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WATERFALL ANALYSIS APPROACH IN THE DEVELOPMENT OF THE BONEN CAVE TOURISM WEBSITE AS A DIGITAL INFORMATION AND PROMOTION MEDIA

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Abstract

This research covers the developing of the Bonen Cave tourism website as a digital platform for promoting geotourism, employing the Waterfall model of software development. The project aims to design and implement a website that effectively conveys the distinctive values of Bonen Cave in Baumata Village, Kupang, acknowledging the increasing significance of digital media in promoting tourism visibility, especially for geotourism sites with substantial geological and cultural heritage. The method consists of five successive phases: requirements analysis, system design, implementation, testing, and deployment. The data collection process encompassed stakeholder interviews and field surveys to ensure website features corresponded with local requirements and visitor anticipations. An accessible and responsive design was developed using a no-code website builder. The finished project, geowisatakupang.fun, encompasses multimedia information, interactive services, and functionalities designed to facilitate education, preservation, and community involvement. Testing validated the site's usability and operation across various devices. The project illustrates how organized digital development may enhance local communities, facilitate conservation initiatives, and advance sustainable tourism via accessible online platforms. Ongoing assessment and prospective incorporation of augmented reality and mobile applications are advised to improve user experience and sustain long-term effects.

Keywords: Geotourism; Waterfall Model; Digital Promotion; Tourism Website; Bonen Cave

INTRODUCTION

In the digital era, websites have become essential tools for promoting tourism, serving as the primary gateway for potential visitors to discover destinations and plan their experiences. An effective internet presence is particularly vital for alternative forms of tourism, such as geotourism, which stresses geological heritage, education, and ecological travel. Effectively designed websites not only draw visitors but also improve their engagement by offering accessible, thorough, and current information regarding geosites, geotrails, and associated cultural and natural attractions (Mylonas et al., 2024; Marques et al., 2024; Williams et al., 2024; Mastrobuono et al., 2020).

Geotourism destinations depend on digital platforms to convey their distinct value propositions, highlight their geoheritage, and promote sustainable tourism practices (Mylonas et al., 2024; Marques et al., 2024; Williams et al., 2024). These websites are essential for public education, facilitating geo-education, and advancing conservation by providing accessible information on geological features, local culture, and gastronomy to a worldwide audience (Marques et al., 2024; Williams et al., 2024; Kılıçhan et al., 2024). Furthermore, digital instruments like interactive maps, virtual field excursions, and mobile applications expand the reach and accessibility of geotourism, allowing varied audiences—including students, educators, and travelers—to investigate and value geoheritage from any location globally (Williams et al., 2024; Karkani et al., 2024; Mastrobuono et al., 2020).

Research suggests that, despite their significance, the online promotion of geotourism is frequently disjointed, with information scattered across multiple broad concepts and missing a comprehensive presentation (Rozenkiewicz et al., 2020; Widawski et al., 2018). Mitigating these deficiencies via synchronized digital strategies and intuitive platforms can markedly improve the visibility and attractiveness of geotourism destinations, thereby bolstering local economies and advancing global sustainability objectives (Mylonas et al., 2024; Williams et al.,

2024; Widawski et al., 2018). Consequently, investing in proficient website building and digital communication is essential for the advancement and prosperity of geotourism in the contemporary tourism environment. The advancement of tourism through digital technology has emerged as a primary strategy for augmenting the appeal of tourist sites while safeguarding existing cultural and natural qualities. Gua Bonen, situated in Baumata Village, Kupang Regency, is a geological tourist attraction with significant potential for development as a prime tourist destination.

This cave possesses not just natural beauty through its distinctive geological formations but also significant historical and cultural qualities associated with the Bonen hamlet population. Consequently, the establishment of a tourism website is crucial as a platform for education, promotion, and cultural preservation, in addition to facilitating an interactive and immersive experience for visitors. This website serves as a platform that presents static information while also offering services such as reservations and catering, along with support for research to deepen visitors' comprehension of the distinctiveness of Gua Bonen. This website empowers the local community by engaging them in content administration and serving as digital tour guides, so facilitating immediate economic and social advantages for the town.

LITERATURE REVIEW

Websites are essential for promoting geotourism destinations and attractions to a global audience, functioning as dynamic platforms for information transmission, engagement, and identity creation. In the digital era, where online visibility is essential, websites have become vital instruments for destination marketing, providing a comprehensive strategy to engage and inform prospective guests. This section examines the diverse methods by which websites facilitate the marketing of geotourism, bolstered by findings from pertinent research.

The Function of Digital Innovations in Promoting Geotourism

Digital advancements have transformed the promotion of geotourism sites. Websites are leading this shift by utilizing tools like social media integration, augmented reality (AR), and virtual reality (VR) to provide immersive experiences for consumers. These technologies allow places to exhibit their distinctive geological characteristics and cultural legacy in compelling manners, therefore captivating a worldwide audience (Kumar & Barua, 2024). For example, augmented reality (AR) can deliver interactive maps and three-dimensional representations of geological structures, whilst virtual reality (VR) can facilitate virtual excursions to distant or unreachable locations, cultivating a sense of discovery and awe.

Furthermore, websites enable the incorporation of geolocation technology, which are crucial for depicting tourist mobility and improving the visitor experience. Geoweb and geolocation tools enable users to navigate and explore destinations accurately, facilitating travel planning and interaction with local attractions (Genevois, 2018). These technologies facilitate the generation of dynamic, user-generated material, including maps and reviews, which can be disseminated across platforms, thereby enhancing the visibility of geotourism sites.

Effectiveness of Websites in Advancing Alternative Tourism Modalities

The efficacy of websites in advocating alternative tourist modalities, like geotourism and astronomical tourism, varies considerably. A comparative analysis of UNESCO Global Geoparks and International Dark Sky Parks indicates that geopark websites are typically more proficient in promoting geotourism via various digital platforms, with only slight opportunities for enhancement (Xanthakis et al., 2024). These websites frequently showcase high-resolution photos, comprehensive descriptions of geological places, and interactive components that appeal to the interests of geotourists. Conversely, dark sky park websites generally exhibit restricted visibility and frequently lack the advanced digital capabilities necessary for the efficient promotion of astronomical tourism.

This gap underscores the necessity of investing in website design and functionality to enable alternative tourism locations to compete in the global market. By implementing best practices, including the integration of multimedia material, intuitive navigation, and search engine optimization (SEO), destinations can improve their online visibility and engage a wider audience (Xanthakis et al., 2024) (Rozenkiewicz et al., 2020).

The Challenge of Information Accessibility and Display

Although websites possess the capacity to enhance geotourism, obstacles persist regarding the accessibility and display of information. An examination of National Tourism Organizations (NTOs) in Central European nations indicates that online information regarding geotourism resources is frequently disorganized and fragmented (Rozenkiewicz et al., 2020). This fragmentation may hinder potential tourists from locating full and reliable

information regarding geotourism destinations, possibly dissuading them from arranging a visit. To resolve this issue, it is imperative to provide a comprehensive online representation of geoheritage, with material systematically categorized under distinct and uniform headings. Hyperlinks and cross-referencing facilitate user navigation among related material, fostering a seamless and intuitive online experience (Rozenkiewicz et al., 2020). Moreover, optimizing websites for international audiences through multilingual support and culturally appropriate material can significantly improve their efficacy in promoting geotourism worldwide.

Websites as Instruments for Identity Development

Websites function not only as promotional instruments but also significantly influence the identity of tourism places. Websites facilitate the formation of a favorable perception of a destination by showcasing its distinctive cultural, historical, and natural characteristics, potentially impacting users' decisions to travel there (Melo, 2013). The process of identity building is crucial for geotourism sites, where distinctive geological features and landscapes frequently serve as the main attractions.

Effective website design should concentrate on crafting a captivating narrative that embodies the destination's character. This can be accomplished by employing superior graphics, captivating narratives, and interactive components that enable consumers to investigate the destination's distinctive features (Kumar & Barua, 2024) (Melo, 2013). By cultivating a robust sense of place and identity, websites may distinguish geotourism destinations in a competitive global marketplace and entice visitors attracted to their unique offerings. Ensure that the literature review is well-organized, flowing smoothly between topics, and logically leading to your research questions or hypotheses. Proper citations and references are essential to uphold academic integrity and provide credit to original authors.

Consumer Evaluations and Assessments

User reviews and ratings are a vital element of website material that profoundly impacts tourist decision-making. These reviews, typically comprising user-generated content (UGC), offer direct experiences and insights regarding places, attractions, and services. Studies have continuously demonstrated that travelers significantly depend on user-generated content (UGC) when making decisions, since it is regarded as more credible and trustworthy than marketer-generated content (Santos et al., 2024) (Jog & Alcasoas, 2023).

The credibility and perceived dependability of user reviews are critical elements. Research indicates that the perceived originality, reliability, and value of user-generated content greatly affect destination image and behavioral intentions (Das et al., 2024) (Asyraff et al., 2023). Positive evaluations and high ratings can augment the cognitive and emotive aspects of destination image, ultimately resulting in heightened pleasure and loyalty (Zain et al., 2024) (Lam et al., 2020).

METHOD

This project use waterfall analysis to develop the website. The waterfall model is a structured software development methodology characterized by sequential phases, where each stage must be completed before the next begins. This approach is particularly suitable for tourism website projects with well-defined requirements and clear objectives, ensuring systematic progress and thorough documentation at each step (Ariasa et al., 2022; Nurhuda & Putra, 2022; Buana et al., 2025; Pratama et al., 2022; Supriadi et al., 2022).

Stages of the Waterfall Model in Tourism Website Development

1. Requirements Analysis and Planning

The process begins with gathering and analyzing requirements from stakeholders, such as local tourism authorities, community members, and potential users. Techniques like interviews, flowcharts, and data flow diagrams (DFD) are used to define the website's objectives, target audience, and essential features, including information on attractions, accommodations, and local products (Ariasa et al., 2022; Nurhuda & Putra, 2022; Buana et al., 2025; Pratama et al., 2022; Supriadi et al., 2022).

2. System and Website Design

Based on the requirements, the design phase involves creating the website's architecture, user interface, and database structure. Entity Relationship Diagrams (ERD) and Unified Modeling Language (UML) models are often employed to visualize data relationships and system components. Visual elements, such as high-quality images and interactive content, are planned to enhance user engagement and support digital branding (Nurhuda & Putra, 2022; Buana et al., 2025; Santyadiputra et al., 2019; Prasetyo & Suraya, 2023).

3. Implementation (Coding and Development)

This phase focuses on translating design specifications into a functional website, integrating features for information dissemination, user interaction, and digital storytelling (Nurhuda & Putra, 2022; Buana et al., 2025; Pratama et al., 2022; Santyadiputra et al., 2019). But in this case, the implementation use website builder that have template and AI that translates the design automatically using Hostinger Web Builder.

4. Testing and Evaluation

Comprehensive testing is conducted to ensure the website meets functional and usability requirements. BlackBox testing is commonly used to validate system functionality, while user experience is assessed through questionnaires and usability theory. Any deficiencies identified, such as invalid test scenarios or below-average user satisfaction, are documented for future improvement (Ariasa et al., 2022; Nurhuda & Putra, 2022; Haryono & Madani, 2024).

5. Deployment and Maintenance

After successful testing, the website is launched and made accessible to the public. Ongoing maintenance addresses user feedback, updates content, and enhances features to improve attractiveness, efficiency, and overall user satisfaction. The website's impact is monitored through metrics such as visitor numbers and community income, guiding further development (Ariasa et al., 2022; Buana et al., 2025; Pratama et al., 2022; Supriadi et al., 2022).

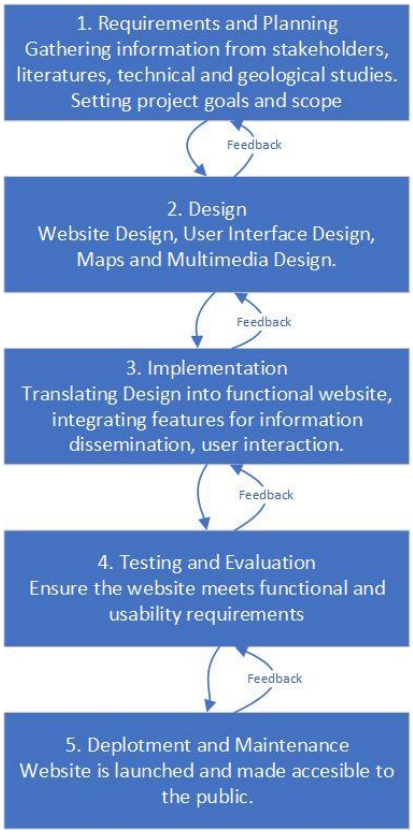

Image 1: Flowchart of Waterfall Analysis in Bonen Cave Tourism Website Making

RESULTS AND DISCUSSION

The development of the geotourism website, geowisatakupang.fun, adheres to the Waterfall Model, a linear and sequential project management approach. This model ensures a systematic progression through distinct phases: Requirements Analysis, System Design, Implementation, Testing, and Deployment & Maintenance. Each phase is meticulously executed to ensure the website meets the needs of geotourism stakeholders while maintaining academic rigor and practical relevance.

Requirements Analysis and Planning

The initial phase involves comprehensive stakeholder engagement, primarily through interviews with local tour guides and community representatives. This participatory approach ensures the website aligns with the needs of geotourism stakeholders, capturing information on attractions, accommodations, and local products, as well as functional and non-functional requirements. Techniques such as semi-structured interviews and surveys are employed to gather qualitative data, that guides subsequent phases. For example, field surveys and interviews with local guides highlight the importance of community involvement in tourism projects

Image 2. Field Survey and Interview with Local Guide

2. System and Website Design

Based on the gathered requirements, the system architecture and website layout are designed. A pre-launch "coming soon" page is created to generate early interest, while the main pages—Homepage, Gallery, Geotourism Blog, and Service Page—are designed to provide an intuitive user experience. The design incorporates UI/UX principles, such as visual hierarchy and responsive navigation. The domain geowisatakupang.fun is selected to reflect the website's focus on geotourism in the Kupang region.

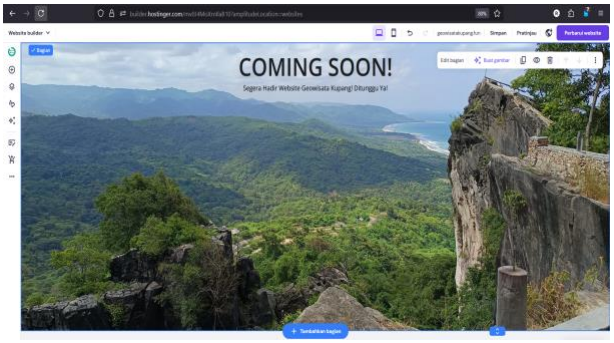

Image 3. Coming Soon Page in Website

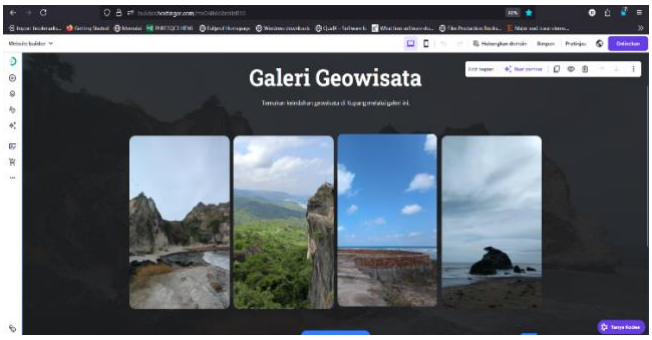

Image 4. Gallery Page Design

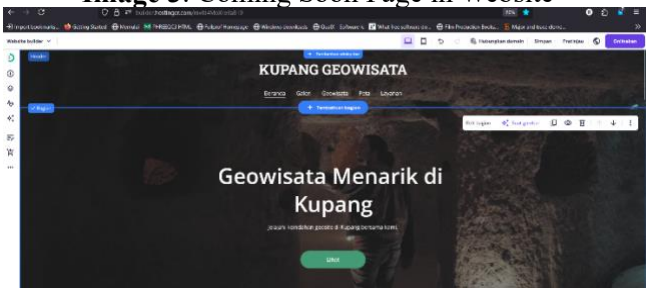

Image 3. Main Page Design

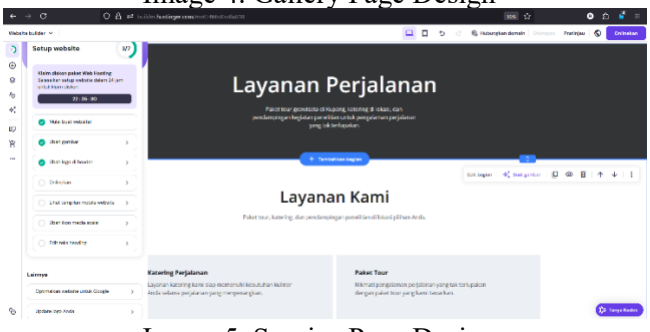

Image 5. Service Page Design

3. Implementation

The design is translated into a functional website using a no-code website builder, enabling real-time updates and seamless deployment. Key features include responsive design for cross-device compatibility and dynamic

content management for blog updates and gallery additions. This phase ensures the website is visually appealing and functionally robust, ready for testing and evaluation. The website composition are consist of Main Page, Gallery, Geotourism Blog, Maps, and Service.

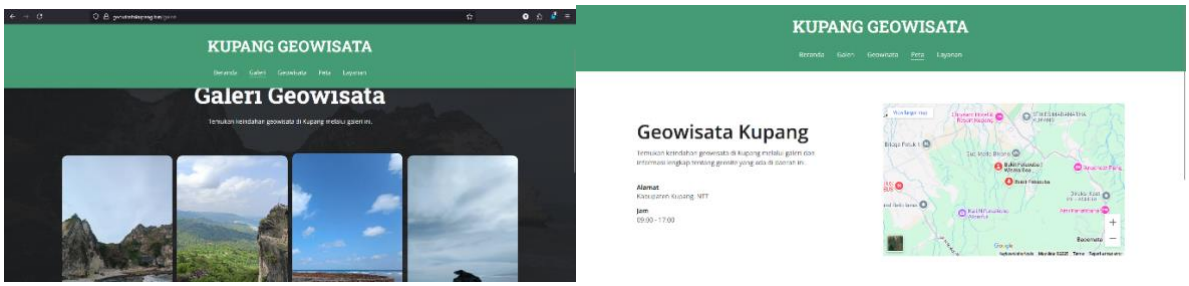

Image 7. Web page Design Implementation

4. Testing and Evaluation

The website undergoes rigorous testing to validate functionality and user experience. Functional testing ensures all features, such as contact forms and maps, work as intended, while usability testing, conducted via questionnaires and A/B testing, assesses user satisfaction. No major deficiencies were identified, though the system remains open for iterative improvements based on user feedback. Testing is conducted on both desktop and mobile devices to ensure broad accessibility. There are no deficiencies identified, but the sites are open for future improvement in design and service via service contact.

Image 8. Web Page Tested on Desktop Computer

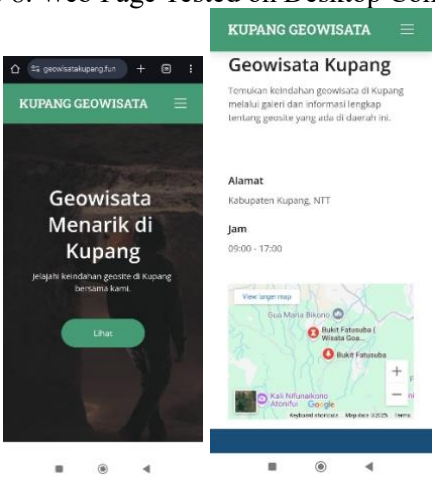

Image 9. Web Page Tested on Mobile Phone Browser

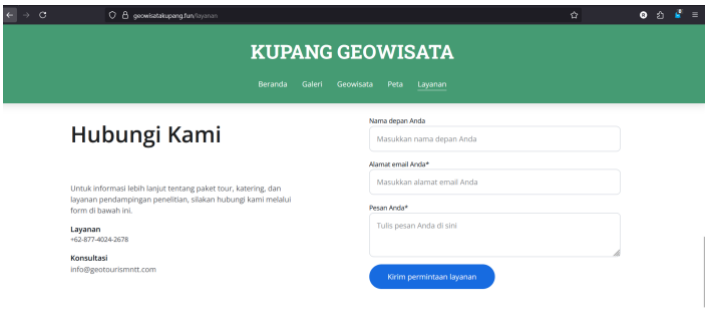

Image 10. Contact and Input Suggestion Page for Future Improvement

5. Deployment and Maintenance

The website is launched under domain geowisatakupang.fun and made accessible to the public. User feedback addressed by service contact, updates content that are inventoried, and enhances features to improve attractiveness, efficiency, and overall user satisfaction. The website is officially launched and monitored for performance using web analytics tools. Key metrics, such as visitor numbers (93 unique visits by June 2025) and community engagement (via service contact), guide further development. Continuous updates are planned to enhance content and features, ensuring the website remains relevant and effective. The impact of the website is measured not only by visitor numbers but also by its contribution to community income and geotourism awareness. The website traffic monitored by website builder analytics.

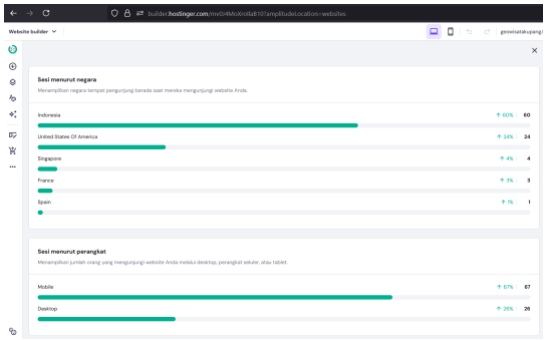

Image 11. Analytics of Websites in June 2025

CONCLUSION

The establishment of the Bonen Cave tourism website in Baumata Village can serve as an efficient means of marketing local tourism potential through the use of web-based information technology. This project can be executed methodically using the Waterfall development methodology, encompassing requirement collection, analysis, design, implementation, testing, and launch. The incorporation of web map functionalities and service tabs on the website augments visitor engagement and experience while facilitating the preservation of local cultural and historical heritage. The outcomes of field surveys and literature reviews present a comprehensive overview of geotourism sites, effectively addressing user requirements and facilitating accessible and engaging information regarding Bonen Cave. Educating the local population is a crucial measure for guaranteeing the sustainability and effective use of the website. It is advisable to enhance interactive features by using Augmented Reality, enabling visitors to engage with futuristic aspects like as filters and interactive animations that elucidate the cave, with social media integration and mobile application development. Ongoing monitoring and assessment are essential to adjust to shifts in user requirements and technological advancements. The active engagement of the local community through the training of geotourism guides and website management requires ongoing enhancement to ensure the website optimally supports the advancement of sustainable tourism in Baumata Village.

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