

Optimization of Quadruple Helix Using RUMEUNG App for Sustainable Tourism Development in West Java

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ABSTRACT

The development of tourism concepts requires collaborative efforts across multiple stakeholders. This study focuses on enhancing the tourism sector through the "RUMEUNG" application, designed to integrate efforts from government, academia, business, and local communities. Such integration is essential for fostering creativity, ensuring high-quality final products, and maintaining competitiveness in the increasingly diverse market of tourism. West Java, an expansive region, is identified as having 2,583 potential tourist sites as per the Department of Tourism and Culture. To optimize these assets, coordinated development and marketing strategies are critical. This qualitative study uses descriptive research techniques to assess and improve the usability of the "RUMEUNG" application's user interface. It adopts the Lean UX methodology for design and evaluates the outcomes using Single Ease Questions (SEQ) and the System Usability Scale (SUS). Additionally, the research explores the application of the Quadruple Helix model in tourism development in West Java through the RUMEUNG program, aiming to enhance digital integration among the key stakeholders. Results indicate that the user interface design of RUMEUNG is highly accessible, with a SEQ score of 8.5%. Most users found the interface to be extremely easy to use (7%), while others rated it as easy (12%) and very easy (3%). The SUS scores were also favorable, falling within the grade B range (80-90), which reflects good usability. By implementing a Quadruple Helix approach, the RUMEUNG application potentially facilitates robust collaboration, promoting sustainable tourism development in West Java.

Keyword: Lean UX, Prototype, Quadruple Helix, Rumeung, West Java Tourism

1. Introduction

Regional development is an integral component of the national development strategy and is inseparable from the notion of regional autonomy. The implementation of the development plan within the framework of regional autonomy requires careful attention and responsibility from each autonomous area, and must be backed by the highest level of authority. The mandate of Law Number 32 of 2004 concerning Regional Government states that the policies implemented by the Regional Government aim to address the need for change and reform in the application of democratic values between the central government and the regions. These policies are expected to empower local communities ([Firmanto, 2019](#)). In addition, Indonesia, as an archipelagic nation, fosters a diverse and inclusive society. The pluralism of Indonesian society is a unique quality that distinguishes it from other nations. The nation's qualities can be harnessed and used as potential strengths and cultivated in the tourism industry.

Tourism is an integral component of a nation's economic progress as it plays a crucial role in augmenting foreign currency inflow ([Latianingsih et al., 2019](#)). In addition, tourism has a multiplier impact, meaning that it can expedite economic expansion by generating more employment possibilities in other connected sectors, such as hospitality, dining establishments, handicraft businesses, and transportation services. Prior to the arrival of Covid-19, the government had set a goal for the tourist sector to make a 4.8% contribution to the

GDP and generate \$21 billion in foreign exchange ([Kemenparekraf & Indonesia, 2020](#)), due to its promising growth. The province of West Java in Indonesia possesses significant tourism potential across multiple locations. As stated by ([Mustapa, 2019](#)), West Java is an advantageous and promising tourism destination. According to data from the Department of Tourism and Culture, there is a potential for West Java Tourist Attraction Objects (ODTW) to reach 2,583 objects in 2021, as reported by Open Data Jabar in 2022.

West Java is renowned for its distinctive culture, which is exclusive to the region and not found in other areas or nations. This culture is separated into three distinct cultural zones: the Parahyangan culture, the Dermayon-Kacirebonan cultural zone, and the Malay-Betawi cultural zone. The culture that flourishes in West Java province is derived from the cultural heritage of several community groups. This aspect possesses the potential to be a valuable local resource in terms of strength and social connections. However, regrettably, it is frequently overlooked and its capacity as a cultural and tourism asset remains untapped. In recognition of the abundant tourist and cultural opportunities in West Java, the Governor has officially designated the province as a hub for tourism, emphasizing its commitment to promoting the creative economy and cultural excellence.

To establish West Java as a tourism province, it is crucial to provide assistance for the fair advancement of tourism and culture in key regions experiencing rapid growth. This will not only generate employment opportunities and alleviate poverty but also ensure support for future cultural development. To achieve future cultural growth, it is imperative to provide assistance to individuals who are involved in cultural pursuits, such as intellectuals and cultural thinkers. This support should focus on enhancing their intelligence, personality, creativity, and abilities, aligning them with the evolving needs of dynamic tourism and cultural development.

West Java possesses significant tourism potential, encompassing cultural, natural, and man-made attractions. Between 2015 and 2019, the number of domestic tourist visits to tourist attractions and the number of foreign tourists increased from 1,067,271 people in 2015 to 3,645,433 people in 2019. The number of domestic tourists has consistently grown each year, with a recorded growth from 56,334,706 individuals in 2015 to 64,610,832 individuals in 2019. The year 2020 witnessed the outbreak of the COVID-19 pandemic, leading to widespread implementation of social restrictions. Consequently, there was a noticeable decline in both international and domestic tourist visits, as depicted in the provided table.

Table 1. Number of visits by foreign tourists and domestic tourists in West Java

Indicator	Unit	2017	2018	2019	2020
Target foreign tourists	People	1.500.000	1.750.000	1.830.000	30.000
Realization of foreign tourists	People	2.038.319	2.597.445	3.645.433	31.160
Vishnus' target	People	42.458.900	46.704.790	49.000.000	15.000.000
Vishnus Realization	People	59.780.016	63.298.608	64.610.832	35.513.885

Source: West Java Province Department of Tourism and Culture (2021)

The promotion of tourism and cultural development in West Java should be conducted through Nation and Character Building, in line with the principles of the Unitary State of the Republic of Indonesia, which emphasizes the reinforcement of national identity. This approach ensures that tourism and cultural development in West Java are not only an essential component of national development, but also contribute to regional development. Therefore, the implementation of regional tourism and culture should be seen as a strategic means to achieve the goal of improving the well-being of the people of West Java. In addition to that, it is necessary to construct and cultivate every available potential in order to ensure its long-term viability.

The 2021 Changes to the Strategic Plan of the West Java Tourism and Culture Office will be used to identify various areas of development based on the Culture and Tourism Development Pillars. The following items are included: 1) The first objective is to develop human resources that are resilient and capable of handling crises. 2) The second objective is to enhance destination governance by focusing on attractions, accessibility, and amenities. 3) The third objective is to boost competitiveness in the tourism industry and strengthen investments. 4) The fourth objective is to improve marketing efforts by leveraging digital media. This aligns with the objective of the tourism sector in the Amendment to the Medium Term Development Plan for West Java Province 2018-2023, which aims to enhance the productivity and competitiveness of the local economy by utilizing digital technology and collaborating with innovation centers and development actors. The goal is to establish West Java as a leader in tourism and the creative economy.

Tourism development is contingent upon the presence of synergy among the government, tourism entrepreneurs, and local communities ([Björk, 2014](#)). In addition, the involvement of academics in the drafting process is also essential ([Yunas, 2019](#)). The parties involved in this research will be designated as the actors in the Quadruple Helix model. In order to transform current challenges into favorable circumstances, it is imperative to embrace the principles of creativity and teamwork. Innovation frequently arises, particularly following collaboration among stakeholders. The reciprocal interchange of ideas and experiences among actors might result in innovative discoveries that may have previously been unimagined. The collaboration in the PIID-PEL program encompasses four key actors: government, community, creative business entities, and universities. The cooperation among these four actors is generally known as the Quadruple Helix, a model frequently employed to foster innovation in the economic sector, including tourism. Sakinah & Sofhani ([2016](#)) assert that the Quadruple Helix model is an innovative approach in rural development initiatives in Indonesia. Similarly, Widjajani et al. ([2016](#)) asserted that the Quadruple Helix model, when tailored to specific circumstances and available resources in each region, can serve as a framework for fostering regional innovation.

Mobile applications are software programs that are specifically created for mobile operating systems like Android, iOS, and Windows ([Saputra et al., 2021](#)). Mobile applications are an optimal solution for effectively reaching the intended audience. Mobile apps use distinctive user interface methods offered by mobile platforms ([Saputra et al., 2021](#)). A mobile application user interface refers to a visual display on a mobile device, like a smartphone or tablet, that enables users to interact with applications, features, content, and device operations through touch-sensitive controls. Given the small size of its layers and the presence of a touch screen display, it is important to prioritize the user interface's ease of use, readability, and consistency ([TechTarget, 2015](#)). Key attributes of a well-designed mobile interface include strong color contrast, a responsive and efficient screen, a consistent user interface, and clear, short, and well-structured information presentation ([Wairooy, 2020](#)). There is already an existing application for tourism in West Java.

This project intends to develop a digital tourist innovation named RUMENG (Rumah Ulin & Ameng) in West Java. The innovation will be based on an application and will be designed through Quadruple Helix cooperation. The goal is to maximize the tourism and cultural potential of the region. This study employs the Lean UX approach to create four stages, namely: Assumption Declaration, Minimum Viable Product (MVP) Creation, Experimentation, and Feedback and Research ([Pressman, 2005](#)). The utilization of Lean UX is necessary in this research due to the reliance on assumptions for the prototype, which must be verified. The Lean UX methodology is an empirical approach that seeks to enhance user experience and optimize process efficiency by reducing unnecessary documentation ([Gothelf, 2013](#)). This approach establishes a mutually dependent and interdependent process of development. Lean UX is built upon three fundamental pillars: Design Thinking, Agile Software Development, and Lean Startup. These foundations share a common characteristic: they all entail user participation in interactive processes and iterations with the intention of creating the optimal user experience, which is the ultimate objective of user experience ([Ramos-Vega et al., 2021](#)). The Lean UX methodology ensures successful testing of implementation and development iterations ([Liikkanen et al., 2014](#)). Design thinking is a crucial cornerstone of the Lean UX process since it fosters the development of cutting-edge technologies. The Lean UX approach prioritizes rapid product delivery and feedback by embracing the principles of the lean startup methodology, enabling swift iterations and enhancements.

The RUMEUNG application exhibits distinct disparities when compared to other tourism applications. RUMEUNG is a unique application that goes beyond simply offering tourist information or booking services. It brings together government, academia, industry players, and the community on a single platform to facilitate more efficient collaboration. In contrast to other tourist applications that primarily prioritize advertising or bookings, RUMEUNG places a strong emphasis on the advancement of sustainable tourism. This guarantees that the expansion of tourism is not merely transient, but enduring in the foreseeable future. Furthermore, RUMEUNG was explicitly developed to cater to the requirements and possibilities of tourism in West Java, rendering it more pertinent and efficient within the local setting as opposed to generic global or national uses. In summary, the RUMEUNG application represents a significant advancement in the promotion of tourism in West Java. It adopts a Quadruple Helix strategy and places a strong emphasis on sustainability. RUMEUNG has the potential to become an effective instrument in optimizing West Java's tourism potential and supporting sustainable economic growth by bringing together different interested parties on a single platform.

2. Method

This study employs a qualitative descriptive approach to elucidate the tourism potential of West Java, with the aim of optimizing its impact, particularly in the economic domain. The data utilized is classified as secondary data. This data is sourced via multiple indirect channels and acquired through intermediaries. Examples of reliable sources include scholarly publications, official government websites, and the official website of West Java Province. Subsequently, the author opted for the documentation strategy as they diligently gathered and documented data encompassing a range of occurrences, spanning from written records to visual representations. Bungin (2007) defines the documentation approach as a data collection technique in social research that involves tracing information from historical records.

Data analysis technique

Lean UX Method

Lean UX is an interaction design method that brings out the real nature of a product so that it achieves success and success more quickly collaboratively and cross-functionally by minimizing emphasis on documentation, but focusing on increasing understanding of the product experience being designed (Gothelf, 2013). There are four steps for Lean UX method, consist of :

1. Declare assumptions

The initial phase of Lean UX design involves articulating assumptions. The assumptions formed are partially accurate, serving as a basis for creating a prototype. The prototype is subsequently refined into a hypothesis, which is thoroughly examined and validated.

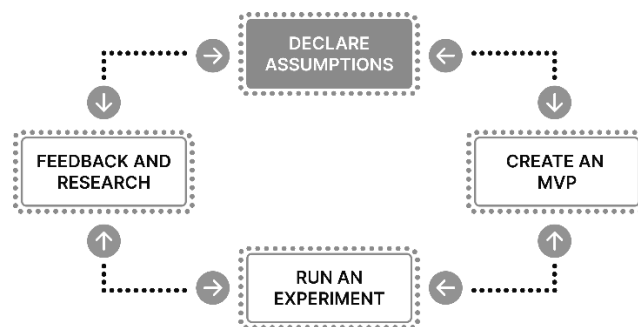


Figure 2. Stages of Declare Assumption

2. Create an MVP (Minimum Viable Product)

The Minimum Viable Product (MVP) is employed in Lean UX to validate the assumptions and hypotheses formulated in the preceding phase. Next, determine the concepts that are valid, the ideas that require more refinement, and the ideas that are not utilized in addressing user concerns (Gothelf, 2013). When creating a prototype, it is essential to take into account a minimum of three factors, which include:

- Who will engage with the prototype?
- The desired outcome you wish to attain ?
- Time required for creating a prototype ?

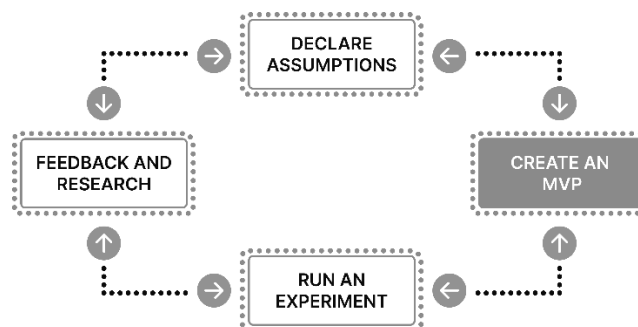


Figure 3. MPV Stages

3. Run an Experiment

This stage is the testing phase for the Minimum Viable Product (MVP) prototype. It allows for the participation of all team members, as well as independent users or relevant agencies who will require the application in the future. The purpose of this test is to determine the functionality and alignment with user requirements of the prototype that has been developed ([Anggara et al., 2021](#)).

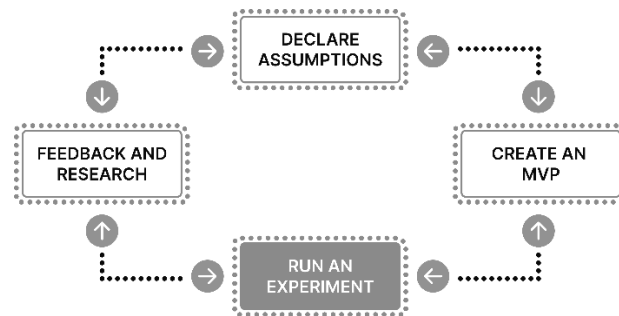


Figure 4. Run and Experiment Stages

4. Feedback and Research

This stage involves the validation of the hypothesis established in the previous stage. At this point, it is crucial to prioritize user feedback as it can greatly contribute to enhancing the design. By diligently documenting all suggestions and comments, we can effectively include them into the ongoing design development process ([Anggara et al., 2021](#)).

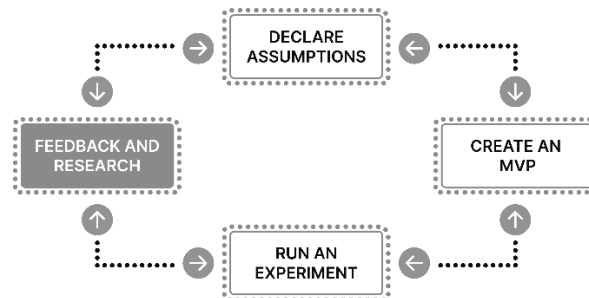


Figure 5. Feedback and Research Stages

Usability Testing

According to Jacob Nielsen, usability is a characteristic that evaluates the level of ease with which a user interface may be utilized. Usability pertains to techniques employed to enhance user convenience during the design process. Usability is comprised of five fundamental components, specifically learnability, efficiency, memorability, mistakes, and satisfaction ([Nielsen, 2012](#)). ([Santoso, 2018](#)) identifies various surveys available for measuring usability, such as:

- System Usability Scale (SUS)
- Post-Study System Questionnaire (PSSUQ)
- WAMMI dan SUPR-Q
- Single Ease Questions (SEQ)
- USE (Usefulness, Satisfaction, and Ease of use)

System Usability Scale

The System Usability Scale (SUS) is a widely used approach for measuring usability, which was established by John Brooke in 1986 ([Brooke, 2013](#)). This approach focuses on a singular metric that is derived from the user's viewpoint regarding the usability of a product ([Darmawan et al., 2021](#)). The Usability Scale system enables the assessment of a diverse array of products and services, encompassing software, hardware, and applications. The System Usability Scale comprehensively assesses different dimensions of system usability, including the requirement for support, training, and complexity. This scale demonstrates a high level of validity in evaluating usability, as confirmed by ([Romadhanti & Aknuranda, 2020](#)). The SUS questionnaire consists of

ten question components, each with five answer possibilities. The scoring range for the questionnaire is from 0 to 100. Brooke ([2013](#)) outlines that the System Usability Scale (SUS) consists of four distinct stages:

- Participants were administered a questionnaire consisting of 10 items rated on a 5-point Likert scale, ranging from "strongly disagree" to "strongly agree."
- The final score for each question with an even number is calculated by subtracting the user's score from 5 (5 - score).
- The score for each odd numbered question will be decreased by 1 (score - 1) for each question answered by the user.
- Total the resultant values obtained from the operations at points 1 and 2, and thereafter multiply the resulting total by the value 2. The number 5. The calculation results will be represented by a numerical range from 0 to 100.

Single Ease Questions

Single Ease Questions is a testing method used to measure the average ease of completing a task by asking participants to rate how easy or difficult the solution is ([De Bleecker & Okoroji, 2018](#)). SEQ consists of one question with a Likert scale of 1 to 7. In Figure 6 Likert scale.

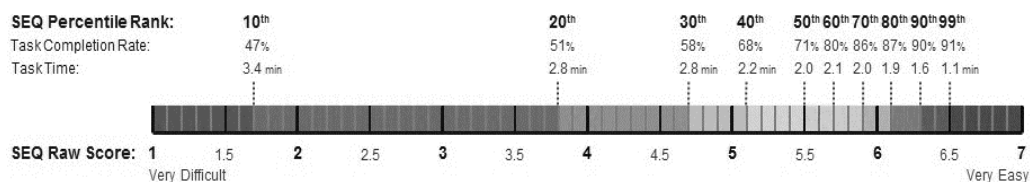


Figure 6. SEQ Likert Scale

3. Result and Discussion.

1. Stages of Declare Assumption

Potential for Tourism Development in West Java

Tourism has a vital role in the development of regions, particularly in West Java, as it serves as the primary source of regional revenue. In addition, the tourism industry serves as a means to enhance regional economic competitiveness. Efficient and coordinated management, in conjunction with other sectors of development, is necessary to facilitate rapid and comprehensive regional tourism growth. West Java has significant tourism potential, encompassing artificial, natural, and cultural attractions. According to report from the Tourism and Culture Office of West Java Province, there is a spatial plan in place for the development of the tourism region in West Java from 2021 to 2029. The graphic below displays the spatial plan for the area

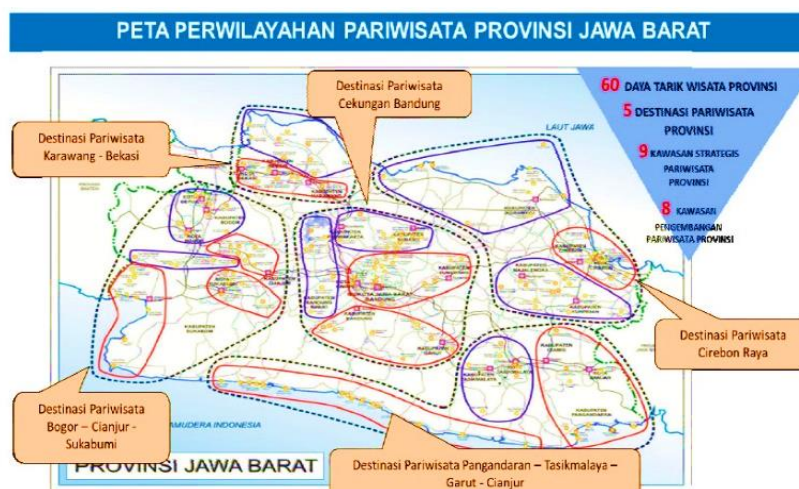


Figure 7. Tourism Distribution Map of West Java

Source: (Dinas Pariwisata dan Kebudayaan Provinsi Jawa Barat, 2021)

There are three pathways for tourism development in the regional spatial plan for West Java province. A more detailed explanation regarding these three routes can be seen in the table below:

Table 2. West Java Tourism Development

The leading tourist area on the northern rout	Region
<ul style="list-style-type: none"> Industrial and business tourism areas Agro tourism area Cultural tourism area 	<ul style="list-style-type: none"> Bekasi dan Karawang Bekasi, Karawang, Purwakarta, Subang, dan Cirebon Pesisir Cirebon
Tourist area on the Middle Route	Region
<ul style="list-style-type: none"> Peak ecotourism area, Cibodas botanical garden, Mount Gede Pangrango, Talaga Warna, Mount Tangkubanparahu Ciremai, Mount Halimun Agro tourism area Urban tourism and education area in WP KK Cekungan Bandung Priangan craft and cultural tourism area 	<ul style="list-style-type: none"> Cibodas, Pangrango, Ciremai, dan Bandung Selatan Bogor, Cianjur, Sukabumi, Majalengka, Kuningan, Bandung Barat, dan Bandung. Bandung
Tourist Area on the Southern Route	Region
<ul style="list-style-type: none"> Ecotourism area Agro Area Southern special interest tourist areas Pangadaran beach recreation area 	<ul style="list-style-type: none"> Pelabuhanratu, Cipatujah, Hutan Sancang, Ujunggenteng, Rancabuaya, Cilauteureun, dan Cijayanti. Sukabumi, Garut, Tasikmalaya, dan Banjar

Source: (Dinas Pariwisata dan Kebudayaan Provinsi Jawa Barat, 2021)

Tourism-centric regions possess the capacity to foster national tourism, which yields significant effects in various domains, including economic, social, and cultural advancement, preservation of natural resources, assessment of environmental sustainability, and enhancement of defense and security. The map depicted in Figure 3 illustrates the precise location of tourism development in the region of West Java.

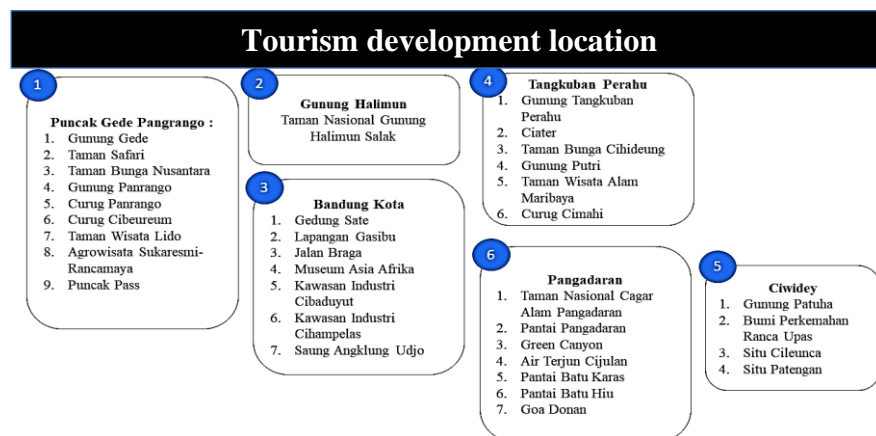


Figure 8. Tourism Development Locations

Source: (Dinas Pariwisata dan Kebudayaan Provinsi Jawa Barat, 2021)

Tourism Problems and Development in West Java

Indonesia is a nation endowed with copious natural resources and has distinct advantages, particularly in the realm of tourism. The tourism industry plays a significant role in enhancing the local economy. Presently, Indonesia boasts a diverse array of tourist destinations that possess immense potential for both man-made and natural tourism. West Java is actively striving to harness its tourism potential to boost local economy. According to a report from the Tourism and Culture Office of West Java Province, some challenges have been encountered throughout the development of the tourism region in West Java Province. These barriers include:

1. The tourism sector's contribution to the Gross Regional Domestic Product (GRDP) of districts or cities remains insufficient.
2. The level of public awareness, particularly in relation to the development of tourism activities, remains insufficient.
3. Not every area and city possesses exceptional tourist attractions.

4. Enhancing transportation accessibility to facilitate the growth of the tourism industry in West Java
5. The allocation of financing for tourism infrastructure is currently suboptimal.
6. The tourist code of ethics and corporate standardization are now suboptimal.
7. The progress of the creative industry is still suboptimal.
8. The collaboration and coordination of marketing efforts among local governments, tourism businesses, tourism promotion bodies, and the community is not yet at its highest level of effectiveness.
9. The planning, management, and supervision in the tourism sector have not reached their maximum efficiency yet.

As said before, it is crucial to maximize the tourism potential of West Java by growing it in a manner that ensures sustainability and has a positive influence on the economy. The subsequent dialogue pertains to the key aspects of West Java's tourism development.

a. Institutional

Enhancing the caliber of human resources involves endeavors aimed at advancing the production of goods and services, as well as their promotion in the market. Competent human resources have the ability to generate high-quality products or services. Similarly, on the marketing front, individuals with astute perception may analyze many scenarios to execute optimal marketing strategies. Competent Human Resources (HR) are undeniably essential in every industry, including tourism. Resilient and susceptible human capital is required to confront crises. The onset of the pandemic in early 2020 had a devastating impact on the tourism industry, resulting in a substantial decline in tourist numbers. Based on data from the Central Statistics Agency (2020), the total number of foreign tourist visits amounted to a mere 3.89 million. This figure is much lower compared to the previous year's performance, which had 14.73 million visits. The Ministry of Tourism and Creative Economy has included enhancing the caliber of human resources as one of the measures devised to revive tourism in the aftermath of the pandemic ([Utami & Kafabih, 2021](#)).

Offering training to individuals employed in the tourist industry is a means of enhancing the quality and skills of the workforce. The counseling and training provided are tailored to the individual's educational level, ranging from middle school and high school diploma to bachelor's degree. The course offered consists of Technical Guide course, which aims to enhance skills in providing tour guidance. Additionally, there is Technical Training available for workers in the Food Product & Room Division. The primary objective of this training is to enhance the skills and talents of the staff, ultimately leading to improved services. West Java tourism can enhance its training program by incorporating a comprehensive tourism risk management training module. This course aims to equip individuals with the necessary skills and knowledge to effectively handle crises and demonstrate strong management abilities, enabling them to thrive in diverse circumstances.

b. Destination

It is important to prioritize the development of destination governance. Governance, as defined by ([Beritelli et al., 2007](#)), is a conceptual framework that elucidates the dynamics and interactions among different stakeholders. The interactions that take place are essential for the establishment, viability, and allure of tourism. Effective management is essential for the tourism industry to achieve a cohesive and coordinated approach ([Wirakusuma, 2017](#)).

Enhancing the 3A factors (Attractions, Accessibility, Amenities) can facilitate the creation of a compelling and desirable tourism experience. Cooper ([2005](#)) provides an explanation for these three points. Attractions encompass several forms of capital, including natural resources, cultural tourism, and man-made tourist. A region can be classified as a tourism destination if it possesses tourist attractions that have the potential to be developed. Thus, attractions play a pivotal role in enticing tourists. Based on its appeal, West Java boasts numerous remarkable tourist attractions, including natural resources like the hot springs in Ciater, Subang. The cultural tourist attraction of Kampung Gede Kasepuhan Ciptagelar in Sukabumi. The tourist attraction known as the Artificial Beach Tour in Parung is a man-made creation. Tourism players in West Java must seize and cultivate creativity and diverse opportunities in order to offer captivating attractions for travelers.

Subsequently, it is imperative to enhance accessibility in order to facilitate tourists' access to various tourism destinations. Exploring natural attractions such as beaches and hot springs in West Java entails navigating over arduous roadways. According to a report by Portal Bandung Timur, Bandung Regent Dadang Supriatna is overseeing the condition of roads that are commonly utilized by the community to access tourist spots. He

plans to initiate repairs, beginning from Ciparay, Pacet, and extending to Rancabali. It is desirable that local governments in other regions, such as Ciamis and Kuningan, prioritize the maintenance of road access to tourist attractions to ensure their good condition and minimize the danger of accidents for tourists. Lastly, there are amenities, which are specifically characterized as sources of comfort. How can tourism optimize its facilities and cater to the needs of its tourists in this scenario? Cleanliness is the most basic and straightforward concept. A clean environment fosters tranquility and enhances the pleasure of your journey. In addition, tourism can provide amenities for Muslim worship, such as prayer rooms and hygienic ablution facilities.

c) Industry

The tourism sector can be developed by enhancing competitiveness and strengthening investment within the sector. Competitiveness is important as it is a criterion that determines success in achieving a goal. Competitiveness is closely related to productivity ([Damanik & Purba, 2020](#)). Porter's theory suggests that a country has high competitiveness if there are competitive companies ([Aditya, 2013](#)). According to ([Gupta & McDaniel, 2002](#)), competitiveness can be achieved when creativity and innovation are built through effective, planned, and sustainable processes. Therefore, the tourism sector in West Java must create creative and innovative tourist attractions.

Innovation and creativity for developing tourism are not limited in this era. Even in remote areas, we can easily provide various information to the public. West Java has many remote tourist attractions, also known as Hidden Gems, including Wisata Budaya Desa Cimanggis in Sukabumi. Creative innovation can also be applied to other Hidden Gems such as Pulau Biawak in Indramayu, Situs Megalitikum Padang in Cianjur, and Pantai Puncak Guha in Garut. These tourist sites can be equipped with facilities that the public likes, such as camping, more Instagrammable spots, and similar amenities. If tourism already has high competitiveness, it will certainly affect the volume of visitors, leading to higher profits. This will attract investors to contribute capital to it. The influx of capital can be used to develop managed tourism, such as adding facilities and expanding networks or branches.

d) Marketing

Strengthening the tourism market through marketing is essential to increase visitors. According to ([Ginting et al., 2022](#)), tourism marketing has two theories. The first is consumer behavior theory, which covers customer satisfaction. The second is the exchange theory and the tourism marketing paradigm. ([Pawitra, 1993](#)) proposed two psychological models in customer satisfaction: cognitive and affective. Cognitive aspects discuss customer evaluations of products or services, so customers gain information. Affective aspects involve customer evaluations based on subjective needs, experiences, and aspirations. The more a tourism service meets consumer expectations, the higher the satisfaction consumers will experience. Therefore, it is hoped that tourism in West Java not only focuses on generating profit but also on ensuring customer comfort and satisfaction for sustainable tourism.

The next theory is the exchange theory and paradigm, which is the core concept of marketing ([Kotler, 2002](#)). As the name suggests, this theory explains the concept of exchange with the rewards received afterward. A simple example is tourists exchanging their money to experience tourism activities, hoping that these activities will provide happiness, tranquility, mental clarity, and other similar benefits as their initial goals.

Market strengthening through marketing can also be achieved by leveraging technological advancements, particularly through social media. Social media marketing involves promoting products or services where sellers and buyers can communicate directly. Many tourism sites now have their own social media accounts, ranging from small to large scales. For instance, Wana Griya Pantai Buatan in Parung Bogor has 3,331 followers, Kawah Putih in Ciwidey Bandung has 10.1K followers, and Cimory Dairy Land in Bogor has 105K followers. Indonesia has 191.4 million active social media users, with 80.1% of internet users seeking information ([Hootsuite-WeAreSocial, 2022](#)). This presents an opportunity for tourism operators to utilize social media and share interesting information about their managed tourism sites to increase visitors.

2. Create an MVP Stages

RUMEUNG Application and Feature Prototype

Recognizing the potential of Indonesian society, which is highly active on the internet, it is appropriate in this era of globalization to use digital tools for various needs. The elements of sustainable tourism development, ranging from Destinations to Marketing, will be conveniently accommodated within the RUMEUNG

application. Additionally, the actors within the Quadruple Helix are integrated to enhance the effectiveness of achieving goals. RUMEUNG itself is an application that comprehensively lists tourist destinations in West Java. All tourist spots listed in RUMEUNG will receive training and guidance to develop their tourism through four main points: Destinations, Institutions, Industry, and Marketing. By optimizing the Quadruple Helix, RUMEUNG will be supported by various stakeholders.

Previously, many parties have taken steps and efforts to bring about change. However, because they worked independently, these efforts were limited to "activities" without leading to any significant changes. For example, Open Data Jabar (Government) provides a tourism database, but it only results in data output. Business actors (Entrepreneurs) in the tourism sector, especially small-scale, only focus on "profit." The community engages in tourism activities merely for fun and to help enliven tourist spots. All three aim to make an impact, but because their goals differ, they do not result in substantial change. Finally, academia has researched and created an innovation to integrate all these efforts for a significant impact.

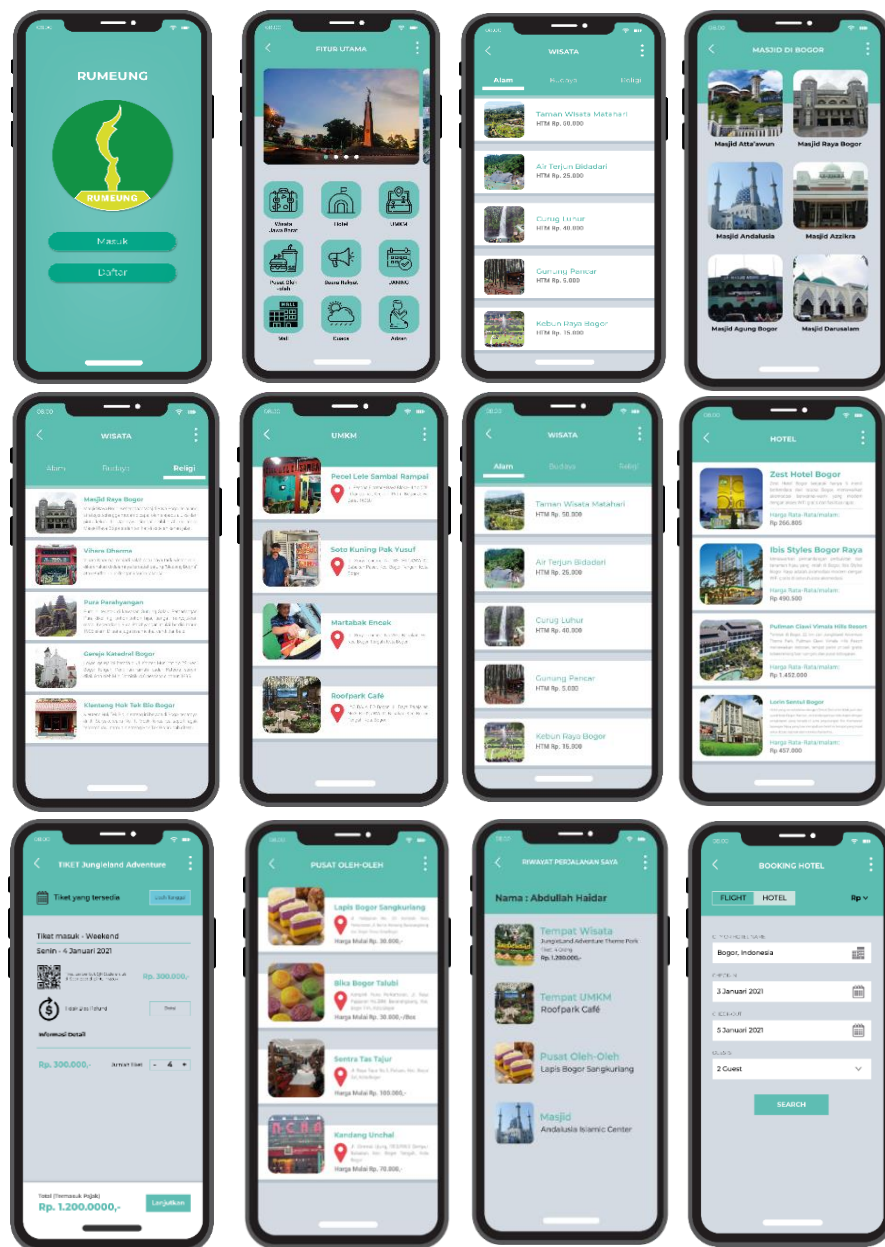


Figure 9. Prototype of RUMEUNG Application And Features
Source: Author (2023)

RUMEUNG is an acronym for "Rumah Ulin & Ameung." Both "Ulin" and "Ameung" are Sundanese words meaning "play," with "Ulin" commonly used in the rough Sundanese dialect and "Ameung" in the soft

Sundanese dialect. The choice of these two synonymous words aims to show that RUMEUNG originates from West Java and is intended for all Indonesians and even the world. RUMEUNG will serve as a home for tourists visiting West Java, providing the most comprehensive tourism information. Additionally, RUMEUNG can become a home base for tourism operators, offering the best solutions to various tourism-related issues they face. Features and Navigation Guide for the RUMEUNG Application:

- a. **Home Page:** Upon opening the application, users are given options to register or log in. Click "register" to create an account if you don't have one yet, or click "log in" if you already have an account.
- b. **Home Menu:** The home menu features several options, including tourist attractions, hotels, UMKM (Micro, Small, and Medium Enterprises), souvenir centers, mosques, Bogor news, and malls.
- c. **Tourist Attractions Menu:** This menu provides information about natural attractions, cultural sites, and religious tourism. It includes ticket prices, descriptions, directions, visitor testimonials, and ratings. Users can also book tickets directly through the RUMEUNG app. Additionally, users can find information about tourist attractions near accommodations, UMKM, souvenir centers, mosques, and nearby malls.
- d. **Hotel Menu:** This section provides information about hotels in Bogor that are close to tourist attractions, UMKM, souvenir centers, mosques, and nearby malls. It includes hotel prices, descriptions, directions, visitor testimonials, and ratings. Users can easily book hotels through the RUMEUNG app.
- e. **UMKM Menu:** This menu provides information about UMKM in Bogor that are close to tourist attractions, hotels, souvenir centers, mosques, and nearby malls. It includes product prices, descriptions, directions, visitor testimonials, and ratings.
- f. **Souvenir Centers Menu:** This section provides information about souvenir centers near tourist attractions, hotels, UMKM, mosques, and nearby malls. It includes product prices, descriptions, directions, visitor testimonials, and ratings. Users can order souvenirs through the RUMEUNG app and pick them up on-site. Payment is made easy with multiple payment methods available.
- g. **Mosque Menu:** Users can search for mosques they want to visit. The app will show the nearest mosque from the user's location along with directions.
- h. **News Menu:** This menu provides the latest news about the city of Bogor.
- i. **My Account Menu:** This section includes sub-menus such as travel itinerary, help center, about us, settings, and account balance.
- j. **Hotel Booking Menu:** Features check-in, and check-out options, and allows users to search for hotels or find the nearest hotels with travel routes provided.
- k. **Tourist Attraction Ticket Booking Menu:** Includes a QR code scanning feature for entry, ticket prices, and ticket quantities.
- l. **Souvenir Ordering Menu:** Users can order souvenirs or add them to a cart for future purchases. There are also many discount coupons available for users to claim.
- m. **Payment Methods Menu:** Several payment methods are available, including mobile banking, fintech service providers, Alfa Mart, and Indomaret.

3. Stage of Run an Experiment

These steps are carried out to determine the extent to which the developed prototype is functioning correctly. The initial testing was conducted independently from May 15 to 22, 2024, to ensure the application's workflow is accurate and free from errors. The subsequent testing involved the Rumeung application development team and stakeholders, with presentations and Q&A sessions regarding the Rumeung application prototype. This process is useful in ensuring that the prototype design meets user needs and validates the assumptions made in the previous stages.

The testing phase is carried out by paying attention to the user requirements which are then described in the table and give a check mark if the requirements have been met. User requirements are described in Table 3 below:

Table 3. User Requirements for Rumeung Application

No	User Requirement	Yes/No	Comment
1	<i>Splash Screen</i>	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
2	Onboarding Page	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
3	Register Account	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.

No	User Requirement	Yes/No	Comment
4	Login	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
5	Forgot Password	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
6	Home	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
7	Survey Categories	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
8	Survey Questions	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
9	Survey Results	Yes(<input type="checkbox"/>)	The requirement was successfully achieved.
10	My Profile	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
11	Membership Benefit	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
12	Reward	Yes(<input type="checkbox"/>)	The requirement was successfully achieved.
13	Points System	Yes(<input type="checkbox"/>)	The requirement was successfully achieved.
14	Points History	Yes(<input type="checkbox"/>)	The requirement was successfully achieved.
15	Edit Profile	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
16	Change Password	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
17	News and Events	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
18	Notification Settings	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
19	Activity History	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.
20	Log Out	Yes (<input type="checkbox"/>)	The requirement was successfully achieved.

3. Stage of Feedback and Research

The Single Ease Question (SEQ) testing involved 10 respondents. These respondents included stakeholders, the application development team, and several individuals residing in West Java. The total number of task scenarios that respondents needed to complete was 23 functions. Below is the table of SEQ testing scores. This testing was conducted from May 23, 2024, to June 4, 2024.

Testing Planning

In this study, testing will be conducted in two stages: Single Ease Questions (SEQ) and the System Usability Scale (SUS). The SEQ testing will involve 10 respondents selected through purposive sampling. The criteria for SEQ respondents include stakeholders, the application development team, and several respondents residing in West Java. The SUS testing will involve 60 respondents obtained through simple random sampling. Each group of respondents, including academics, tourism business operators, community members, government officials, legal experts, and media representatives, will consist of 10 people per category. This approach ensures a balanced representation from various sectors for a comprehensive system usability assessment.

Single Ease Question (SEQ)

The Single Ease Question (SEQ) testing involved 10 respondents. These respondents included stakeholders, the application development team, and several individuals residing in West Java. The total number of task scenarios that respondents needed to complete was 23 functions. Below is the table of SEQ testing scores. This testing was conducted from May 23, 2024, to June 4, 2024.

Table 4. SEQ Testing Scores

R	Fungsi																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
2	6	6	7	7	6	6	6	6	6	7	7	7	7	7	7	7	7	7	6	7	6	6	6
3	7	7	7	7	6	7	7	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
4	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	6	7	7	7	7
5	6	6	6	7	7	5	6	7	5	7	5	7	7	7	7	7	7	5	7	6	7	5	7
6	7	7	7	7	6	7	7	6	7	7	7	7	7	7	7	7	7	7	7	7	5	6	7
7	7	6	7	7	7	6	5	6	7	7	7	7	7	7	7	7	7	7	7	6	7	6	7
8	7	7	6	7	7	7	7	6	5	6	7	7	7	7	7	7	7	7	7	7	7	7	7
9	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
10	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7

The following is a graph of the results of the SEQ test of the RUMEUNG application on 10 respondents. The vertical line as (presentation value) and the horizontal line as (respondents who conducted the test). From the SEQ test results, 3 values were obtained, namely 7 (very easy), 6 (easy), 5 (quite easy). Overall, the results of the SEQ test on the RUMEUNG application obtained 85% of the values 7 (very easy), 12% of the values 6

(easy), and 3% of the values 5 (quite easy). From these results, it can be concluded that the design of the RUMEUNG application is very easy for users to use and can be developed.

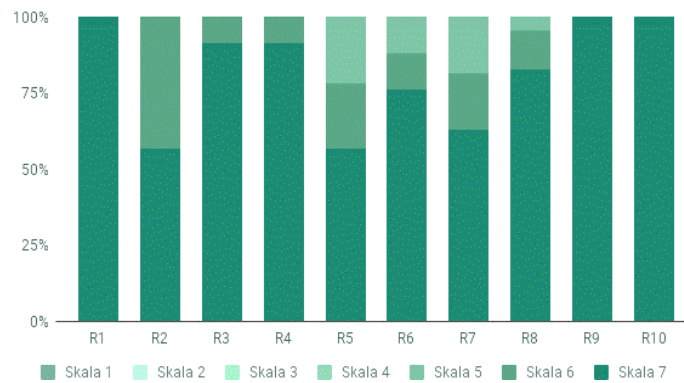


Figure 10. Test Result Graph SEQ

Result of Testing System Usability Scale (SUS)

In the SUS testing, after obtaining the respondents' scores, the calculation is carried out in the following steps:

- Odd-numbered questions: These are positively worded questions. The score obtained from the respondent is subtracted by 1 (Score - 1).
- Even-numbered questions: These are negatively worded questions. The final score is calculated by subtracting the respondent's score from 5 (5 - Score).
- After calculating the results for each question, each final question score is multiplied by 2.5

Based on the SUS testing results, the RUMEUNG application prototype design received an acceptable rating with a grade scale of B and an adjective rating in the range of 80-90, or Good. From these results, it can be concluded that the RUMEUNG application prototype design is accepted by users and ready for further development..

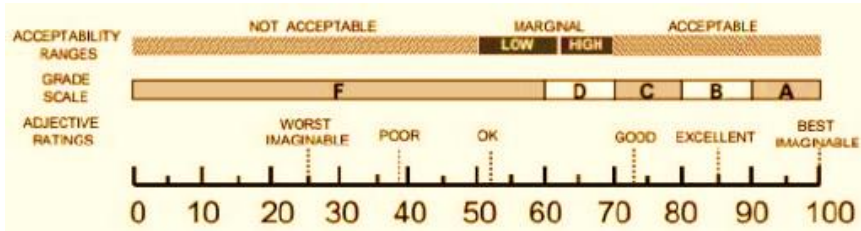


Figure 11. Test Result SUS

Implementation of Quadruple Helix and RUMEG in Optimizing Tourism in West Java

Based on field research concepts, the Quadruple Helix model is more relevant than the Triple Helix model because it involves more than three stakeholders, namely four stakeholders: government, industry, universities, and society or users. (Delman & Madsen, 2007) argue that the role of the fourth helix actor based on the Quadruple Helix structure is an independent, nonprofit, and member-based organization. (Yawson, 2021) states that the emerging needs come from users (user-driven innovation), thereby formalizing them as part of the fourth helix.

In contrast, (Carayannis et al., 2012) explain that the fourth helix consists of two aspects: first, culture and media, and second, public participation to generate innovation and knowledge. The Quadruple Helix model positions the role of society more strategically as a source of innovation. Furthermore, the Quadruple Helix is a development concept of the Triple Helix that incorporates civil society as well as innovation and knowledge (Afonso et al., 2012).

The Quadruple Helix is defined as a collaboration of four sectors: government, companies or industry, academia or universities, and civil society, which believes that innovation driven by creative citizens encourages the successful achievement of common goals while each stakeholder remains responsible for creating innovation and development according to their capabilities. Thus, synergy and cooperation among all

Academia

According to Bekraf (2016), the role of academia includes innovation, research, and collaboration that leads to cooperation between the government, entrepreneurs, and the community. RUMEUNG is an output of the academic role within the Quadruple Helix model. In addition to addressing issues in the tourism sector, RUMEUNG also serves as a platform to integrate various involved parties, thereby facilitating easier mobility.

An application like RUMEUNG will undergo continuous updates to meet user needs. Academics will consistently conduct research to provide the latest information that can be implemented in RUMEUNG. Business incubators, being significant contributors within academic institutions, can be leveraged to support this research. All business incubators in higher education institutions in West Java will collaborate and join RUMEUNG as researchers and developers. This collaboration will ensure that the application remains relevant and beneficial for sustainable tourism development in the region.

Community

The role of the community is as consumers of tourism products and services. They also help promote and influence others to use the services they utilize. Specifically, in the context of tourism development in West Java, the community will hold two roles.

First, they will act as visitors and users of RUMEUNG. Second, they will serve as informants; when they find tourist spots in their area that are not yet included in RUMEUNG, they can recommend these places to be followed up and developed. To encourage the community to take on this second role, the government can intervene by offering rewards to those who provide useful information. These rewards can include incentives and other similar benefits. By engaging the community in these roles, the development of tourism in West Java can be more inclusive and comprehensive, leveraging local insights and promoting broader participation in tourism initiatives.

Law and Regulation

The role of law and regulation in the development of sustainable tourism is crucial for ensuring that tourism activities are conducted in a manner that is beneficial, ethical, and sustainable for all stakeholders involved. In the context of West Java's tourism development, establishing a clear regulatory framework is essential to govern tourism activities, promote sustainable practices, and protect the environment, cultural heritage, and local communities. Government policies must support tourism growth while ensuring sustainability, providing incentives for businesses adopting sustainable practices.

Compliance and enforcement of these regulations are necessary to maintain standards and protect stakeholders. Additionally, protecting intellectual property rights and traditional knowledge is vital to prevent exploitation. Public participation in decision-making processes ensures that the rights and interests of local communities are considered and protected. Conflict resolution mechanisms should be fair, transparent, and accessible, ensuring disputes between stakeholders are resolved equitably. Regulations must also ensure the safety and security of tourists and local communities, promoting fair pricing, taxation, and financial practices to support equitable economic growth. Aligning tourism regulations with Sustainable Development Goals (SDGs) ensures that tourism contributes to broader development objectives, supporting environmental sustainability, economic growth, and social inclusion. Continuous monitoring and evaluation of tourism activities and regulations are necessary to maintain their relevance and effectiveness, creating a conducive environment for sustainable tourism development in West Java.

Media

Media plays a vital role in the development of sustainable tourism by acting as a bridge between tourism stakeholders and the public. It helps in promoting tourism destinations, highlighting their unique features and attractions to potential visitors both domestically and internationally. Media also serves as a platform for disseminating important information regarding sustainable practices and the benefits of responsible tourism. By showcasing success stories and best practices, media can inspire both tourists and tourism operators to adopt more sustainable behaviors. Additionally, media coverage can raise awareness about the cultural and environmental significance of tourist destinations, encouraging preservation and respect among visitors. In the context of the Quadruple Helix model, media acts as a crucial component by facilitating communication and collaboration among government, industry, academia, and the community. Through investigative journalism and reporting, media can also hold stakeholders accountable, ensuring that tourism development aligns with

ethical standards and regulations. Overall, media not only enhances the visibility of tourism destinations but also plays a key role in educating the public and fostering a culture of sustainability in the tourism sector.

4. Conclusion

This research successfully designed the RUMEUNG application prototype using the Lean UX method with four stages: declare assumptions, create an MVP, run an experiment, and feedback and research. In the declare assumptions stage, assumptions were declared by analyzing the problems and tourism potentials in West Java. Next, in the create an MVP stage, a wireframe was designed based on the results of the declare assumptions stage. The next stage was run an experiment, where the RUMEUNG application prototype was evaluated by stakeholders and the development team to ensure that the created features functioned well. The final stage was feedback and research. In this stage, usability testing was conducted on potential users of the RUMEUNG application using two methods: Single Ease Questions (SEQ) and the System Usability Scale (SUS). The usability testing results for the RUMEUNG application design scored 8.5% for SEQ with 7 (very easy), 12% with 6 (easy), and 3% with 5 (fairly easy). Meanwhile, the SUS score was 80, or acceptable, with a grade B in the 80-90 range, or good.

The RUMEUNG application is a digital innovation designed to support the development of sustainable tourism in West Java. The name "RUMEUNG" is derived from the Sundanese language, meaning "develop" or "advance," reflecting the application's goal of advancing the tourism sector in the region. This application integrates the Quadruple Helix approach, involving four main elements: government, academia, industry players, and the community. Thus, RUMEUNG functions not only as a tourism marketing platform but also as a coordination and collaboration tool among stakeholders.

The use of the Rumeung application is crucial for several reasons. First, it optimizes the Quadruple Helix, integrating various stakeholders in tourism development into a single digital platform, enabling better synergy between the government, academia, industry, and the community. Second, RUMEUNG focuses on sustainable tourism development, ensuring that tourism activities are not only economically beneficial but also environmentally friendly and positively impactful on the welfare of the local community. Third, West Java has 2,583 potential tourist attractions (ODTW), many of which have not been optimally developed. RUMEUNG aims to bridge this gap with coordinated development and marketing strategies. Finally, with the decline in economic growth in West Java in recent years, innovations like RUMEUNG are expected to act as accelerators of economic growth through the tourism sector.

To foster sustainable tourism development in West Java, it is crucial for the government to enhance its support by improving infrastructure, providing financial incentives, and offering training programs for tourism businesses. The RUMEUNG application should be utilized to facilitate industry collaboration, encouraging businesses to participate in development programs and continuously innovate. Academia must actively engage in research and innovation, collaborating with business incubators to support the tourism sector. Community involvement is essential, as locals can provide valuable feedback and identify potential tourist attractions. Media should be leveraged to promote tourism destinations and sustainable practices, raising awareness and inspiring responsible tourism behavior. Continuous monitoring and evaluation of tourism activities and the RUMEUNG application will help maintain relevance and effectiveness. Aligning tourism strategies with the Sustainable Development Goals (SDGs) will ensure that tourism contributes to broader social, economic, and environmental objectives. Finally, ongoing training and capacity-building programs for all stakeholders will equip them with the necessary skills and knowledge to effectively contribute to sustainable tourism development. By implementing these measures, RUMEUNG can become a powerful tool for driving sustainable tourism, fostering collaboration among stakeholders, and enhancing the overall tourism experience in West Java.

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