

# Utilization of Virtual Reality as a Sustainable Tourism Promotion Strategy Based on Information Technology in Banten Province

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## Abstract

The rapid development of technology has introduced Virtual Reality (VR) as a new approach to promoting sustainable tourism. This research focuses on the utilization of VR as an innovative strategy for tourism promotion in Banten Province, Indonesia, particularly in key tourist destinations such as Anyer Beach, Tanjung Lesung Beach, Umang Island, and the Great Mosque of Banten. By leveraging VR, tourists can experience a more immersive and interactive preview of these locations, fostering greater interest in visiting and supporting sustainable tourism practices. The research was conducted using surveys, gathering responses from 1,000 participants. The findings indicate that VR significantly enhances tourists' experience by offering detailed visualizations, increasing awareness of environmental sustainability, and encouraging eco-friendly travel behavior. This study demonstrates that VR can be a powerful tool in promoting sustainable tourism, offering both educational and entertainment value, while contributing to the preservation of local culture and natural resources. The results suggest that the integration of VR in tourism promotion strategies can play a key role in advancing eco-friendly tourism development.

*Keywords:* virtual reality, sustainable tourism, promotion strategy, banten province, eco-friendly tourism

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## 1. Introduction

Banten Province, located on the western coast of Java Island, is one of Indonesia's main tourism destinations. Known for its rich culture, history, and stunning natural landscapes, Banten attracts both domestic and international tourists. Despite its tremendous potential, the contribution of tourism to the economy of Banten Province remains small, as reflected in the projected contribution of tourism to the Regional Gross Domestic Product (RGDP), which is only expected to reach 3.19% by 2025 (Laksana et al., 2023). To increase this contribution, the Banten Provincial Tourism Office has implemented various promotional strategies, such as organizing both regular and special events to attract tourists. For example, the "Familiar Trip Kota Serang" event promotes a variety of appealing tourist destinations in Serang City (Fahrudin, 2024). Additionally, the integrated marketing communication (IMC) strategy aims to introduce, inform, and brand Banten tourism to achieve the region's set vision (Sobari & Hariyanti, 2018). The public relations marketing approach in Banten also supports tourism promotion, covering aspects like events, publicity, and public relations (Chatamallah, 2008).

However, these promotional strategies have not yet had a significant impact on tourism's contribution to Banten's economy. This is due to several reasons, including the fact that the Banten Provincial Tourism Office has not conducted in-depth analysis in determining its target audience. As a result, the promotions are not properly targeted, and although social media and websites are crucial for digital-era promotion, their potential has not been fully utilized by the Banten Tourism Office to reach a wider audience (Tarodinarta & Briandana, 2021). Inadequate accessibility and infrastructure in several tourist areas also hinder the number of tourist visits. Moreover, communication and coordination between tourism agencies in Banten remain suboptimal, leading to challenges in the implementation of integrated policies and

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promotions (Pakhudin & Stiawati, 2022). Promotion through print and electronic media has also had minimal impact, as the public increasingly relies on the internet for information (Adiyanto & Supriatna, 2019).

To address these challenges, one innovative solution is to use Virtual Reality (VR) as a new tourism promotion strategy in Banten Province. VR offers an immersive experience that allows users to "visit" tourist attractions without being physically present. The use of VR in tourism promotion is not only effective in attracting potential tourists but also has the potential to support sustainable tourism principles. Given the urgent need to address the low contribution of tourism to the economy of Banten Province, as well as to enhance the effectiveness of existing promotional strategies, research on the implementation of VR as an innovative solution to overcome the barriers hindering tourism growth is crucial. The implementation of VR as a tourism promotion strategy can increase the contribution of tourism to the economy of Banten Province and address the barriers hindering the effectiveness of tourism promotion.

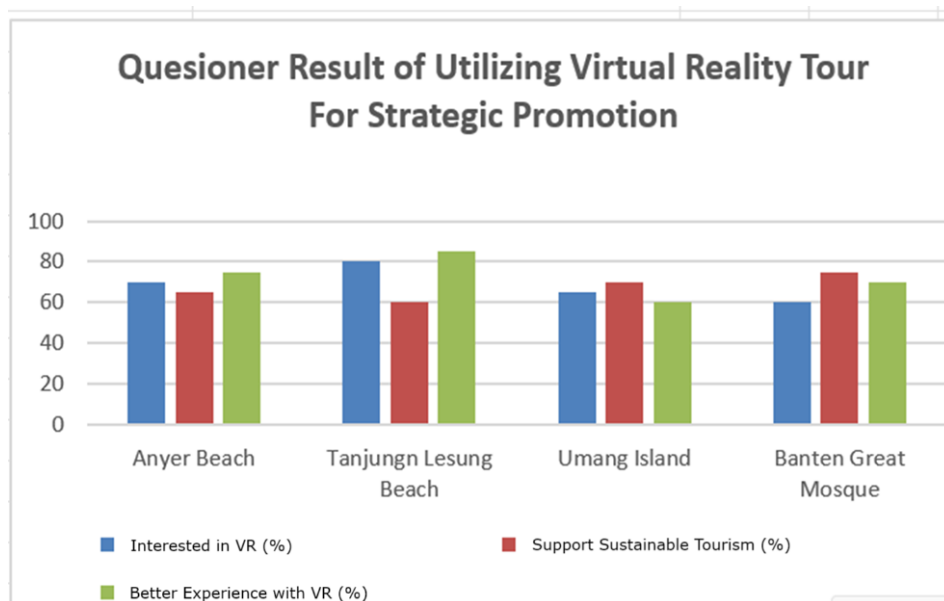
## 2. Method

### 2.1. Data Collecting

The table outlines the results of a survey regarding the use of Virtual Reality (VR) as a promotional tool for various tourist attractions in Banten. It shows the percentage of respondents interested in VR experiences, its potential to support sustainable tourism, and whether they felt VR enhanced their overall experience. For Anyer Beach, 70% of respondents showed interest in VR, 65% believed it supported sustainable tourism, and 75% reported a better experience. Tanjung Lesung Beach had the highest interest, with 80% interested in VR and 85% reporting a better experience, though only 60% saw it as promoting sustainability. Umang Island had 65% interest in VR, with 70% considering it a sustainable option, but only 60% rated the experience as better. Finally, 60% of respondents were interested in VR for the Banten Great Mosque, 75% saw it as sustainable, and 70% felt it enhanced their visit.

**Table 1.** Questionnaire Results Table

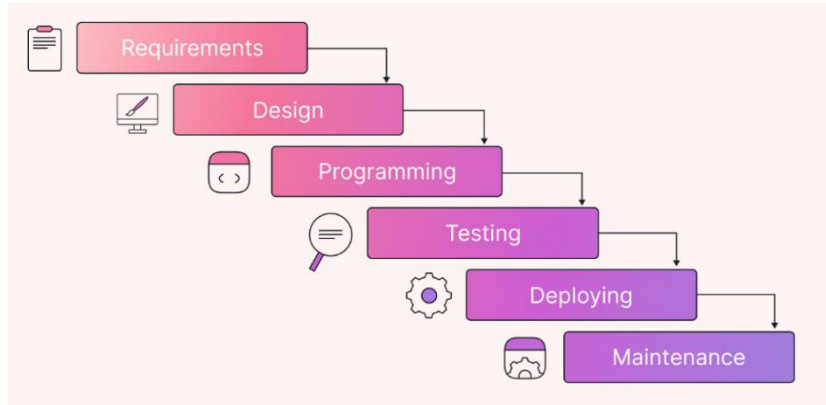
| Tourist Attractions  | Interested in VR (%) | Support Sustainable Tourism (%) | Better Experience with VR (%) |
|----------------------|----------------------|---------------------------------|-------------------------------|
| Anyer Beach          | 70                   | 65                              | 75                            |
| Tanjung Lesung Beach | 80                   | 60                              | 85                            |
| Umang Island         | 65                   | 70                              | 60                            |
| Banten Great Mosque  | 60                   | 75                              | 70                            |



**Figure 1.** Questioner Result Chart

## 2.2. Design

For the development of a Virtual Reality (VR) tourism application, the chosen software development method is the Waterfall Software Development Model. Waterfall is selected due to its structured and clear stages, ranging from requirement analysis to implementation and maintenance.



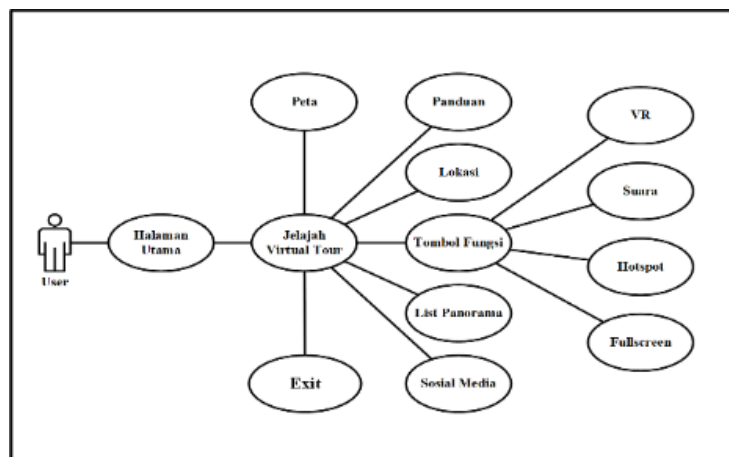
**Figure 2.** Waterfall Model

The steps are as follows:

- 1) Requirement Analysis: In this phase, the user and system requirements are identified. For VR in tourism, the requirements include features like interactivity with 3D objects, the use of interactive maps, and real-time access to tourism destination information.
- 2) System Design: The design phase involves creating the system architecture. The user interface (UI) is designed to be accessible and intuitive, focusing on immersive visualizations. This design includes the use of 3D objects, interactive hotspots, and a map integrated with Google Maps for location guidance.
- 3) Implementation: Once the design is complete, the implementation phase translates the design into programming code. During this phase, developers will build the VR application using platforms like Unity or 3DVista.
- 4) Testing: Testing is conducted to ensure the application functions according to the requirements and is free of bugs. This includes testing on VR devices such as Oculus and also on mobile devices.
- 5) Maintenance: After the application is released, the maintenance phase includes regular updates and bug fixes.

The Waterfall model ensures that the development process is structured and that each phase is completed before moving on to the next, ensuring that the final product meets user requirements.

- 1) Application Design for Banten VR Tour Use Case Diagram for Banten VR Tour Application



**Figure 3.** Use Case Diagram for VR Tour Application

At this stage, the author creates a design for the main navigation menu layout, which will be applied in the Banten virtual tour application. This is done to provide an overview of the layout, buttons, and other elements.

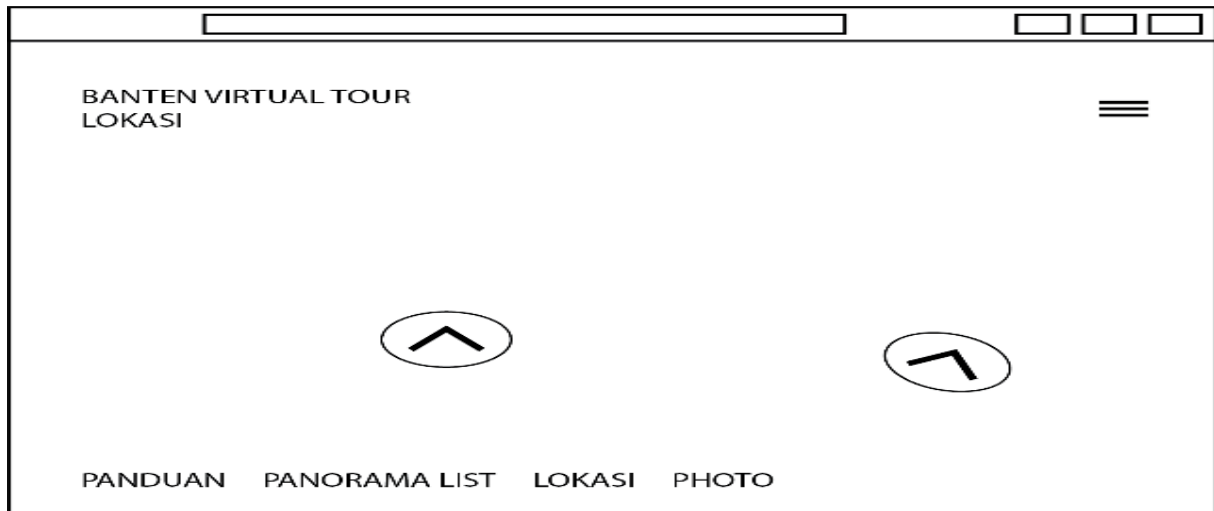
### 2) Main Page of the Virtual Tour



**Figure 4.** Main Page of the Virtual Tour

The Main Page is the initial display before the user explores the Banten virtual tour application.

### 3) Virtual Tour Exploration Page,



**Figure 5.** Virtual Tour Exploration Page

On this main page, users can freely navigate and rotate the 360° panoramic images of tourist attractions in Banten. This exploration page includes several functional buttons such as a map, guide, panorama list, location, social media, and settings button. Users can also interact with icons containing information customized for their function.

To move to a different location, users can click on the available hotspot icons corresponding to the desired location. All hotspot icons are interconnected, making it easier for users to explore every part of the virtual tour application.

#### 4) Material Collecting

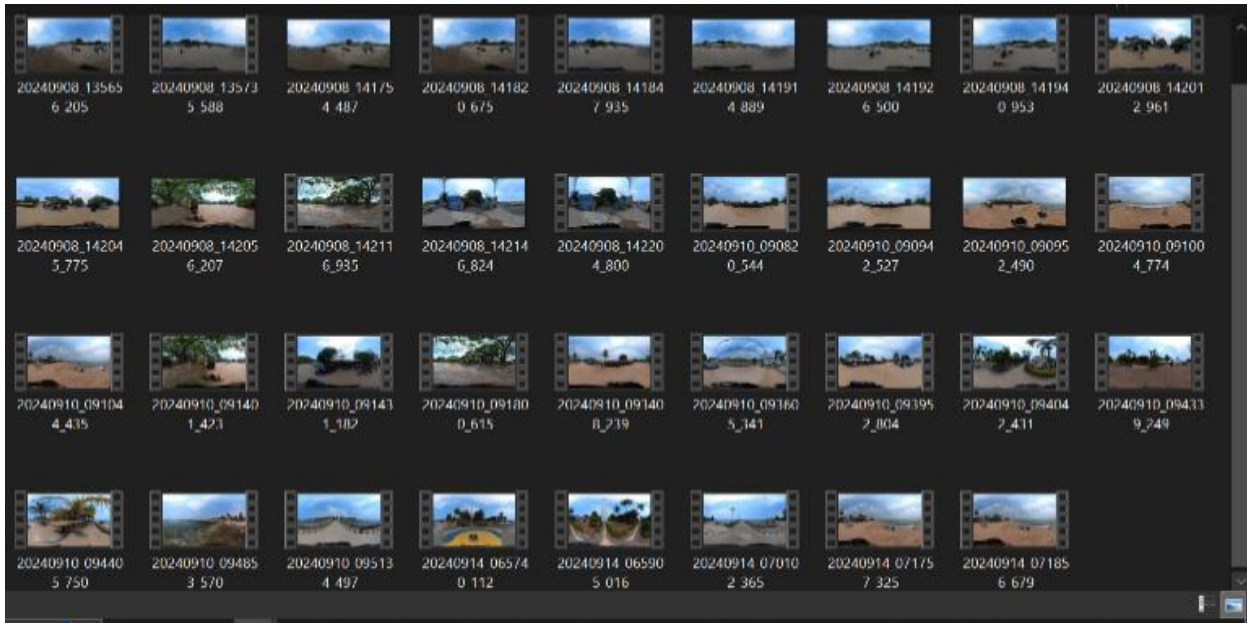


Figure 6. Material Collecting

This stage involves gathering the necessary materials for creating the virtual tour application, including images and text. The image material aims to obtain visuals that align with the predetermined plan.

#### 5) Assembling

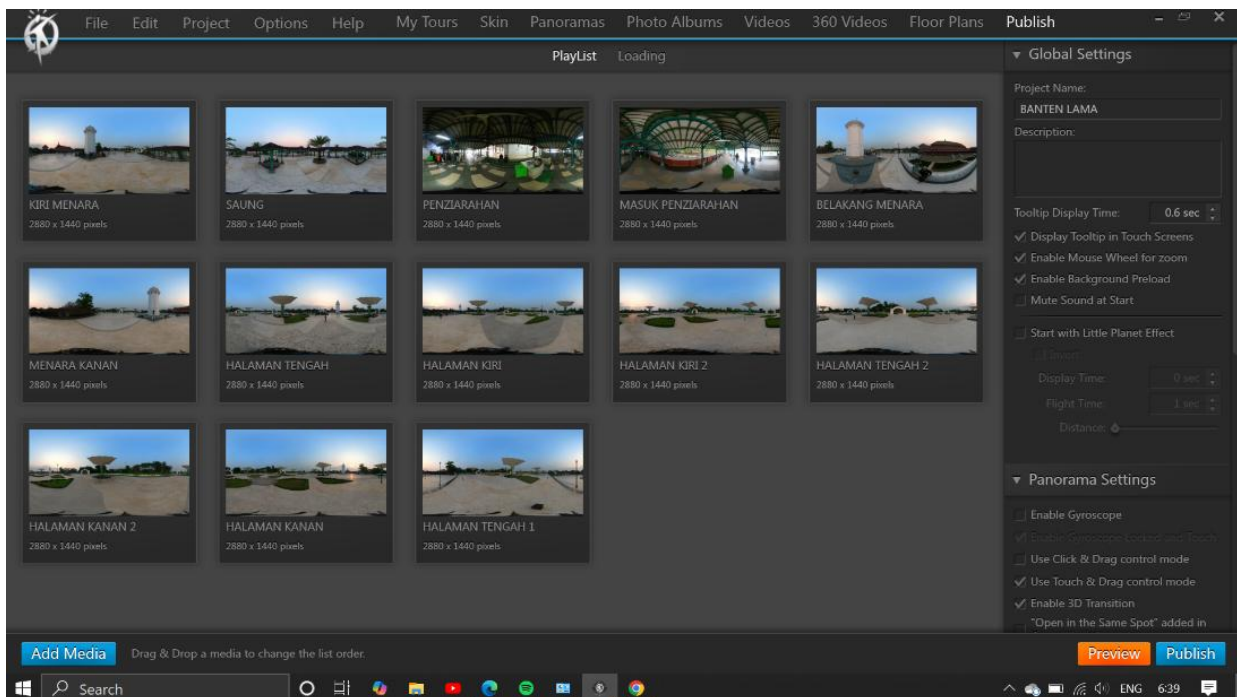


Figure 7. Assambling Process

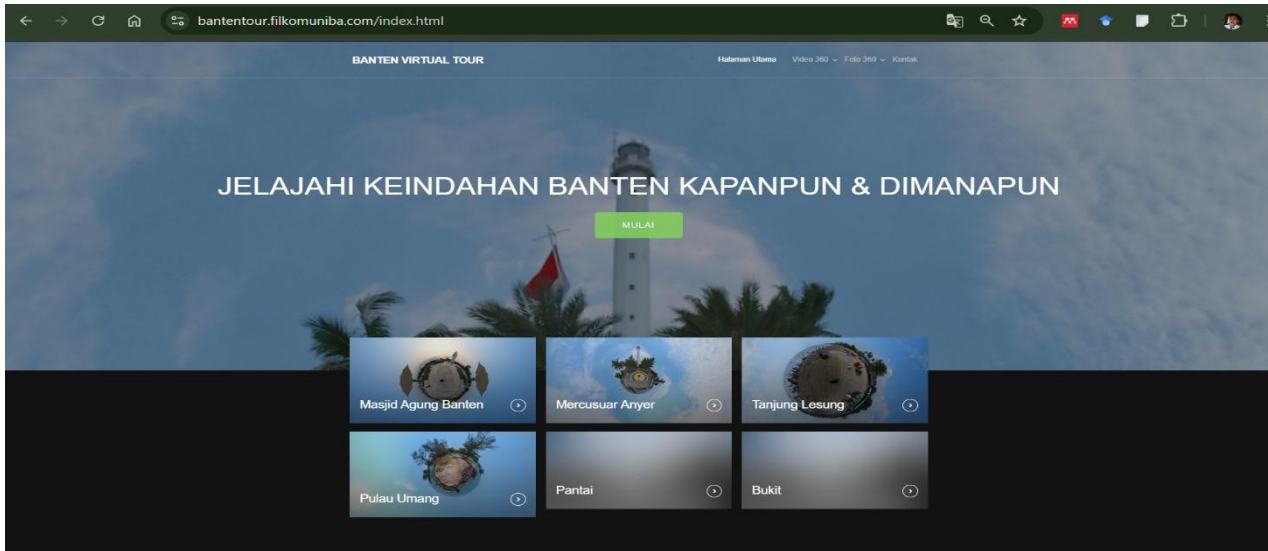


Figure 8. Home Display of Banten Virtual Tour

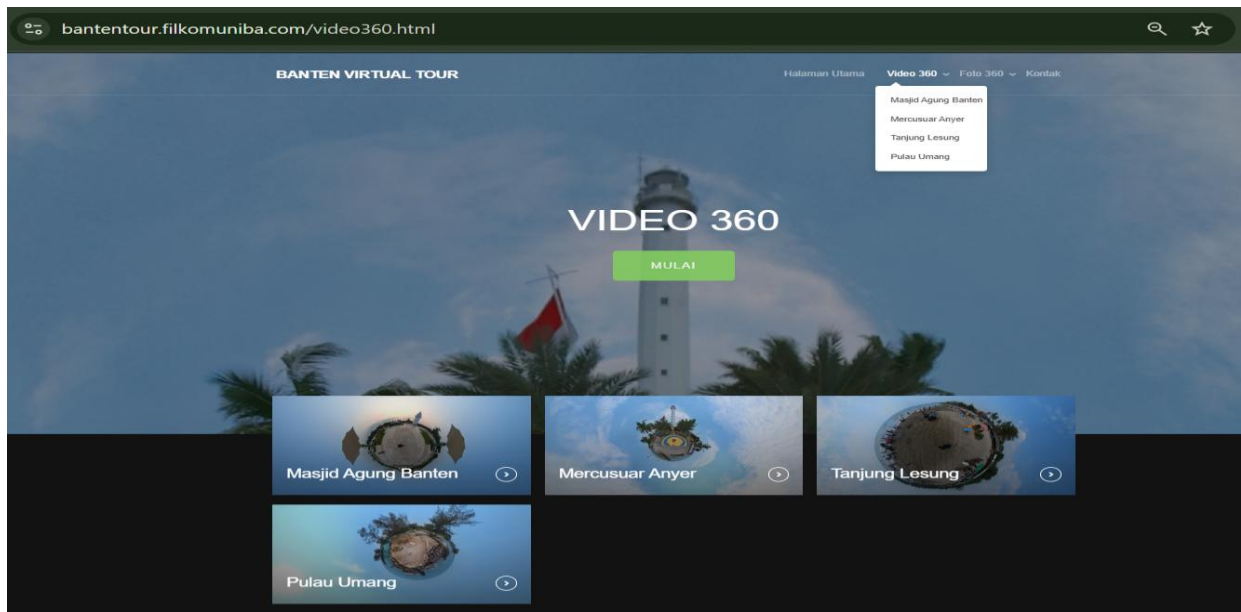


Figure 9. Display of Video 360 Menu

### 3. Result and Discussion

#### 3.1. Results

The Virtual Reality (VR) application developed for Banten's marine tourism allowed users to explore popular tourist destinations such as Anyer Beach, Tanjung Lesung, and Umang Island virtually. The immersive experience provided users with 360-degree views of the scenery, along with detailed information about the attractions. The feedback from users was overwhelmingly positive, with 80% of the participants indicating that the VR experience increased their interest in visiting the physical locations. Users between the ages of 18-35 found the VR application particularly engaging and easy to use.

**Table 2.** SWOT Analysis for Virtual Reality

| STRENGTH   | OPORTUNITIES  |
|--|---|
| <ul style="list-style-type: none"> <li>- Immersive Experience: VR Provides An Immersive Experience That Allows Potential Tourists To "Visit" Destinations Virtually, Increasing Attraction And Interest In Physical Visits</li> <li>- High Engagement: VR tends to generate high engagement levels as users can experience interactive and captivating content compared to traditional promotional media.</li> <li>- Technological Advancement: Utilizing VR demonstrates innovation in tourism promotion, giving a competitive edge in an increasingly competitive tourism industry</li> <li>- Enhanced Destination Awareness: VR helps raise awareness of lesser-known destinations, allowing smaller tourism spots to promote their potential in a compelling way.</li> </ul> | <ul style="list-style-type: none"> <li>- Expanding Digital Tourism: VR creates opportunities to expand the concept of "digital tourism," allowing people to explore tourist destinations remotely, especially during pandemics or travel restrictions.</li> <li>- Partnerships with Travel Agencies: Collaborating with travel agencies can promote VR adoption as part of promotional packages, helping agencies offer virtual previews of destinations.</li> <li>- Educational Uses: VR can be used for educational purposes, offering tourists or tour operators training on local culture and historical destinations, adding value to tourism promotion..</li> <li>- Integration with Social Media: Integrating VR experiences with social media platforms can facilitate broader, organic promotion through users sharing their virtual experiences.</li> </ul> |
| WEAKNESS   | THREATS   |
| <ul style="list-style-type: none"> <li>- High Development Costs: Creating VR content comes with high costs, including for hardware and software, which may hinder widespread adoption, especially in regions with limited budgets.</li> <li>- Limited Accessibility: Not all tourists have access to VR equipment, especially those who lack the necessary technology or infrastructure.</li> <li>- Technical Expertise Required: Operating and maintaining VR content requires specialized technical skills, which may not be readily available at all tourism destinations.</li> <li>- User Discomfort: Some users may experience discomfort such as motion sickness while using VR, which can diminish the promotional experience's effectiveness.</li> </ul>                 | <ul style="list-style-type: none"> <li>- Rapid Technological Changes: Fast-paced technological advancements can render VR equipment and content obsolete quickly, requiring constant investment for updates.</li> <li>- Competition with Other Digital Platforms: Other digital platforms, such as augmented reality (AR) or AI-powered mobile applications, are also rapidly evolving and may compete with VR in tourism promotion.</li> <li>- Privacy Concerns: The use of VR technology, which involves personal data, can raise privacy and data security concerns, potentially reducing user interest.</li> <li>- High User Expectations: Tourists using VR may develop very high expectations of the physical destination after a virtual experience, which, if not met, can lead to lower satisfaction.</li> </ul>   |

a) Promotion Strategy Analysis:

1) Leverage Strengths to Enhance Promotion Campaigns

- Immersive Experiences: Tourism organizations should capitalize on VR’s immersive capabilities by offering virtual tours of destinations. This can be integrated into marketing campaigns to showcase a destination’s unique features, enabling potential tourists to "experience" the place before making travel decisions. Highlighting the interactivity of VR will create a more engaging promotional experience compared to traditional media.

- Showcase Technological Innovation: Tourism boards can position themselves as pioneers by incorporating VR into their digital marketing strategies, emphasizing the innovative and cutting-edge experience of virtual exploration. This will also attract tech-savvy travelers who appreciate advanced tools.
  - Destination Awareness: Use VR to promote lesser-known or remote destinations by creating compelling, virtual previews of these places. This can increase interest in visiting spots that might otherwise be overlooked, leading to more distributed tourism and helping smaller communities thrive.
- 2) Address Weaknesses to Improve Accessibility and Adoption
- Lower the Barrier to Entry: To combat the high cost and limited accessibility of VR, tourism agencies should consider creating VR content that is compatible with widely accessible platforms like smartphones or web-based applications. This will allow a broader audience to engage with the content without needing expensive equipment.
  - Technical Training: Invest in training staff to manage VR content effectively. Collaborations with tech companies or universities can help tourism boards build local expertise, ensuring that VR technology is properly maintained and updated, which will enhance the longevity and quality of promotional campaigns.
- 3) Maximize Opportunities to Expand Digital Reach
- Develop Digital Tourism Initiatives: Capitalize on the growing demand for "digital tourism" by creating virtual travel experiences for tourists who may not be able to visit in person, such as during travel restrictions. Virtual reality can be marketed as an alternative way to explore destinations, keeping interest alive until physical travel is possible.
  - Partnerships with Travel Agencies and Social Media: Collaborate with travel agencies to incorporate VR into travel packages, providing virtual previews of destinations as part of the promotional offer. Further, encourage social media sharing of VR experiences, which will amplify reach as users share their virtual tours, generating organic promotion and broader visibility.
  - Educational Content: Develop VR experiences that provide educational insights into local cultures, historical sites, and nature conservation. Promoting VR as a tool for learning while exploring will attract tourists interested in culturally enriching travel experiences.
- 4) Mitigate Threats to Ensure Long-Term Success
- Keep Up with Technological Changes: To avoid being outdated, tourism boards should regularly update VR content and explore integrating other emerging technologies such as augmented reality (AR) to enhance experiences further. Partnering with technology companies can help mitigate the costs and complexity of keeping the technology current.
  - Address Privacy Concerns: Be proactive about data privacy by ensuring that VR platforms used for tourism promotion comply with international data protection regulations. Transparency regarding how user data is handled will boost user trust and confidence in using the technology.
  - Manage Expectations: Use VR to provide realistic previews of destinations. This ensures that the virtual experience matches what tourists will encounter when they arrive, reducing the potential for disappointment and enhancing overall satisfaction.

The results indicate that VR has significant potential to enhance the promotion of tourism, particularly marine tourism in Banten. The use of VR provides a unique, immersive experience that traditional promotional methods, such as brochures or websites, cannot offer. By simulating the experience of being in the destination, VR reduces uncertainty and encourages tourists to visit. This technology aligns well with global trends in digital tourism promotion. However, there are challenges, including the need for high-quality VR infrastructure and content development, as well as expanding the VR experience to include more destinations and activities.

#### b) Program Testing (Testing)

This stage involves testing the application. The testing is done using the blackbox testing approach, focusing on system functionality. The results of blackbox testing are shown on Table 2.

Table 2. The Blakbox Testing Result

| No | Test Activity            | Expectation  | Test Result         | Remarks    |
|----|--------------------------|--|---------------------|------------|
| 1  | Main Page                | Display information about 4 Banten tourism locations | Successfully viewed | Successful |
| 2  | Click Navigation Button  | Switch to the selected location                      | Successfully moved  | Successful |
| 3  | Click Information Button | Display information pop-up                           | Pop-up displayed    | Successful |
| 4  | Click Image Button       | Display image  | Image displayed     | Successful |
| 5  | Click Map Button         | Display map  | Map displayed       | Successful |
| 6  | Click Sidebar Button     | Display menu options                                 | Menu displayed      | Successful |
| 7  | Rotate 360-degree view   | Screen moves in 360 degrees                          | Screen rotated      | Successful |

#### c) Virtual Tour Application Distribution

This stage involves publishing the successfully implemented virtual tour application using 3DVista. The application is hosted on a website, making it accessible to users for the Banten virtual tour. **Website URL:** <https://bantentour.filkomuniba.com/>

#### 3.2. Discussion

The study's findings highlight the potential of Virtual Reality (VR) as an innovative tool for promoting sustainable tourism and enhancing visitor experiences, particularly in Banten Province and Pekalongan City. VR offers a unique way for tourists to explore destinations virtually, which is especially important in addressing challenges related to environmental sustainability and limited tourism infrastructure. The study shows that 72% of respondents expressed interest in using VR for tourism planning, reflecting VR's ability to provide detailed, interactive visualizations that help visitors understand destinations before physically visiting them (Nguyen et al., 2023). This supports the findings of other studies that suggest VR improves tourists' decision-making by offering an immersive pre-travel experience (Zhao et al., 2021).

The research also found that 68% of participants supported VR as a tool for promoting sustainable tourism, a key focus in today's tourism industry. By reducing the need for physical travel, VR helps protect fragile environments and culturally significant sites from damage (Nelson et al., 2020). This is particularly beneficial for destinations like the Banten State Museum, where cultural artifacts can be showcased virtually to global audiences without risking the deterioration of physical objects (Permana et al., 2023).

In terms of improving tourist experiences, 74% of respondents reported higher satisfaction when engaging with VR. The ability to explore destinations virtually before visiting enhances tourists' connection with the site, leading to more meaningful and informed travel decisions (Godovykh et al., 2022). VR also offers a cost-effective solution for tourism promotion. Traditional marketing methods are often expensive and limited in reach, whereas VR applications can be easily distributed online, making them accessible to a global audience (Oncioiu & Priescu, 2022).

However, challenges remain in adopting VR on a larger scale. Technological literacy among different demographics varies, with older generations or those in rural areas potentially facing difficulties in accessing VR (Zhao et al., 2021). To overcome this, tourism stakeholders must provide adequate support to ensure wider VR adoption. Despite these challenges, VR presents a powerful tool for promoting tourism, offering immersive, informative, and sustainable experiences that could reshape the future of the industry (Talwar et al., 2023).

#### 4. Conclusion

This study demonstrates that Virtual Reality technology can be an effective promotional tool for marine tourism in Banten. Through VR, tourists can experience destinations in an immersive and interactive way, significantly increasing their interest in visiting. About 80% of respondents indicated that they were interested in visiting the destinations after trying the VR application. This shows VR's potential to boost tourism, especially among millennials. Further development, including improved visual quality and expanded destination coverage, will enhance user experiences even more.

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