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Analysis and Design of Mangrove Ecotourism Management System (SIMANGROVE) of Dodola Island, Morotai Island Regency, Indonesia

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Abstract

Tourism destination managers need information systems necessary for tourism destination managers to optimize the ecological, economic, and socio-cultural monitoring functions. This study aims to develop a management information system known as SIMANGROVE based on the context of managing mangrove areas in Dodola Island of Morotai Island Regency, Indonesia. The system design is carried out using the Software Development Life Cycle (SDLC) framework through the Waterfall approach. The analysis of the concept of mangrove ecotourism is adjusted to the availability of resources classified into accessibility, accommodation, attractions, and amenities on Dodola Island. The research of analysis and design of SIMANGROVE show that the ease of use of the application (usability), quality of information (information), and user security (security) are essential elements that benefit managers and visitors when accessing data as well as making reservations and transactions in the SIMANGROVE system.

Keywords: Simangrove, Dodola Island, SDLC, Waterfall, Ecotourism

1. INTRODUCTION

Previous research that examines the analysis and design of tourism information systems emphasizes various functions, both based on the field's theoretical approach and empirical conditions. [1] shows that one of the trends in tourist behaviors before traveling is to find out information about tourist destinations using digital media, so the system designed adopts the ROPO (Research Online Purchase Offline) approach. Unlike the case with [2], which emphasizes the function of a decision support system to make it easier for stakeholders to determine priorities for tourism development programs. It shows that the analysis and design of tourism information systems will constantly develop along with the

increasing needs of system users from time to time. Otherwise, this study offers different insights into designing other information systems, focusing on managerial aspects of mangrove ecotourism on Dodola Island, Morotai Island Regency, Indonesia.

This study offers an idea to design an application for the mangrove ecotourism management system, abbreviated as SIMANGROVE. The idea to create a system was driven by the results of previous studies related to the concept of ecotourism [3], identification of tourist needs related to information systems [4]–[6], sentiment analysis [7], [8] and analysis of changes in mangrove vegetation index [9]–[11]. Based on the previous research roadmap, SIMANGROVE was carried out to optimize the management of tourist destinations that optimize local ecological, economic, and socio-cultural aspects and consider the needs of tourists as system users. Meanwhile, the design of this information system is limited to the creation of a website-based information system to reach a broader tourism market through the internet network.

Mangrove ecotourism is a tourism development concept that is environmentally friendly, so it is categorized as part of the characteristics of natural tourism and particular interest. Mangrove Ecotourism emphasizes community participation in every mangrove development program, starting from the nursery, planting, monitoring, to evaluation stages. Tourists who visit mangrove tourism destinations generally have a goal of recreation or relaxation, considering the ecological conditions of the mangroves that produce fresh air, making it suitable for tourists who want to meditate or rest from busy work. According to an ecotourism approach, Indonesia is an archipelagic country with potential mangrove areas to be developed into tourist destinations [12]. Therefore, information systems management is needed to optimize the organizational goals that control the ecological, economic, and local socio-cultural balance.

The system design approach used in this research is the Software Development Life Cycle (SDLC) through the Waterfall approach. SDLC is used to clarify the systematics or flow of system design, starting from the initiation stage to identify system user needs, design flow, and system interfaces to evaluate system performance [13]. In-depth, SDLC is a framework that clarifies the flow of system design, starting from system specifications and user requirements, interface and database design, system development and testing, and system maintenance [14]. Website-based tourism information systems in Indonesia show unique and characteristic performance according to user needs and the creativity of system designers [15]. It indicates that the SDLC framework with the Waterfall approach can be used as a guide for designing information systems in tourism and other fields. Thus, this study uses SDLC and Waterfall as the SIMANGROVE design framework.

The waterfall approach in the SDLC framework has its challenges. In contrast to other methods such as evolutionary prototyping, which identifies user needs and immediately makes a system prototype that fits the requirements [16]. The Waterfall approach has different stages from the Agile method in the Dynamic System Development Model (DSDM), which emphasizes the feasibility of producing innovative features according to user needs [17]. The methods of designing website information systems are chosen based on the needs of users, both static, dynamic, and interactive websites. Meanwhile, the stages in the Waterfall approach consist of the requirements definition stage, system and software design, implementation and unit testing, integration and system testing, and operation and maintenance [18]. This research will use the Waterfall approach as a part of the SDLC framework to design the SIMANGROVE website.

The Morotai Island Regency Government provides supporting facilities for tourism activities in the Dodola Island area. Tourists can rent bicycles to surround the mangrove area. Infrastructure in wooden bridges along the mangrove area has been prepared to support mangrove tourism attractions. In addition, there are accommodations in the form of resorts that tourists can use to spend the night or stay for some time on Dodola Island. Although the resources and supporting facilities are available, information management to introduce the tourism potential of Dodola Island is still done partially in a conventional way. Therefore, a management information system for mangrove ecotourism destinations is needed, making it easier for tourists to access information. It is easier for managers to use information as a reference for setting policies and programs for tourism development on Dodola Island. Considering this, SIMANGROVE is designed to meet the needs of visitors and managers of mangrove ecotourism on Dodola Island, Morotai Island Regency, North Maluku Province, Indonesia.

2. METHODS

The research method used is the information systems research method. Furthermore, the framework used in designing SIMANGROVE is the Software Development Life Cycle (SDLC) with the Waterfall approach. Meanwhile, the stages in the SIMANGROVE design process are divided into four stages, namely the analysis stage of the mangrove ecotourism concept, the identification and classification stage of resources and tourism stakeholders, the identification of the existing condition of the tourist destination management system, and user needs, and the SIMANGROVE design stage based on the SDLC and Waterfall frameworks, as Figure 1 below.

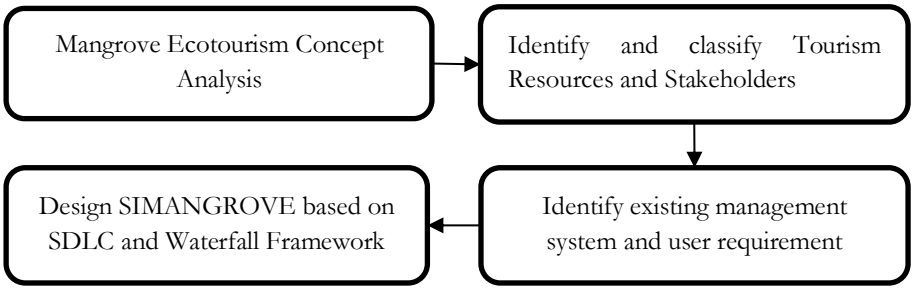

Figure 1. Research Process

Figure 1 is the research stage before designing the SIMANGROVE system. The analysis stage of the concept of mangrove ecotourism is needed to identify challenges and opportunities for developing mangrove ecotourism on Dodola Island and ecological principles that need to be optimized to balance environmental and economical, and socio-cultural benefits. The next step is to identify and classify tourism resources and stakeholders on Dodola Island. At this stage, information regarding accessibility, accommodation, amenities, and attractions will be collected and managed comprehensively to utilize all interested parties, both managers and visitors. Meanwhile, the identification stage of the existing condition of destination management and the needs of system users is needed to analyze aspects that need to be optimized from the current destination management system so that they can be accommodated in the system as required by destination managers and tourists. The next stage is the SIMANGROVE application design following the SDLC and Waterfall frameworks, shown in Figure 2 below.

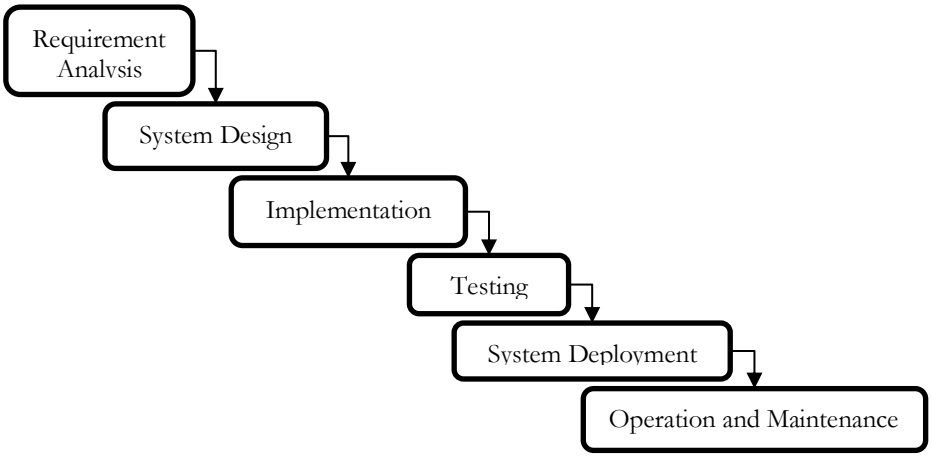

Figure 2. SDLC and Waterfall Framework

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Figure 2 is the SDLC and Waterfall [19] framework used in the SIMANGROVE application design process. The research process in Figure 1 is part of the Requirements Analysis research stage. Next, the system design stage is continued by describing the system flow using Unified Modeling Language (UML) through the Star UML application to display Use case diagrams and explain each feature's actors, flows, and functions in SIMANGROVE. Meanwhile, the SIMANGROVE interface design mock-up was carried out using the Figma application for visualizing the system interface. This article's primary focus is on the user requirements and system design stages. In contrast, the implementation, testing, system integration, and maintenance phases will be discussed in the following manuscript using a different perspective.

3. RESULTS AND DISCUSSION

Mangrove Ecotourism in Dodola Island: Tourism Stakeholders and Resources

The ecotourism development model is an alternative development strategy that emphasizes the ecological aspects and tourism activities. Ecotourism is known as an environmentally friendly model and can provide economic benefits to improve the social welfare of local communities [20]. In the context of mangrove ecotourism, some factors influence the interest of tourists in visiting mangrove areas, such as enjoying the natural beauty, recreation, or having fun [21]. In addition, the development of mangrove ecotourism destinations is primarily determined by the motivation of managers and stakeholder interests [22]. It shows that the management of mangrove ecotourism destinations needs to consider tourists' perspectives and managers' perspectives in optimizing the management of Dodola Island tourist destinations.

The resources that need to be mapped from the mangrove ecotourism area are accessibility, amenities, accommodation, and attractions. The ecological diversity of mangroves attracts tourists motivated to visit to learn [23]. [24] reveal that the management of mangrove ecotourism discussed based on institutional governance, environmental conservation, education, economy, and community participation with the following dynamics: ecotourism managers who are not well coordinated and do not have a clear legal umbrella; mangrove ecotourism managers consisting of the government and the community but the relationship between cooperation and coordination is not yet optimal; ecotourism management budget originating from ticket sales and the manager's funds; the absence of a limit on the number of visitors; conventional ecotourism promotion; regulations still refer to Regional Regulations. [25] shows that each region has a contextual ecotourism development strategy to the availability of resources and stakeholders' preferences. It indicates that contextually, the intentions of tourism stakeholders on Dodola Island and the availability of local tourism resources need to be

analyzed comprehensively as part of the identification stage of the needs of SIMANGROVE system users.

In the context of Dodola Island mangrove eco-tourism, the preferences of tourism stakeholders can be classified as follows: North Maluku Provincial Government through the Provincial Tourism Office; Morotai Island Regency Government through the Regency Regional Tourism Office; Generation of Enchantment of Indonesia, North Maluku Province and Morotai Island Regency; D'Aloha Resort; Morotai Online Journal Forum; Kurung's Big-Family; Local communities; local Entrepreneur in Tourism Business (Transportation Services and Souvenir Business); and Academicians. Recently, the Dodola Island tourist area management has been carried out based on each stakeholder's role and institutional functions. Although managing the Dodola Island mangrove eco-tourism destination is still conventional, the synergy in marketing the tourism image of Dodola Island is driven by the same interest in preserving the environment, encouraging economic growth, and improving people's welfare.

Stakeholder synergy in mangrove ecotourism management encourages tourism development which can be classified based on accessibility, accommodation, amenities, and attractions. Stakeholders who support the accessibility aspect are local governments and entrepreneurs who provide communication and internet facilities and transportation modes for Dodola-Daruba Island. Meanwhile, stakeholders who support the accommodation aspect are the local government and the D'Aloha resort as investors who provide accommodation services for tourists. Furthermore, Amenities is also supported by local entrepreneurs and provincial and regional governments related to the completeness of tourist facilities, wooden bridges in the mangrove area, and bicycles for tourists to get around the mangrove area on Dodola Island. Meanwhile, the attraction is supported by Kurung's big family, GenPi, and the local community, who also play a role in supporting the development of Dodola Island tourism. In addition, academics are also intensely conducting scientific studies related to mangroves and island coastal areas to provide scientific recommendations for ecological, economic, and socio-cultural sustainability.

The ecotourism model emphasizes collaboration between stakeholders. It indicates that a participatory approach is an essential part of realizing the goals of destination development [12], [26], [27]. Furthermore, [28] showed that the development of mangrove ecotourism areas would be effective if carried out with a participatory approach to reduce the possibility of damage to mangrove forests due to human negligence. On the other hand, the mangrove vegetation index needs to be monitored regularly to establish a rehabilitation program to maintain mangrove species based on family [10], [11]. It indicates that mangrove ecotourism management is not limited to product or service development from an economic perspective but also needs to emphasize the function of monitoring or controlling

the ecological sustainability of mangroves. Thus, the SIMANGROVE system is designed based on an informative website with various integrated information in one platform: Micro, Small, and Medium Enterprises (MSMEs), accommodation, transportation, amenities, partnerships, and mangroves.

Based on the mangrove ecotourism model analysis, stakeholders' identification, and the availability of tourism resources on Dodola Island, SIMANGROVE is designed to facilitate the needs of managers and visitors in one integrated website-based platform. From the manager's perspective, information is related to MSMEs, Mangroves, Accommodation, Amenities, Accessibility, Transportation, and Partnerships. SIMANGROVE is designed as a medium of communication that tourists can use to obtain comprehensive instructions related to tourism needs. Meanwhile, managers can take advantage of SIMANGROVE system user data to analyze the existing condition of mangrove areas. Furthermore, identify the number of participants as SIMANGROVE platform users to analyze trends and read destination development opportunities based on tourist needs from time to time.

SIMANGROVE: Mangrove Ecotourism Management System

The Evaluation of the mangrove ecotourism model and identifying stakeholders and tourism resources on Dodola Island are part of the initial stage of the SDLC framework and Waterfall approach. Several studies on the design of tourism information systems show that the visualization of mangrove areas based on zones and mangrove biodiversity is essential in mangrove ecotourism management [29]. In addition, educational values are also crucial in mangrove ecotourism destinations to provide tourists with an understanding of the importance of mangrove habitat for the sustainability of small islands and coastal areas from the threat of abrasion or erosion [30]. It indicates that the mangrove area control feature is needed in SIMANGROVE to control mangrove areas. Therefore, two actors can access this information on the mangrove page, namely managers and visitors.

Mangrove ecotourism is a tourism potential development model that adopts a participatory approach involving local entrepreneurs and communities as souvenir sellers, transportation services, accommodation, amenities, superior products, and other creative works. It shows that the motivation and participation of the community need to be accommodated in SIMANGROVE so that product marketing can be controlled and optimized. In addition, tourists who want to visit Dodola Island need information related to accommodation, accessibility, amenities, and attractions. Thus, the Transportation, Amenity, Accommodation, and Partnership pages need to be provided on the SIMANGROVE platform to be used by tourists, tourist destination managers, and other stakeholders.

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Meanwhile, the visualization of the SIMANGROVE use case diagram can be seen in Figure 3 below.

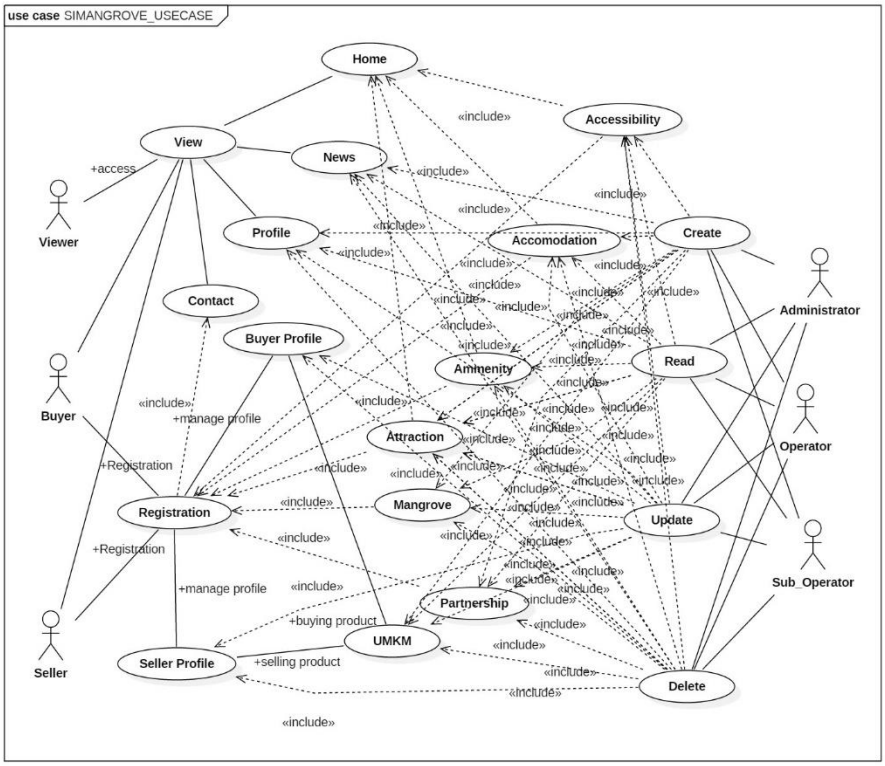

Figure 3. Use Case Diagram SIMANGROVE

Figure 3 shows that SIMANGROVE has six types of actors who have the authority to read or view information. Still, only five types of actors have authentication to perform the function of creating, updating, and deleting data. In the use case diagram, the actor who acts as a user/viewer can access every home page, profile, news, and contact, to meet information needs related to the availability of tourism resources according to the classification of accessibility, accommodation, and amenities and attractions information. Actors who act as buying members have access capabilities on the member's homepage to update profiles by performing the Create, Read, Update, and Delete (CRUD) functions. Members can access the MSME, Accommodation, Accessibility, and Amenity pages to make reservations and provide reviews related to the products and services provided. Furthermore, the actor who plays the role of Administrator has the authority to freeze member accounts that violate the SIMANGROVE user privacy policy and manage member, operator, and sub-operator data.

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User status as a member is obtained when registering on the SIMANGROVE website contact page. Member status is divided into two parts in the registration process: a seller and a buyer. Members with seller status are intended for stakeholders, entrepreneurs, or local communities who want to sell products or services to earn income from economic activities on Dodola Island. Meanwhile, members with seller status are specially designed for domestic and foreign tourists who want to buy MSME products and place orders for products or services related to accommodation, accessibility, amenities, and attractions. Registration as a member will be helpful for managers who want to use member data and information as well as reviews on products and services that have been used to improve performance in the management of mangrove ecotourism destinations on Dodola Island. Members as sellers or buyers who have institutional backgrounds can carry out the process of inputting the identity of the Institution so that they are registered as partners or stakeholders in the management of mangrove ecotourism on Dodola Island, as shown in figure 4 below.

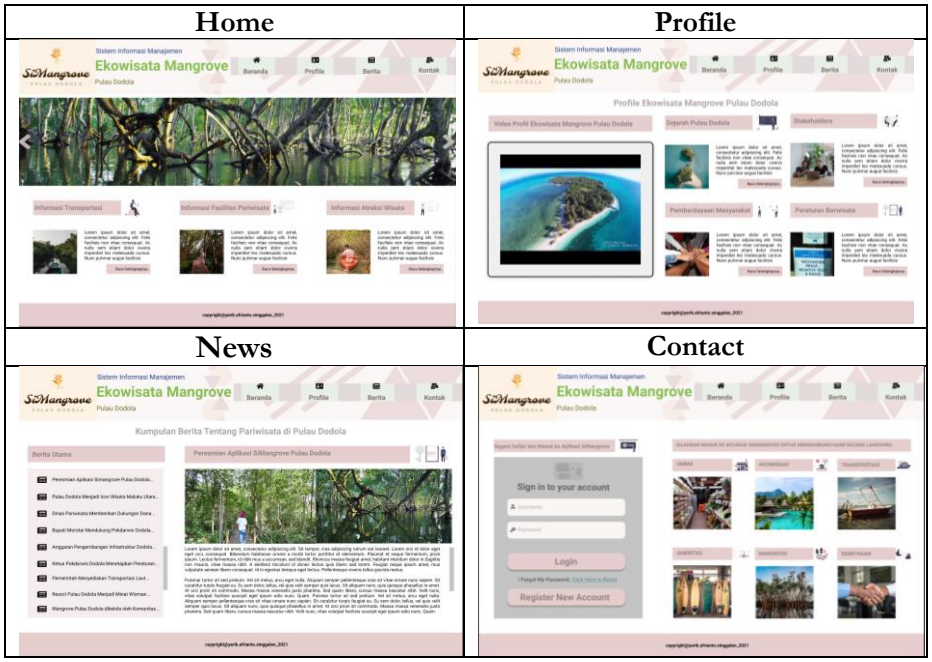

Figure 4. Mock-UP Desain Interface SIMANGROVE Website

Figure 4 is a mock-up of the SIMANGROVE website interface design that provides information related to transportation, supporting facilities, and tourist attractions in the form of news on the home page. Furthermore, on the profile page, there is in-depth information related to history, stakeholders involved in the development of Dodola Island, community empowerment programs that have

been carried out or are included in the annual plan, and travel regulations for Dodola Island. SIMANGROVE provides information that considers tourist behavior related to the habit of throwing food and beverage waste, damaging plants, to destroying facilities that have been built (vandalism). It is a consideration to include information related to travel regulations integrated with Sapta Pesona and Tourism Awareness.

On the news page, administrators can generate operators and sub-operators to regularly update news related to tourism activities on Dodola Island so tourists can follow the development of accessibility, accommodation, amenities, and attractions on Dodola Island. Next, on the contact page, users must register to gain access to the MSME, Accommodation, Accessibility, Amenity, Attractions, Mangroves, and Partnerships pages. Users who register as buyer members have the authority to access member profile pages, MSME pages, Accommodation pages, Accessibility pages, Amenity pages, and Attractions pages to view product and service descriptions and do reviews about products and services on each of these pages. Furthermore, members as buyers can also access the Mangrove page to view in-depth information related to the existing condition of mangroves, information on mangrove species, mangrove zones, and the donation system for mangrove rehabilitation. Members as buyers can make voluntary donations to help maintain the mangrove forest on Dodola Island. Members who have participated as donors on the mangrove page have the opportunity to include a name or logo that will be displayed by the administrator or operator and sub-operator on the partnership page.

The uniqueness of SIMANGROVE is the member donation system as a buyer who will have the opportunity to participate in nursery attractions, plant mangrove trees, and care for mangrove trees that members have purchased. Members are also allowed to choose a planting location (Zone 1, Zone 2, and Zone 3) and give names to the mangrove trees ordered and planted to participate in monitoring the growth of mangrove trees. In the donation system, the services sold by the manager of the Dodola Island mangrove ecotourism destination are mangrove nursery, planting, and maintenance services at locations determined by members, both Zone 1, Zone 2, and Zone 3. Members who visit Dodola Island can participate in nursery socialization, training, and offline planting and maintenance of mangrove trees. SIMANGROVE Dodola Island is designed to create interpersonal relationships between tourists and managers, tourists with nature, and fellow tourists. The harmonious relationship between humans and nature makes SIMANGROVE a website that encourages humanity, prosperity, and awareness of the environment.

SIMANGROVE is a website-based information system designed contextually, based on comprehensive research results. In contrast to e-commerce websites that emphasized transaction security and increased profits, SIMANGROVE

emphasizes partnerships, information quality, and collaborative programs that support ecological, economic, and socio-cultural sustainability of the local community or community and the integration of stakeholder interests. Thus, SIMANGROVE can be used as a digital marketing medium for mangrove ecotourism to reach more comprehensive market access, a medium for controlling and monitoring the distribution of mangrove areas, transaction media for superior products for people living around Dodola Island, as well as a reference for recommendations for developing Dodola Island into an ecotourism area. Competitive mangroves on a local, regional, national and global scale.

4. CONCLUSION

This study indicates that the ecotourism model emphasizes a participatory approach that is more dominant in the ecological aspect than in the economic and socio-cultural factors. In a participatory approach, partnerships are essential where stakeholders need to be integrated to achieve the common goal of realizing Dodola Island mangrove ecotourism as a superior and competitive tourist destination. The website-based information system SIMANGROVE was designed using the SDLC framework with a Waterfall approach. SIMANGROVE is designed with the features and functions of system users in mind. SIMANGROVE has home, profile, news, and contact pages. The user must register as a buyer or seller member on the contact page to access the information listed on the MSME, Accessibility, Accommodation, Mangrove, and Partnership pages. Each page is designed to integrate stakeholders' interests, the community or local communities, provincial and local governments, academics, and tourists. The research of analysis and design of SIMANGROVE show that the ease of use of the application (usability), quality of information (information), and user security (security) are essential elements that benefit managers and visitors when accessing data as well as making reservations and transactions in the SIMANGROVE system. Thus, SIMANGROVE can be used as a medium of information and transactions that facilitate the sustainable development of Dodola Island tourism.

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