod tools contribute to clarifying the information about the property, as well as minimizing its incorrectness.					
12.	Marketing with the use of technology enhances openness between					

	the purchasers and the builders.					
13.	Platforms using AI up the ante when it comes to post-sales customer service and support.					
14.	AR/VR applications allow seeing the changes or interior design in the future after buying them.					
15.	Long-term trust and interaction of the buyers and the developers are enhanced due to the use of AR/ VR/ AI.					

Q19: What are the potential implications of adopting artificial intelligence and augmented & virtual reality technologies in real estate in India? (Mark✓)

☐More prompt property search and matching with AI algorithms

☐Immersive AR/VR property tours to provide a superior customer experience

☐Enhanced accuracy in estimating the property and its price by use of using AI tools

☐More openness and confidence in property marketing

☐Increased rate of conversion of sales as a result of involving virtual experiences

☐ Minimized In-person visits to the business sites

☐ Marketing and promotional cost effectiveness

☐An improvement in the use of digital systems in real estate dealings

☐ AI-enhanced market forecasting and demand projection

☐ Better tailored advertising activities

☐Abbreviated paperwork and legal confirmation using AI technologies

☐Better project management, resource utilization

☐Very expensive to introduce the use of AR/VR and AI technologies

☐The need to be digitally literate by buyers and agents

☐Threat of too heavy dependence on technology causing less human touch

☐Fears of an invasion of privacy and malicious hacking

☐ Low rural or less tech-savvy market accessibility

Thanks for your cooperation!

APPENDIX B

SURVEY COVER LETTER

Dear Participant,

I am conducting academic research on the adoption of augment reality & virtual reality and impact of artificial intelligence in real estate sector in India. You are invited to participate in this study by completing the attached survey in APPENDIX A focused on AR, VR & AI on real estate sector in India.

The survey should take less than 15 - 25 minutes and your participation is completely voluntary. Your responses will remain anonymous, and no individual respondent will be identified in any research report. Only aggregated results will be analysed from overall responses. The data is collected solely for academic research purposes as part of my university thesis project. However, your views can help shape an understanding of the opportunities and challenges in adopting augment reality & virtual reality and impact of artificial intelligence in real sector in India.

Please contact me at [email address] if you need any clarification or have additional thoughts to share beyond the survey. I appreciate your consideration of this request and thank you for the vital role you play in adopting AR & VR and AI technologies in real estate sector

Best regards,

[Name]

[University details]

APPENDIX C

QUESTIONER GUIDE

Questioner guide: A Study to Analyze the Adoption of Augment reality & Virtual reality and Impact of Artificial intelligence on Real estate Sector in India

Date & Time:

Participant:

Participant details:

Opening Comments:

Thank you for your willingness to participate in this survey questioner focused on Analyze the adoption of Augment reality & Virtual reality and impact of Artificial intelligence on Real estate Sector in India. As outlined in the consent form you signed, this participation should take 15 - 25 minutes and will be kept confidential with your responses anonymised in any research reports. Do you have any questions for me before we begin?

Please provide your responses in the questioner in APPENDIX A.

Thank you

APPENDIX D

FORM OF INFORMED CONTENT

Study Title: A Study to Analyze the adoption of Augmented Reality & Virtual Reality and Impact of Artificial Intelligence on Real Estate Sector in India

Researcher: [Name and credentials]

☐ I confirm I have read and understand the information sheet for the above study and have had the opportunity to consider the information and ask questions which have been answered satisfactorily.

☐ I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason. If I withdraw within 4 weeks of participating, my data will be removed from the study.

☐ I agree to answer for research questioner. I understand only the research team will have access to the answers which will be kept in a secure location then destroyed after transcription.

☐ I understand that anything I say will remain confidential and anonymous unless it is thought that there is a risk of harm to myself or others, in which case the principal investigator may need to share this information with appropriate authorities.

☐ I agree that research data gathered from me during participation may be stored anonymously, securely and may be used for future research studies pending ethical approval.

☐ I understand that the information I provide will be used for a paper, thesis, or dissertation, and academic articles and I consent for it to be used in this manner.

☐ I agree to take part in the above study.

_____	_____	_____
Name of Participant	Date	Signature

Lead Researcher	Date	Signature

Once signed:

- 1 copy to be retained by Participant

- 1 copy to be retained by Lead Researcher

Contact Details:

Any concerns about this study should be directed to the lead researcher via the contact details provided on the information sheet.