

Overcoming Constraints on Implementing Augmented and Virtual Realities Technology in the Real Estate Industry in the Philippines

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ABSTRACT

The use of augmented reality (AR) and virtual reality (VR) technologies in the real estate industry in the Philippines, focusing on overcoming challenges, discussing extensive uses of available AR/VR devices, exploring ergonomic features, analyzing the impact of its high costs, and suggesting government initiatives to utilize the use of AR/VR in the Philippines. This study provides a comprehensive review of the current state of these technologies' adoption. This also identifies key areas for improvement and proposes solutions to enhance the utilization of these technologies in the real estate sector.

Keywords: Augmented Reality, Virtual Reality, Real Estate Industry, Remote Collaboration, Adoption.

INTRODUCTION

In today's modern time, reality and technology have been merged. Augmented and virtual reality are technologies that allow users to experience a computer-generated environment through screens that provide real time and creative details. These kinds of technologies have been significantly utilized in the real estate industry to provide better performance in different applications. With the advancements in technology, augmented and virtual realities have become the real game changers in the real estate industries where these devices are reshaping how future projects are designed, planned, and even created. Enabling seamless remote collaboration and communication between investors and real estate agents. The possibilities are endless with the continuous development of AR/VR technologies.

The evolution of AR/VR spans over two centuries. In the year 1838, Charles Wheatstone changed the field when he invented the first stereoscope which creates 3D pictures by combining two images from each eye into a single three-dimensional image. After that, Morton Heilig built the first virtual reality machine in 1956. It had a theater booth that used stereoscopic 3D color video, sounds, smells, and a chair that vibrates. Back in 1968, Ivan Sutherland and his student Bob Sproull made the 35th head-mounted display (HMD) that tracked in three dimensions. Because of its large weight and requirement to be fixed to the ceiling above, they jokingly called it "The Sword of Damocles." With the help of stereoscopic vision, users can easily explore the 3D and digitally generated environment that changes randomly (Barnard, 2023). Late 1970's, The MIT organization developed a computer-generated tour by Aspen Movie Map of Aspen's streets that was made from pictures of a car traveling around the city. This was the first experience that showed how VR could transport all the users to completely different dimensions. In contrast, the growth of virtual reality headsets in the market started to appear in the mid 1990's for home usage only.

Several challenges have been experienced when utilizing AR/VR technology. These technologies are known to help the investors and real estate agents to effectively collaborate with each other. In utilizing these technologies, they might encounter technical issues such as lagging, glitching, and software bugs. Another

problem is the internet connectivity, this is relative in some areas of the Philippines that have slow internet connection. These factors hinder the widespread implementation of AR/VR. As these technologies require a fast and stable internet for real-time and exciting experiences. Additionally, the effective use of these technologies demands a specific knowledge and skills which many agents and investors may lack, affecting their overall collaboration. Health risks like eye strain and motion sickness, also pose a concern. Emphasizing the need for comfortability and safety of the users and ensuring seamless connectivity and analyzing these challenges for better solutions in order to leverage AR/VR's full potential in enhancing collaboration.

Overcoming these issues is crucial for the effective implementation of AR/VR in the Philippines. Based on a report, the virtual reality business in the Philippines is expanding due to the increasing demand for more immersive experiences across all industries. The government is also making efforts to enhance internet connectivity and accessibility. Improving the internet connectivity will help real estate management or other companies work together as conveniently as they could. On the other hand, the problem of lack of knowledge and skills between the investors and real estate agents could be resolved by giving extensive training programs for users within the Philippines on how to close the gap of skills and training by providing them with specific instructions in utilizing these technologies. However, the health risks and conditions such as eye discomfort and motion sickness could be resolved by including health warnings that provide awareness to everyone before using the devices. Another option is the installation and setting up the device with a blue light filter to comfort the eyes. Encouraging user safety, making platforms that are easy for people to use and making the whole user experience better are some solutions to these human factor problems.

LITERATURE REVIEW

Milestone of AR/VR Technology in Real Estate Industry

The early 2000's saw a rise in interest in virtual reality development, and in 2007 Google added Street View to Google Maps, enabling users to explore places in a similar way to how they explored Aspen on MIT's Aspen Movie Map. Furthermore, Google enhanced StreetView in 2010 with a stereoscopic vision feature that let users view their surroundings in three dimensions with the aid of basic 3D glasses. Palmer Luckey, the founder of Oculus, developed the prototype for the Rift VR headgear, which had a field of vision of 90 degrees. Meanwhile, Google introduced its Google Glass augmented reality spectacles, which display digital information in the real world and enable users to access applications such as Gmail. Additionally, Google released its initial Cardboard device, an affordable cardboard virtual reality viewer designed for cellphones (Marr, 2021). Additionally, the HTC Vive developed by HTC and Valve Corporation has a 360-degree field of view that allows for natural exploration in all directions (Borrego et al., 2018). In the future, companies began developing virtual reality/augmented reality technology. One specific example is the IKEA Place App, which allows prospective customers to preview furniture in their homes prior to buying it. This widening evolution of AR is no longer used only in games or entertainment. Currently, VR/AR technology is rapidly being adopted across various businesses, including the real estate market.

Features of AR/VR

Augmented and Virtual Reality has its key features that provides an important advantage to the investors and real estate agents. Utilizing VR technology, all areas of a property can be easily explored, providing a comprehensive understanding of the layout and the scenic views from different angles. VR tours offer a dynamic and captivating experience, far surpassing the passive and limited perspective of traditional photos and videos (Bajaj, 2024). In different environments, VR enables potential customers to observe real estate properties, facilitating association of the property with their lifestyle. For this reason, buyers have a deeper

consciousness about what the layout, size and possible applications of the property would be such that it becomes easier for them to make a decision (Wang & Tungsawat, 2023). Real estate agents apply VR to demonstrate how a potential house looks like with different furniture and fittings helping them choose the best size layout for their needs.

There are several factors that contribute to customers' preference for buying one product over another. One important factor is the convenient method of showcasing for sale properties offered by real estate agents. Potential buyers prefer visiting properties and houses compared to the traditional approach since it is more lifelike. The common and traditional marketing method such as flyers, brochures, billboards, and advertisements also have disadvantages (Ibrahim et al., 2023). One common scenario is when a client seeks detailed information and visual representation about the houses they are interested in. With the help of AR/VR technology, walking through houses in person isn't as necessary. AR/VR technology offers a more convenient and comfortable viewing experience. By offering them the most effective method of showcasing while at home with their family. Clients can now view housing designs and plans without going on-site. This is a cost-effective and efficient solution.

A virtual reality experience enhances customers' inclination to purchase, develop emotional connection, and express intents to visit a certain destination, while also stimulating impulsive desires (Kang, 2020). Virtual reality is being utilized as an effective tool to enhance various aspects of customer behavior and engagement in destination marketing. A study suggests that VR not only increases customers' likelihood of making purchases but also fosters emotional connections to the client. In addition to that, virtual reality experiences can increase impulsive desires and potentially affecting decision-making process. This finding emphasizes the impact of virtual reality technology in changing customer viewpoints and intentions regarding visiting specific destinations. In the end, virtual reality has the potential to generate captivating marketing campaigns that really connect with clients and yield tangible outcomes.

Challenges and Barriers

Most investors and real estate agents are hesitant to embrace new technologies. As AR/VR offers a different level of engagement with potential buyers, businesses or even companies may not feel motivated to invest in these new types of technologies. Lack of understanding of its benefits may impede the growth of the company's sales. As implementing these technologies leads to several changes this might lead to adjustments, specifically in organizational structure (Huang, 2019).

A study explores the application of virtual reality technology in the field of real estate marketing. This study investigates the barriers, advantages, consumer perceptions, and the overall impact on the industry. However, the widespread adoption faces several challenges that includes affordability of these technologies which is the costs of hardware and software that are needed to operate these technologies. The high cost of AR/VR both hardware and software makes it difficult for the widespread implementation among consumers and companies (Hussin and Abu Bakar, 2023). The Philippines also experience the expensive cost as it affects the adoption of these devices. Aligned with the five challenges that could possibly be faced by the Philippine Real estate industry, Malaysia also encounters technical challenges such as hardware compatibility issues and software defects. On the other hand, it has the key feature of providing different levels of showcasing houses and properties, and managing clients' expectations is an ongoing challenge in the real estate marketing landscape (Hussin and Abu Bakar, 2023). This is because of the overloaded information and their high expectation in the property as visualized in these technologies.

Virtual reality devices can make users feel sick and weak (Londoño, 2023). This happens because their eyes are close to the screens, and it can cause tiredness of the eyes due to visual strain thus leading to eye strain and motion sickness. Worst still, in instances like when looking at houses on a computer screen or playing games such as Minecraft at home people tend not to realize time passing by. It enters the space where

everything becomes possible like things but does not have any limitations hence lack actual life experience.

Insufficient training on how to use Augmented reality (AR) virtual reality (VR) and is a big reason why these fairly new design methods aren't being used more widely (Huang, 2019). Because of this obstacle, professionals are unable to successfully integrate these modern technologies into their workflows. As a result, the benefits that augmented reality and virtual reality may offer have the potential to be limited. These benefits include increased visualization, immersive property tours, and simplified design processes. For real estate professionals to be able to overcome this impediment, it is vital to implement targeted training programs and educational initiatives that will provide them with the required skills and confidence to utilize AR/VR tools.

AR/VR Adoption: An Opportunities for Real Estate

Imagine the possibilities that augmented and virtual reality could offer. Many opportunities could open when adapting these technologies. The application of AR/VR in real estate marketing can provide the clients a realistic and interactive experience in a virtual property tour, without physically visiting the location ("Reality Digital Marketing", 2024). With the help of these technologies and by offering a detailed view of the property, potential buyers increase their confidence by exploring every aspect of the space, for them to lessen the uncertainty and hesitation to purchase. Based on the findings of Rebusel (2023), the real estate market has a lot of room to grow. This offers an opportunity to attract more customers and could successfully close deals that eventually create and increase sales. By integrating AR/VR in their marketing strategies, companies may provide prospective buyers with a deeper knowledge of properties and let them make well informed decisions. Companies have the opportunities to gain more clients and boost their sales when more people want to buy properties. Being able to offer virtual tours and fun activities helps a real estate business stand out and focus on what the customers want. Stivemindz (2023) explains how these technologies allow customers to tour the properties virtually and analyze features before planning about purchasing a property. With this, they could attract customers looking for new and convenient solutions.

These technologies can help attract more buyers and investors, which can help businesses grow. Real estate companies can prove themselves as innovative and progressive organizations by embracing virtual reality technology (Butt, 2023). These industries focus on improving their properties and marketing approach by adopting AR/VR as an opportunity for development. With innovation, companies keep up with the market's competition by giving clients unique experiences that makes them different in the marketplace. This will help create an edge that greatly attracts clients and meets their needs. The business environment is constantly changing. With this, the real estate businesses need to innovate for them to adapt to rapid changes in technology. Ensuring their continued relevance and resilience amidst difficult circumstances. In adapting to new technologies, it can lead to increased efficiency and productivity. Organizations can save up and improve their performance. This concept of innovation enables organizations to address customer's concerns more effectively. To achieve customer satisfaction and retain their loyalty, products and services should meet their expectations. In addition to this, promoting new and improved services often opens up new sales and this innovation can contribute to successful business growth.

The augmented and virtual realities technologies have the ability to improve and enable remote collaboration among buyers and professionals. Users can gather online to discuss property details, get into negotiations, and change virtually the property with different furniture and decor options. In addition to this, users have the capability to engage with agents in real-time, address inquiries, and receive timely responses. This different level of remote collaboration will enable more efficient communication and decision-making, especially for buyers that are located internationally or remotely (Sohail, 2023).

Integrating these technologies, agents can differentiate their products and services that gives them an advantage in the market (Parmar et al., 2024). The overall idea is improved as a result of this differentiation,

which is achieved by including the unique capabilities and features that are not currently offered by their competitors. The strategic application of these technologies not only improves both the operational efficiency and user's experience, but this also encourages the growth of ongoing innovation. By taking this strategy, businesses are able to keep up with the trends in the market and fulfill the desire of their customers.

In order to implement these technologies successfully, there is a need for further exploration and discussion about the various constraints that could possibly hinder the remote collaboration between the users. This study aims to fill the gaps that analyze the evolving role of past devices in the real estate industry management. Understanding the extent of use of these devices can help with future development and enhancements of current technologies, leading to its convenient, friendly and easy usage. Additionally, this exploration will review the ergonomic features necessary to lessen the physical discomfort and health issues that are associated with the usage of AR/VR devices. As ergonomic features play a crucial role in the utilization of these technologies and understanding it is crucial to mitigate these risks and ensure user well-being. This will also explore the potential impact of the high costs associated with adopting AR/VR in the real estate industry which could potentially hinder the sector's ability to fully leverage the benefits of these innovative tools and limit their potential to enhance remote collaboration between investors and real estate agents. Furthermore, this paper aims to suggest initiatives for the government to overcome constraints in connectivity. This is significant for the seamless utilization of these devices in the Philippines.

In line with the research gap, this study identifies the extent of use of the past devices in applying these to the current real estate sector of the Philippines. By identifying the uses and utilization of these technologies in today's modern era, we will be able to enhance and improve the future technologies that could help real estate companies to increase their sales and enhance agents' skills and expertise. Relatively, this paper determines the necessary ergonomic features that will help lessen the physical discomfort and health issues associated in utilizing these technologies. This also provides an in-depth explanation of the influence of high cost in adopting these technologies as the substantial upfront investment required can pose a significant obstacle to widespread adoption and this also provides recommendations on government initiatives regarding the constraints in connectivity.

Problem Statement

This study intends to explore the extent of use of AR/VR devices, comprehensive review on ergonomic features, discuss the ergonomic features that need to be considered, and suggest policies that are in need for connectivity issues. Therefore, the following research questions are expected to be answered:

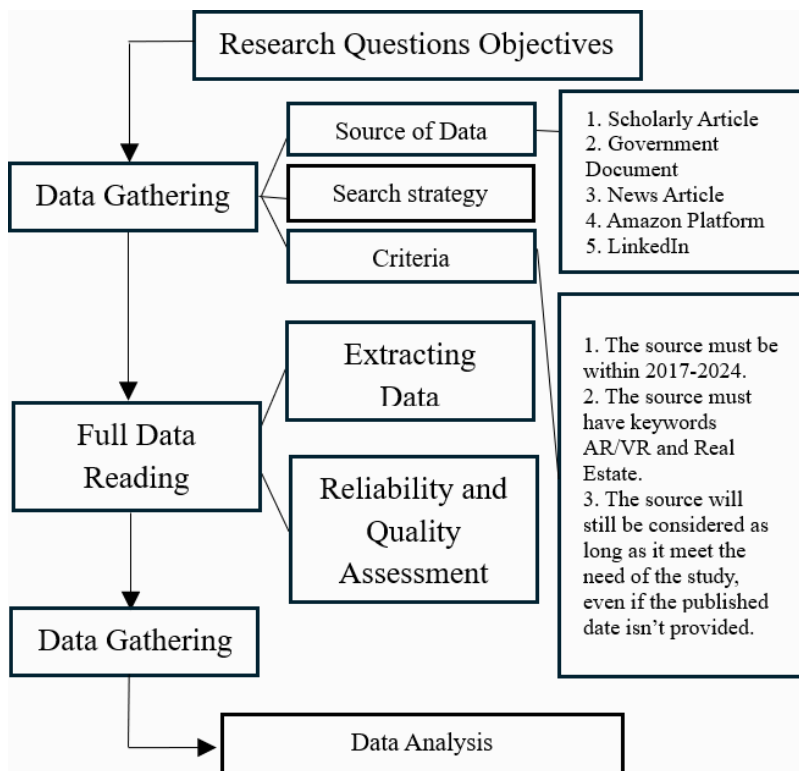
1. What are the comparative specifications of AR/VR devices available in the market?
2. What is the extent of use of AR/VR devices in real estate management, and how are these technologies impacting current industry practices?
3. What ergonomic features are important for reducing physical discomfort and health issues when using AR/VR devices?
4. What is the impact of high costs of AR/VR technology and how it influences the investor's willingness to adopt and implement these technologies?
5. What policies or government initiatives should be developed to promote the usage of AR/VR in real estate in the Philippines and its neighboring country?

METHODS

In order to answer and address the objectives of this study, the researchers follow three guidelines (*refer to figure 1*): data collection, full data reading, and data analysis. The first procedure is data collection. To gather data, the researchers collect articles, news articles, government documents, LinkedIn posts, and feedback from the Amazon shopping platform. These sources will undergo a full data-reading process with

certain criteria. The criteria include: The published date must fall between 2017 and 2024; the data must contain keywords like AR/VR and real estate; and even without a published date, the source will still be acceptable as long as it aligns with the study’s needs. The second approach is full data reading, which includes data extraction and quality checking. This process involves collecting specific information from a larger set of data. Afterwards, the specific data gathered will be assessed and checked for its reliability and quality of content. The last procedure is data analysis. The researchers will conduct a thematic content analysis. Thematic content analysis is a method of assessing qualitative data that involves examining the information acquired to uncover common ideas, topics, and patterns of meaning that appear repeatedly (Caulfield, 2023). Through a thorough analysis, researchers can gain valuable insights that tackle the uses, effects, and areas that need to be addressed. In this approach, researchers will be able to determine how other countries apply these technologies allowing the researchers to gain insights. Developing recommendations and implementing them in the Philippine context. Providing researchers valuable observations in the context of adopting augmented and virtual reality in the Philippines.

Fig. 1. Data Collection and Preparation



Source: (Delmo et al., 2023).

RESULTS AND DISCUSSIONS

Table I. Comparison of the specifications of Meta Quest 2 and HTC Vive Pro

| Specifications | Brand | |
|----------------|----------------------------------|---|
| | Meta Quest 2 | HTC Vive Pro |
| Display | Fast- switch LCD | Dual Amoled |
| Resolution | 1832×1932 pixels per eye | 440×1600 pixels per eye (2880×1600 pixels |
| Refresh rate | 72Hz, 90Hz, 120Hz (experimental) | 90Hz |
| Field of view | 110 degrees | 110 degrees |

| Specifications | Brand | |
|----------------------|--|--|
| | Meta Quest 2 | HTC Vive Pro |
| Audio Feature | Integrated, in strap | Hi-Resolution certificate headset Hi-Resolution certificate headphones (removable) High impedance headphones support |
| Connectivity Options | Bluetooth 5, USB-C, Wi-Fi 6, 3.5mm headphone jack | Bluetooth and a USB-C port for connecting peripherals. |
| Weight | 503 g | 550g without head strap 800 g with head strap |
| Lens Adjustment | 58-68mm | 60.7-73.5 mm |
| Battery life | 2-3 hours | Approx. 6 hours |

Source: Processed by Authors

The Meta Quest and HTC Vive Pro are the market’s most high-quality and widely available technology. They both stand out in various aspects. In terms of affordability, Meta Quest 2 is the better option because of its cost-effective features, which are the fast switch LCD and lightweight structure. HTC Vive Pro becomes remarkable when it comes to advancements and more upgrades. Both have impressive specifications which makes them valuable devices of AR/VR in the real estate industry. Given their distinct and extraordinary qualities, each device has the potential to have a different effect. impact because of its unique and exceptional features.

A total of 7 feedbacks were gathered from various buyers on the Amazon shopping platform to analyze the comparison of specifications of HTC Vive Pro and Meta Quest 2. The researchers gathered comments on the shopping link of the specific device in a span of six months.

Table I.I. Comments and specifications of AR/VR devices

| Brand | Client | Client Statement | Themes |
|--------------|----------|--|---|
| HTC Vive Pro | Client A | “Our family is thoroughly enjoying the VIVE PRO 2, thanks to its crystal clear graphics. It was purchased as a Christmas present for our son. The Vive Pro 2 offers a single wire connection to the headset, enhancing comfort and freedom of movement. In addition to its other impressive features, the face adjustment for individuals who wear glasses is a notable inclusion. It was a fantastic purchase for our family.” | Excellent visual clarity and resolution |
| HTC Vive Pro | Client B | “The device boasts a 120Hz refresh rate and a 4896 x 2448 resolution, complemented by its exclusive motion compensation technology, guaranteeing seamless performance on a 4070 GPU. The visuals are truly impressive, and the system operates flawlessly. Having an on/off button on the link box is a useful feature. The screen detail on this PC VR device is truly remarkable, and the drivers are incredibly user-friendly.” | Convenient features |

| Brand | Client | Client Statement | Themes |
|--------------|----------|---|--|
| HTC VivePro | Client C | “After about eight months of use, the headset started to have major problems with its wiring. After approximately 30 minutes of use, the display tends to go black. Furthermore, there are occasional rectangular flickers of purple static, particularly noticeable when the head is in motion, which can be attributed to faulty wiring. The headset also experiences graphical issues, including washed-out images and ghosting, that can persist for extended periods if the linkbox is powered off while the Steam VR software is still active.” | Persistent Software and Wiring Problems |
| Meta Quest 2 | Client D | “The Meta Quest 2 is an incredible value for the performance it delivers. The display is sharp, the tracking is reliable, and the wireless functionality is a game-changer. I was able to play a wide variety of VR games and experiences without any issues. The battery life is also quite good, lasting 2-3 hours on a single charge. Overall, this is an excellent standalone VR headset that I highly recommend.” | Excellent value and performance |
| Meta Quest 2 | Client E | “I’ve been thoroughly impressed with the Meta Quest 2. The headset is comfortable for extended gaming sessions, and the visuals are highly immersive. The controllers are intuitive and responsive, enhancing the experience. The wireless freedom is a significant improvement over tethered PC VR. This headset is a fantastic entry point into high-quality virtual reality.” | Immersive and comfortable VR |
| Meta Quest 2 | Client F | “Although the Meta Quest 2 hardware is undeniably impressive, the software and app ecosystem have left much to be desired. The Oculus/Meta store provides a narrower range of options compared to PC VR, and several apps and games appear to be in an early stage of development or lacking in content. The social features are also quite basic. Considering the extensive resources available to Meta, I had higher expectations. The headset seems limited by the software experience.” | Disappointing software ecosystem and app selection |
| Meta Quest 2 | Client G | “I have conflicting emotions regarding the Meta Quest 2 as I have reservations about its impact on privacy. Having to use a Facebook/Meta account in order to utilize the device implies that they possess a substantial amount of information regarding my VR usage and activities. I have concerns regarding the extent of data collection and its potential implications, despite the impressive hardware involved. I find the privacy tradeoffs to be a significant drawback.” | Concerns over privacy and data collection by Meta |

Source: Processed by Authors

The clients provide feedback on their experience with the HTC Vive Pro and Meta Quest. Most of the feedback is positive, however there is a few negative feedback. Clients are impressed by the performance of both devices, which makes them more prominent these days. Meta Quest 2 receives acclaim for its mobility, user friendly and impressive features. But some clients pointed out limitations such as restricted access to information and unexpected technical glitches. On the other hand, HTC Vive Pro receives acclaim for its outstanding visual clarity and captivating audio, but this device also faced criticism for its high cost and restricted mobility caused by the tiny form. The feedback highlights the importance of considering the user experience and technical specifications when evaluating the interactive aspects and visuals of these

technologies. By considering these, real estate companies may have the chance to choose their preferred AR/VR device that suits the needs of their company in order to improve their business.

Table II. Extent of use and its impact on industry practices.

| Use of AR/VR in Real Estate | Impact | Themes |
|---|---|-------------------------------|
| Virtual Property Viewings | Enables clients to remotely visualize properties. Looking at different rooms, layout, and design possibilities | Remote Visualization |
| Interior Design Visualization | Augmented Reality helps potential buyers how they can arrange and customize properties that fits their personality. | House Customization |
| Off-plan Property Visualization | Enables buyers to visualize property that are still under construction or in the planning stage. Exploring and interacting with their future properties | Showcasing Future Property |
| AR Assisted Real Estate Marketing | Allowing customers to learn all the important details about real estate properties and even objects before contacting a real estate agent. | Innovative Marketing Strategy |
| VR Training for Real Estate Professionals | Virtual Reality as a tool to be used in training real estate professionals for a better understanding of their designs. | Tool for Training |

Source: Processed by Authors

In the extensive usage of these technologies, the findings prove that using AR and VR technology in the real estate business is having a big effect on how the companies work. Virtual property tours refers to how these technologies provide different levels of viewings. There’s no need for physical appearances, it saves time especially to those who are interested but don’t have enough time to see it for themselves. Another factor is the interior design visualization, this allows potential buyers to customize the property with the things that could suit their personality or even arrange the placement of the rooms, this will let them visualize and imagine possibilities that can help them with their decision in purchasing their dream home. Making every client satisfied with their liking. Same goes with the off property visualization, this will also let them visualize properties that are still under construction. Augmented reality also offers a different level of strategy, the AR Assisted Real Estate Marketing. This will help customers to make it easy for them to choose and pick their interested property, before contacting an agent for an official purchase. In addition to this, virtual property also serves as a tool for the agents and professionals to better understand their designs by walking through the houses they made. In summary, these technologies are transforming real estate practices by their extensive uses.

Table III. Impact of High Cost and its benefits..

| Ergonomic features | Physical discomfort and health issues | Intervention | Safety and comfort precautions |
|-------------------------|---------------------------------------|----------------|--|
| Implement Regular Break | Eye strain | Break reminder | Using the 20/20/20 approach to taking a regular break. During the long period of screen time, it is important to frequent eye blinking to keep eyes moist and prevent dryness. |

| | | | |
|----------------------------|------------------------|-----------------------|--|
| Adjustable Display Setting | Eye strain | Display Setting | Adjusting the font size, quality, brightness and contrast can reduce eye fatigue during the prolonged use of the device. |
| Smooth Motion movement | Motion Sickness | Environmental Control | Avoid using camera animations and tactics like zooming in and out, as they may cause motion sickness. |
| Adjustable /Frame rate | Motion sickness | Frame rate setting | VR HMD refresh rate should match the VR content's frame rate. |
| Lightweight Headset Design | Musculoskeletal issues | Ergonomic Design | Enhance comfort and reduce the impact of physical fatigue. |

Source: Processed by Authors

Changing the display's settings and taking a regular break can help lower the risk in the eye and enhance user experience and productivity. On the other hand, environmental control elements help to lower motion sickness. Smooth motion movements also help to keep the orientation and comfort of the user. Encouraging the use of AR/VR devices while also ensuring the well-being of the balance system requires a consistent use. Relatively, moving and stretching with the combination of comfortable headpiece designed for an effective ergonomics, can have significant benefits for flexibility, posture, blood circulation and chronic injury pain. These solutions increase comfort and long-term health benefits by letting users experience these technologies free from constant discomfort or health issues. Interventions mentioned above show their value as these devices are associated with these health risks. Clearly these interventions are enhancing the whole use and experience. With longer usage times, many businesses will notice increased customer satisfaction, enhanced sales performance and wider acceptance of AR/VR devices. This not only enhances the immediate experience of the user but also promotes long-term well-being and efficiency, highlighting the significance of ergonomic features in the AR/VR's design and function. All in all, the ergonomic features that have been mentioned are needed to reduce the pain and health risks that are experienced using AR/VR devices.

Table IV. Impact of High Cost and its benefits..

| High Cost | Impact | Benefits |
|--------------------|---|---|
| Initial Investment | The high investment cost of the AR/VR devices can discourage potential investors from adopting these technologies, as they might not see an immediate return on their investment. | Competitive Advantage: Investing in AR/VR can provide competitive advantage in the market. Providing clients a different level of viewing experiences and having the chance to make a different way of marketing strategy from their competitors. |
| Operational Costs | Operational costs can be considered as another barrier in implementing AR/VR. These include upgrades and the maintenance of the device to utilize it smoothly. | Competitive Advantage: Investing in AR/VR can provide competitive advantage in the market. Providing clients a different level of viewing experiences and having the chance to make a different way of marketing strategy from their competitors. |

| | | |
|----------------------|--|--|
| Technical Challenges | Integration issues such as technical difficulties can pose a significant factor in adopting these technologies. This demands technical expertise and resources which could be considered as another expense. | Convenience for everyone: Everyone could benefit from VR tours using Virtual Reality. This will help the buyers to search available houses conveniently and makes it easier for real estate agents to sell properties. |
|----------------------|--|--|

Source: Processed by Authors

Looking at the table, it is observed that the high cost of AR/VR devices has its own pros and cons. The Upfront investment, operational costs and technical issues are the factors of high adoption costs. Although the results show that this has made it harder to use these devices in the real estate business, they also show that they have the potential to make things better and bring about big changes in the field. It is proven that potential investors in the real estate industry may be discouraged by those expenses associated with the implementation, especially if they don't expect to see immediate return on their investment. Operational costs such as maintenance and upgrades that requires financial budget and that can contribute to the financial burden of the company and technical challenges include hardware malfunction and connectivity problems. On the other hand, the advantages of these devices can outweigh the expenses. These advantages contribute to enhance the overall performance of the company including client satisfaction which plays a big part. Real estate companies that effectively utilize these technologies can keep a competitive advantage in the market and gain long-term benefits. These explanations are highly convincing as AR/VR technology offers a range of benefits for marketing innovative strategies, efficient processes and captivating property tours. Overall, the high initial cost and continuous operating expenses associated with AR/VR technology may discourage potential investors, but through improved customer satisfaction and innovative marketing strategies they may end up gaining edge and significant long-term rewards for those who are prepared to make the investment.

Table V. Existing government initiatives or policy and the opportunity for improvement in the Philippines and its neighboring country

| Existing government initiatives and policy | Setting | Opportunity for improvement |
|---|-------------|--|
| Tech4ED or the Technology for Education, Employment, Entrepreneurs, and Economic Development by the Department of Information and Communications Technology (DICT). | Philippines | The opportunity for improvement for this initiatives are the following: establish more Tech4ED centers, provide more computers , improve internet connectivity and partner with more local government units (LGU's). |
| Brand Metaverse Onboarding Programme and Immersive IP Experiences Programme by Malaysian Digital Economy Corporation | Malaysia | This program's opportunity for improvement are the following: enhance collaboration, increasing people's awareness, and expanding the Criteria for Global Participation. |
| Pixel Innovation Hub by Infocomm Media Development Authority (IMDA) | Singapore | This incentives by the IMDA has lack some improvement such as expanding the AR/VR lab facilities, offer Training Workshops and Mentorships and collaboration with the International AR/VR hubs. |

Source: Processed by Authors

The table above provides the existing government initiatives in the Philippines and its neighboring countries like Malaysia and Singapore. The analysis of the existing initiatives and policies shows a positive approach by the government to the utilization and implementation of AR/VR technology into their real estate sectors.

Some opportunities for improvement can enhance the effectiveness and reach of these initiatives. The Philippine Department of Information and Communications Technology's Tech4ED program aims to make technology accessible to all Filipinos. The continuation of Tech4ED centers, increased number of PCs, greater access to the Internet, and collaboration with more LGUs are needed to improve digital literacy and fly the application of AR/VR technology in real estate. Malaysian Digital Economy Corporation manages operations and provides an exciting program such as the Brand Metaverse Engagement Program and Comprehensive Intellectual Property Experience. To make the programs more effective it is important to establish partnerships and collaborations, increase public awareness, and make the global participation criteria inclusive. The Singapore Media Development Agency supports startups with the Pixel Innovation Hub which offers facilities such as AR/VR labs and 5G hotbeds which can be furthered by expanding these offerings, more training and consultancy, and additional collaboration with AR/VR companies around the world, which can position Singapore as a global lead for AR/VR developments in real estate, and the programs.

With these opportunities, Partnerships, Collaborations, and Providing more facilities and centers for these programs are the highlighted and most needed for the improvement and betterment of these initiatives. Therefore, National Trainings enabling Employment, Education and Economic Development just like Tech4Ed for AR/VR with the help of National, Local Government, Big companies should be developed to adopt and make people familiarize these technologies for betterment of the expertise of those who are willing. In this way, the government could help agents, users, gamers, or even an ordinary individual to explore and discover what these devices could offer. Enhancing one's curiosity and encouraging a world full of possibilities.

CONCLUSIONS

The study's findings are derived from an analysis of the search results, indicating AR/VR devices are advanced technologies and each has unique advantages. When evaluating usability, we need to consider user experience and technical issues. By carefully analyzing user feedback and understanding its constraints, real estate companies can make appropriate choices that will enhance their business. It can provide detailed presentations by adding high-end AR/VR capabilities. This technology dramatically improves agents' ability to comprehend design and make informed decisions, benefiting both businesses and consumers. Along with those obvious benefits, the real estate industry is expected to see a significant increase in the use of this technology. Having a deep understanding of the importance of ergonomic features in AR/VR design can significantly improve the user experience and reduce the likelihood of health issues. The result showed that improved sales performance and increased customer satisfaction were caused by the increasing time of usage. The adoption of these technologies can give investors and other businesses a competitive advantage, especially in the real estate sector. These probably enhance their customer satisfaction and new marketing strategies. The Philippines, Malaysia, and Singapore have made significant contributions in integrating these technologies into the real estate industry. However, there are still areas that have room for further improvement and development. To optimize the success of these activities, it is crucial to prioritize the improvement of partnerships, collaborations, and facilities.

RECOMMENDATIONS

Based on the conclusion, the following are the recommendations to the government and real estate stakeholders. First, the government should continue to promote and develop initiatives aimed at integrating AR/VR technology into the domestic sector, with a focus on enhancing technical infrastructure and boosting adoption. Additionally, develop national standards for AR/VR equipment, software, and content to ensure quality and interoperability, establish guidelines for using AR/VR applications in real estate to address data privacy and consumer protection concerns. Furthermore, real estate enterprises must prioritize user-friendly

design and ergonomic elements to increase user experience and prevent health issues. Regular maintenance and updating of AR/VR systems is required to resolve technical issues and provide a dependable system. Lastly, partnerships with technology businesses and educational institutions can also stimulate creativity and lead to the development of innovative AR/VR solutions. Sharing industry best practices and triumphs will help to speed and improve technology adoption, as well as boost sales performance, customer happiness, and competitiveness.

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