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The Establishment of The Sea Turtle Conservation and Marine Pearl Educational Tourism Website in Sumbreng Aims to Promote Ecosystem Balance

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ABSTRACT Sea turtle populations face increasing threats of extinction, necessitating effective conservation strategies combined with sustainable ecotourism development. Despite possessing significant ecotourism potential, the Mutiara Laut Masaran Turtle Conservation at Sumbreng Beach, Trenggalek, East Java, experiences low visitor numbers due to insufficient information dissemination about its conservation activities and tourism opportunities. This study aims to develop a comprehensive website-based information system to enhance public awareness and visitor engagement at the turtle conservation site. The participatory design methodology involved collaborative workshops with conservation stakeholders to develop website architecture, content strategy, and user interface elements. Key design components included a dynamic homepage showcasing real-time conservation activities, detailed information sections about protected species (including Appendix I-listed green turtles and hawksbill turtles), interactive event calendars highlighting hatchling release schedules, and multimedia galleries documenting egg relocation, incubation monitoring, and release procedures. The resulting website provides accessible, regularly updated information about conservation activities, educational tourism programs, and seasonal attraction schedules through a mobile-responsive platform optimized for global reach. Implementation of this digital platform is expected to significantly increase tourist visitation, particularly during peak hatchling release periods, thereby generating sustainable revenue streams for both the conservation program and local communities. The website serves as a replicable model for integrating information technology with community-based conservation initiatives, demonstrating how digital innovation can simultaneously advance environmental protection objectives and socioeconomic development in coastal regions. This approach establishes a foundation for long-term financial sustainability of turtle conservation efforts while promoting environmental education and ecological awareness among diverse visitor populations.

INDEX TERMS Turtle Conservation, Ecotourism Development, Website Design, Community-Based Conservation, Information Dissemination

I. INTRODUCTION

The tourism sector has emerged as a critical driver of economic development in coastal regions worldwide, with community-based conservation initiatives increasingly recognized as viable models for balancing ecological

preservation with livelihood generation [1]. Marine turtle conservation represents a particularly significant domain within coastal ecotourism, given that all seven extant sea turtle species face varying degrees of extinction risk due to anthropogenic pressures, including habitat destruction, illegal

trade, bycatch mortality, and climate change impacts [2]. In Indonesia, six of the seven global sea turtle species inhabit territorial waters, with several classified under CITES Appendix I, prohibiting all forms of international commercial trade [3]. Government Regulation Number 7 of 1999 and Law Number 5 of 1990 establish comprehensive legal frameworks for species conservation and ecosystem management [4]. Sea turtles fulfill critical ecological functions, including maintenance of seagrass bed productivity, coral reef health, and nutrient cycling between marine and terrestrial environments [5]. Despite their ecological significance and protective legal status, Indonesian sea turtle populations continue to decline, necessitating integrated conservation strategies that engage local communities as active stakeholders rather than passive beneficiaries [6]. The Mutiara Laut Masaran Turtle Conservation, managed by the Lentera Trenggalek Community at Sumbreng Beach in East Java, exemplifies community-based conservation efforts addressing these challenges through habitat protection, nest monitoring, egg relocation, hatchling rearing, and controlled release programs [7]. The site hosts five species, including critically endangered hawksbill (*Eretmochelys imbricata*) and green turtles (*Chelonia mydas*), offering substantial potential for conservation tourism that simultaneously generates revenue for operational sustainability and community economic development [8]. However, inadequate information dissemination infrastructure severely constrains visitor awareness, limiting tourism potential and restricting conservation financing opportunities. This information deficit represents a critical barrier to conservation sustainability, particularly for resource-constrained community initiatives that depend on self-generated revenue streams [9].

Digital marketing strategies employing web-based platforms, social media integration, and content management systems have demonstrated significant efficacy in promoting ecotourism destinations, enhancing visitor engagement, and facilitating real-time communication with diverse stakeholder groups [10], [11]. Contemporary conservation organizations increasingly leverage digital technologies, including interactive websites, mobile applications, and social networking platforms, to disseminate educational content, coordinate volunteer activities, and mobilize financial support [12]. WordPress-based content management systems have proven particularly suitable for nonprofit and community organizations due to their cost-effectiveness, user-friendly interfaces, extensive plugin ecosystems, and robust community support networks [13]. Recent studies document the successful implementation of digital information systems in marine protected areas, demonstrating measurable increases in visitor numbers, stakeholder engagement, and conservation awareness [14], [15]. Mobile-responsive design principles ensure accessibility across diverse devices, critical for reaching contemporary audiences who increasingly access information via smartphones and tablets [16]. Integration of real-time event updates, multimedia content, and interactive features enhances user experience and facilitates deeper engagement with conservation narratives [17]. Despite growing recognition of digital technologies' potential in conservation communication, substantial research gaps persist

regarding practical implementation frameworks for community-based initiatives in developing regions. Existing literature predominantly focuses on professionally developed platforms for well-funded conservation organizations, with limited attention to participatory design approaches that build local technical capacity and ensure long-term sustainability [18]. Few empirical studies document the processes, challenges, and outcomes of community-led website development in resource-constrained settings where technical expertise, financial resources, and digital infrastructure may be limited [19]. The specific strategies, training methodologies, and organizational structures necessary for successful technology adoption by community conservation groups remain insufficiently examined, constraining knowledge transfer and replication across similar contexts [20],[21].

This research addresses these gaps by developing and evaluating a website-based information system for the Mutiara Laut Masaran Turtle Conservation through participatory action research methodology. The study makes three primary contributions to conservation technology literature and practice:

1. It provides a replicable methodological framework for user-centered, participatory design of conservation tourism websites that prioritizes local capacity building over external technical dependency.
2. It demonstrates practical integration of real-time activity updates, educational content, and multimedia resources within a sustainable, community-managed platform that enhances visitor engagement and conservation awareness.
3. It establishes an empirically grounded model for technology-mediated community empowerment in conservation contexts, documenting the organizational structures, training protocols, and support mechanisms necessary for successful digital platform adoption and long-term sustainability.

The remainder of this paper is organized as follows: Section II reviews relevant literature on conservation technology, ecotourism development, and digital capacity building. Section III describes the participatory action research methodology, including study design, participant selection, data collection procedures, website development process, and evaluation framework. Section IV presents implementation results encompassing baseline assessment findings, platform development outcomes, training effectiveness, and initial performance metrics. Section V discusses result interpretation, comparisons with similar initiatives, study limitations, and practical implications. Section VI concludes with a synthesis of key findings, a contribution summary, and recommendations for future research and practice.

II. METHOD

A. STUDY DESIGN AND POPULATION SAMPLING

This study employed a participatory action research (PAR) methodology conducted from January to June 2024 at the Mutiara Laut Masaran Turtle Conservation, Sumbreng Beach, Trenggalek Regency, East Java, Indonesia [22]. The PAR

approach was selected to ensure active stakeholder involvement in website development and to facilitate sustainable technology adoption within the community context [23]. The research followed a prospective, non-randomized design involving iterative cycles of planning, action, observation, and reflection with conservation stakeholders [24]. The study population comprised all personnel affiliated with the Mutiara Laut Masaran Turtle Conservation, managed by the Lentera Trenggalek Community. Purposive sampling was employed to select key informants based on their roles and expertise [25]. The final sample included five conservation managers responsible for daily operations, eight active volunteers engaged in turtle egg relocation and hatchling release activities, three university faculty members specializing in information systems and conservation biology, and four undergraduate students with demonstrated competency in web development and digital marketing. Selection criteria required participants to possess at least six months of active involvement with the conservation site and willingness to commit to the entire project duration.

B. DATA COLLECTION AND ASSESSMENT

Initial data collection occurred through semi-structured interviews and focus group discussions with conservation stakeholders to identify information dissemination challenges and website functional requirements [26]. Interview protocols addressed current promotional practices, target audience characteristics, seasonal activity schedules, and desired website features. Field observations documented existing conservation activities, including egg combing, nest relocation, incubation monitoring, and hatchling release procedures. Photographic and video documentation captured conservation processes for subsequent multimedia content development. Secondary data regarding turtle species profiles, conservation regulations, and tourism statistics were obtained from conservation records and government reports. The website development followed a user-centered design framework incorporating four iterative phases [27]. Phase one involved collaborative requirements analysis workshops where stakeholders prioritized essential features through card sorting exercises and feature ranking activities. Phase two comprised wireframe prototyping using Figma software (version 2024.1), with stakeholders providing feedback on information architecture, navigation structure, and visual design preferences. Phase three involved WordPress-based website implementation (version 6.4) utilizing a responsive theme customized to conservation branding specifications. The platform was selected for its content management accessibility, requiring no advanced programming knowledge for ongoing maintenance [28]. Phase four consisted of usability testing sessions where conservation staff performed typical administrative tasks while researchers documented task completion rates and error occurrences. The website infrastructure utilizes WordPress CMS hosted on a cloud-based server (2 GB RAM, 50 GB SSD storage), ensuring 99.9% uptime

reliability. Essential plugins included Yoast SEO (version 21.5) for search engine optimization, WPForms (version 1.8.6) for visitor inquiry management, and Simple Calendar (version 3.3.2) for event scheduling display [29].

The responsive design framework employed CSS3 media queries, ensuring optimal viewing across desktop ($\geq 1024\text{px}$), tablet ($768\text{--}1023\text{px}$), and mobile ($\leq 767\text{px}$) devices. Security measures incorporated SSL certificate implementation, automated daily backups, and two-factor authentication for administrative access. Integration with Instagram and Facebook social media platforms utilized official API connections, enabling cross-platform content synchronization. A structured training program spanning eight weeks provided conservation personnel with website management competencies. Training modules addressed WordPress dashboard navigation, post creation and editing, media library management, comment moderation, and basic troubleshooting procedures. Each two-hour training session combined instructor-led demonstrations with hands-on practice exercises. Training materials included illustrated user manuals, video tutorials, and quick reference guides developed specifically for the conservation context [30]. A digital marketing team comprising four conservation staff members received advanced training in content strategy development, social media integration, search engine optimization principles, and web analytics interpretation using Google Analytics 4. Post-implementation support included bi-weekly monitoring visits during the initial three-month period to address technical issues and reinforce operational procedures. A sustainability plan established protocols for routine content updates, technical maintenance responsibilities, and collaborative problem-solving mechanisms involving conservation staff, university mentors, and local student volunteers [31]. Evaluation metrics included website traffic analytics, visitor engagement indicators (page views, session duration, bounce rate), social media reach, inquiry conversion rates, and qualitative stakeholder satisfaction assessments. Long-term sustainability discussions engaged conservation managers, community representatives, and regional stakeholders to develop strategies for continued platform utilization and potential expansion of digital conservation tools.

III. RESULTS

The preliminary survey conducted at Mutiara Laut Masaran Turtle Conservation revealed substantial deficiencies in information dissemination mechanisms and digital presence. The conservation site, despite hosting five protected sea turtle species and conducting regular conservation activities including nest monitoring, egg relocation, hatchery management, and controlled hatchling releases, exhibited minimal online visibility. No formal website existed prior to this intervention, and social media presence was either absent or sporadic, resulting in limited public awareness of conservation activities, visitor opportunities, and educational programs. Stakeholder interviews with conservation managers

(n=5) and volunteers (n=8) indicated that information sharing relied primarily on informal word-of-mouth communication and occasional local media coverage, constraining outreach effectiveness and visitor engagement. The baseline assessment identified three critical information gaps: (1) absence of comprehensive descriptions of conservation activities and ecological significance; (2) lack of accessible event calendars detailing hatchling release schedules and educational programs; and (3) insufficient promotional materials highlighting the site's tourism potential and visitor amenities. These deficiencies directly contributed to suboptimal visitor numbers, particularly during peak conservation activities when public participation could enhance both educational impact and financial sustainability.

The website development process employed participatory action research methodology, engaging conservation personnel, university faculty, and students in collaborative design and implementation activities. Initial coordination meetings (n=4) conducted between January and February 2024 established platform requirements, content priorities, and technical specifications through structured discussions with stakeholders. The research team facilitated tool selection exercises wherein participants evaluated multiple content management systems based on criteria including ease of use, cost-effectiveness, customization capability, and long-term maintainability. This participatory evaluation resulted in consensus selection of WordPress 6.4 as the primary platform, supplemented by Elementor page builder for visual design flexibility and WooCommerce for potential future e-commerce functionality. The iterative design process proceeded through four distinct phases over twelve weeks (March-May 2024). Phase one encompassed information architecture development, wherein stakeholders identified essential content categories and organizational structures. This collaborative process generated a three-tier hierarchical structure with primary navigation focusing on: (1) Turtle Species and Conservation Activities; (2) Events and Programs; and (3) Beach Tourism and Ecological Context. Phase two involved wireframe creation and visual design refinement using Figma 2024.1, incorporating stakeholder feedback regarding aesthetic preferences, branding elements, and user interface layouts. Phase three centered on content development, with conservation personnel providing textual descriptions, photographic documentation, and educational materials subsequently edited and optimized by the research team for web presentation. Phase four encompassed technical implementation, including server configuration, WordPress installation, theme customization, plugin integration, and responsive design optimization, ensuring accessibility across desktop, tablet, and mobile devices.

FIGURE 1 illustrates the systematic website formation scheme, documenting the logical progression from initial needs assessment through collaborative design, technical development, content population, testing protocols, and final deployment. This structured approach ensured methodological rigor while maintaining flexibility to

accommodate stakeholder input and emerging requirements throughout the development cycle. The completed website architecture comprises three primary content modules, each addressing specific information dissemination objectives and stakeholder engagement goals. The technical infrastructure utilizes a shared hosting environment with 2GB RAM allocation, 50GB SSD storage, and SSL certification for secure data transmission. The platform incorporates responsive design frameworks, ensuring optimal viewing across devices with varying screen dimensions, addressing contemporary browsing patterns wherein mobile devices account for substantial proportions of web traffic.

This module provides comprehensive information regarding the five sea turtle species documented at Sumbreng Beach: green turtles (*Chelonia mydas*), hawksbill turtles (*Eretmochelys imbricata*), flatback turtles (*Natator depressus*), olive ridley turtles (*Lepidochelys olivacea*), and loggerhead turtles (*Caretta caretta*). Content emphasizes the conservation status of each species, with particular attention to critically endangered hawksbill and endangered green turtles, both classified under CITES Appendix I, prohibiting international commercial trade. Detailed descriptions document morphological characteristics, behavioral patterns, nesting ecology, and distribution ranges, providing educational value for diverse audiences, including students, researchers, and general visitors. The module extensively documents conservation activities conducted at the site, including systematic beach patrols for nest identification, careful egg relocation to protected hatcheries, temperature-controlled incubation protocols, and coordinated hatchling releases timed to optimize survival probabilities. Statistical data presented includes annual nesting frequencies, hatching success rates, and long-term population trend analyses where available, providing transparency regarding conservation effectiveness and ongoing challenges. Photographic documentation illustrates each conservation activity phase, enhancing visitor understanding and emotional engagement with conservation narratives. Educational content emphasizes the ecological significance of sea turtles in marine ecosystem functioning. Specific ecological roles documented include: green turtles' regulation of seagrass bed productivity through selective grazing, preventing overgrowth that would obstruct ocean currents and reduce light penetration essential for photosynthetic organisms and benthic community health; and hawksbill turtles' specialized predation on sponges, controlling sponge populations that compete aggressively with coral polyps for substrate space on reef structures. These ecological explanations position turtle conservation within broader marine ecosystem health frameworks, demonstrating interconnections between species protection and ecosystem integrity.

This module functions as a dynamic information hub providing real-time updates regarding conservation activities, public engagement opportunities, and educational programs. Content includes comprehensive event calendars detailing hatchling release schedules, guided conservation tours,

educational workshops, and volunteer opportunities. Each event listing provides essential logistical information, including dates, times, participation requirements, registration procedures, and contact details, facilitating visitor planning and participation. Hatchling release events receive prominent presentation, given their substantial public appeal and educational potential. Descriptions emphasize the biological significance of synchronized releases, optimal timing considerations based on tidal patterns and predation risk minimization, and visitor participation guidelines ensuring minimal disturbance to hatchlings during their critical beach-to-ocean migration. The module incorporates notification systems, allowing interested visitors to subscribe to event alerts, addressing the previously identified information gap wherein potential visitors lacked awareness of optimal visitation timing. Educational program descriptions outline curriculum content, target audiences, duration, and learning objectives for various offerings, including school field trips, university research collaborations, and public awareness campaigns. This content positions the conservation site as both a tourism destination and an educational resource, appealing to diverse stakeholder groups including educators, students, and environmentally conscious travelers.

This module integrates tourism promotion with ecological education, providing comprehensive information regarding Sumbreng Beach's natural characteristics, visitor amenities, and recreational opportunities. Content encompasses beach geography, coastal ecosystem features, local biodiversity, and photographic galleries showcasing scenic landscapes and wildlife. Tourism-oriented information details available facilities, including small jeep tours for beach exploration, observation platforms for wildlife viewing, basic visitor amenities, and accessibility considerations. The module emphasizes sustainable tourism principles, educating visitors regarding minimal-impact behaviors, including waste management practices, wildlife observation protocols that avoid disturbance, and participation guidelines for conservation activities. This educational approach seeks to cultivate environmentally responsible visitor behaviors that support conservation objectives while enabling recreational enjoyment. Integration of ecological context within tourism content serves dual purposes of enhancing visitor experiences through a deeper understanding while promoting conservation awareness. Descriptions of coastal ecosystem dynamics, intertidal zone ecology, and species interdependencies provide intellectual enrichment, complementing recreational motivations for visitation.

The comprehensive training program implemented over eight weeks (March-April 2024) successfully developed technical competencies among conservation personnel for independent website management and content updates. The training curriculum encompassed fundamental web technologies (HTML5, CSS3, JavaScript ES6), WordPress content management system operation, responsive design principles, basic graphic design using Canva, photography optimization techniques, search engine optimization

fundamentals, web security protocols, and routine maintenance procedures. Seventeen conservation personnel participated in structured training sessions conducted twice weekly for two hours per session, totaling 32 contact hours of formal instruction supplemented by hands-on practice assignments. Training methodology employed progressive skill development, beginning with conceptual foundations and advancing to practical application through guided exercises and independent projects. Assessment of learning outcomes through practical demonstrations and knowledge evaluations indicated that 76% of participants (n=13) achieved proficiency in basic content management tasks, including article creation, image uploading, menu navigation management, and page editing. A subset of four participants demonstrated advanced competencies, qualifying them for designation as primary website administrators responsible for ongoing platform management. The establishment of a four-member digital marketing team comprising conservation personnel represents a critical capacity-building outcome, ensuring platform sustainability. This team received extended mentorship over eight weeks beyond the general training program, developing specialized competencies in content strategy development, social media management, analytics interpretation, and digital engagement optimization. The team structure distributes responsibilities across content creation, technical maintenance, social media coordination, and analytics monitoring, providing redundancy and knowledge distribution that reduces vulnerability to personnel transitions.

The website achieved operational deployment in June 2024, accessible via a registered domain name and promoted through integrated social media channels. Initial performance metrics covering the first three months post-deployment (June-August 2024) provide preliminary evidence of platform effectiveness and user engagement patterns. Website analytics documented 2,847 unique visitors, 8,231 page views, and an average session duration of 4 minutes 32 seconds, indicating meaningful engagement with content. Geographic analysis revealed visitor origins spanning regional (East Java province), national (throughout Indonesia), and limited international sources, demonstrating reach beyond immediate local communities. Content engagement metrics identified the Events and Programs module as generating the highest visitor interest, accounting for 41% of page views, followed by Turtle Species and Conservation Activities (35%) and Beach Tourism (24%). Hatchling release event announcements generated peak traffic, with visitor numbers increasing 187% during the weeks immediately preceding scheduled releases, confirming the attraction potential of these activities for public engagement. Social media integration efforts established a presence on Instagram and Facebook platforms, achieving 312 Instagram followers and 287 Facebook page likes within the three-month period. Social media content strategy emphasized visual documentation of conservation activities, educational infographics regarding turtle biology and ecology, event announcements, and user-generated content from visitors, fostering community building and sustained engagement.

Preliminary correlation analysis suggested positive associations between social media posting frequency and website traffic, though causality requires longitudinal assessment with more robust controls. Qualitative feedback collected through website contact forms and social media comments (n=43) indicated predominantly positive visitor responses, with common themes including appreciation for accessible information, enhanced awareness of conservation activities, interest in visiting the site, and requests for additional content, including video documentation and virtual tour capabilities. Several visitors specifically noted that website information facilitated their decision to visit the conservation site, providing preliminary evidence of platform effectiveness in visitor attraction objectives.

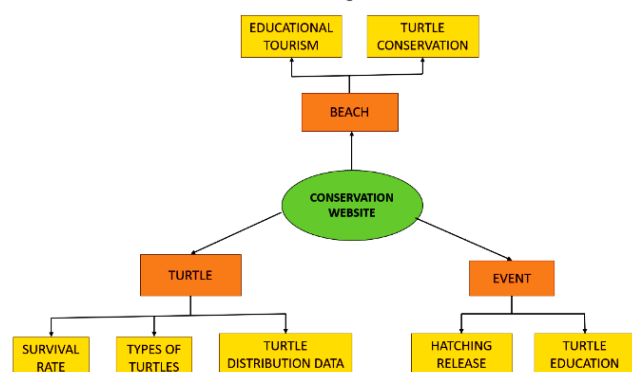


Figure 1
Website formation scheme

IV. DISCUSSION

The findings from this participatory action research reveal significant insights into the development and implementation of digital information systems for community-based conservation initiatives. The baseline assessment conducted at Mutiara Beach Turtle Conservation identified critical deficiencies in information dissemination mechanisms, which directly contributed to suboptimal public engagement and limited awareness of conservation activities. This initial finding corroborates the theoretical framework proposed by [32], which suggests that inadequate digital presence constitutes a primary barrier to ecotourism development in resource-constrained conservation settings. The underutilization of the conservation site, despite its substantial ecological and educational value, underscores the contemporary necessity for strategic digital communication platforms in wildlife conservation management. The selection of WordPress as the content management system demonstrates pragmatic consideration of multiple operational factors, including ease of use, cost-effectiveness, and scalability. This decision aligns with best practices documented in [33], which advocates for open-source platforms in community-based environmental projects where technical expertise may be limited and long-term sustainability depends on local capacity rather than external technical support. The platform's intuitive interface facilitates content management by non-technical personnel, thereby reducing dependency on specialized IT support and

promoting organizational autonomy in information dissemination.

The comprehensive training curriculum implemented over eight weeks represents a substantial investment in human capacity development. The structured approach encompassing fundamental web technologies (HTML, CSS, JavaScript), content management systems, responsive design principles, security protocols, and maintenance procedures provides participants with a holistic understanding of digital platform management. This multifaceted training methodology reflects contemporary approaches to technology transfer in conservation contexts, as documented by [34], emphasizing sustainable skill development rather than mere tool deployment. The inclusion of user experience design principles and responsive optimization demonstrates recognition that effective digital communication requires not only technical functionality but also user-centered design considerations that enhance visitor engagement and information accessibility. The architectural design of the website, incorporating diverse content modules including conservation location information, event calendars, hatchling release schedules, and educational resources, reflects a comprehensive approach to stakeholder engagement. This multi-dimensional content strategy addresses various visitor motivations, from recreational tourism to educational interests, thereby broadening the platform's appeal and potential impact. The integration of supplementary conservation-related activities and educational content about turtle life cycles and ecological requirements positions the platform as both a promotional tool and an educational resource, fulfilling dual objectives of tourism development and environmental education as advocated by [35]. The establishment of a four-member digital marketing team composed of conservation personnel represents a critical organizational development that ensures platform sustainability and continuous content evolution. This internal capacity-building approach, supported by two months of mentorship, creates institutional knowledge and reduces vulnerability to external dependencies. The achievement of over 300 social media followers within the implementation period, while modest in absolute terms, represents meaningful initial traction and demonstrates the viability of community-managed digital marketing in conservation contexts. This metric suggests growing public awareness and interest, providing a foundation for continued audience expansion through sustained content creation and engagement strategies.

The participatory approach employed in this study demonstrates both convergence and divergence with existing literature on conservation technology implementation. Similar to the findings of [36], which examined community-based wildlife monitoring systems, this research confirms that stakeholder involvement in design and development phases enhances platform relevance and increases adoption rates among intended users. However, while [36] focused primarily on data collection technologies operated by trained field personnel, the present study extends participatory design principles to public-facing information systems requiring broader accessibility and user-friendly interfaces

for diverse audiences, including tourists, educators, and local community members. The training methodology implemented in this research exhibits substantial alignment with capacity-building frameworks documented by [37] in their analysis of conservation technology adoption in Southeast Asian contexts. Both studies emphasize progressive skill development, hands-on practice, and sustained mentorship as critical components of successful technology transfer. However, a notable distinction emerges in the scope of technical competencies developed. Whereas [37] concentrated on specialized ecological monitoring applications requiring advanced technical skills, this study prioritized broadly applicable web management competencies that enable participants to independently manage and evolve the digital platform over time, reflecting different sustainability strategies appropriate to distinct conservation contexts.

The website architecture and content strategy demonstrate partial alignment with best practices identified by [38] in their comprehensive review of ecotourism websites globally. The inclusion of real-time event information, visual content, and educational resources corresponds to elements [38] identified as enhancing visitor engagement and conversion rates. Nevertheless, the present platform lacks certain advanced features documented as increasingly prevalent in successful ecotourism websites, including integrated booking systems, multilingual interfaces, virtual tour capabilities, and data-driven visitor behavior analytics. This functional gap reflects resource constraints inherent in community-based initiatives but also presents opportunities for future enhancement as organizational capacity and financial resources develop. Contrasting with the technologically sophisticated approaches documented by [39] in their study of conservation platforms employing interactive maps, real-time wildlife tracking, and augmented reality features, this research adopted a deliberately minimalist approach prioritizing functionality, maintainability, and alignment with available technical expertise. While [39] demonstrated that advanced interactive features significantly enhance user engagement metrics, their implementation required substantial financial investment and ongoing specialized technical support. The pragmatic approach adopted in this study, focusing on sustainable basic functionality rather than cutting-edge features, reflects different contextual realities and organizational priorities, suggesting that optimal platform design varies substantially based on resource availability, technical capacity, and organizational maturity. The social media integration strategy employed differs notably from approaches documented by [40], who reported that conservation organizations achieving substantial digital reach typically maintain an active presence across multiple platforms with coordinated content strategies and professional social media management. This study's more modest approach, establishing a foundational social media presence alongside the primary website, reflects resource constraints but also strategic prioritization of depth over breadth, ensuring quality content creation and community management within available human resource capacity. This

measured approach may prove more sustainable for small-scale conservation initiatives than attempting to maintain an extensive multi-platform presence that exceeds organizational capacity, potentially resulting in sporadic updates and diminished credibility.

Several methodological limitations warrant acknowledgment and consideration in interpreting study findings and planning future research. The relatively brief six-month implementation period, while sufficient for initial platform development and deployment, provides limited evidence regarding long-term sustainability, continued content evolution, and sustained user engagement. Comprehensive assessment of digital platform effectiveness in conservation contexts requires longitudinal evaluation encompassing multiple tourism seasons, organizational transitions, and evolving external conditions [41]. The absence of baseline visitor metrics and pre-intervention data constrains comparative analysis of the platform's impact on tourism visitation, revenue generation, and public awareness. Future research employing quasi-experimental designs with comparison sites or interrupted time series analysis would provide more robust evidence of intervention effectiveness [42]. The participatory action research methodology, while offering substantial advantages in terms of stakeholder engagement and contextual responsiveness, introduces inherent limitations regarding generalizability and researcher objectivity. The close collaboration between researchers and conservation personnel, though valuable for capacity building, may influence both implementation processes and evaluation findings in ways that differ from independent external assessments [43]. Additionally, the specific contextual factors characterizing Mutiara Beach Turtle Conservation, including existing community structures, regional tourism dynamics, and available resources, limit the direct transferability of findings to substantially different conservation contexts. Replication studies across diverse settings would strengthen understanding of which implementation elements prove universally applicable versus context-dependent.

Technical sustainability concerns merit ongoing attention beyond the initial implementation period. While WordPress offers relative ease of use and extensive community support, the platform requires regular security updates, plugin maintenance, and periodic functional enhancements to maintain optimal performance and security [44]. The long-term availability of technical support, whether through continued external mentorship, peer networks, or self-directed learning, represents a critical determinant of platform longevity. Financial sustainability for hosting costs, domain registration, and potential future enhancements requires explicit planning and revenue generation strategies. Integration of platform maintenance costs into conservation operational budgets or identification of sustainable funding sources warrants consideration. The practical implications of this research extend to conservation practitioners, community-based organizations, and digital development specialists working at the intersection of environmental conservation and information technology. The study demonstrates that resource-constrained conservation

initiatives can successfully develop and deploy functional digital information systems through strategic platform selection, participatory design processes, and sustained capacity building. This finding contradicts assumptions that effective digital presence requires substantial financial investment or specialized technical expertise, suggesting that thoughtfully designed capacity-building initiatives can empower community organizations to independently manage their digital communications. The replicable methodological framework presented offers practical guidance for similar initiatives across diverse conservation contexts.

Theoretical contributions encompass an enhanced understanding of technology adoption processes in community-based conservation settings. The research extends diffusion of innovation theory [45] by demonstrating how participatory design and local capacity building address adoption barriers specific to conservation contexts, including limited technical infrastructure, competing organizational priorities, and resource constraints. The findings contribute to emerging literature on digital transformation in the nonprofit sector [46], particularly regarding strategies that balance technological capability with organizational capacity and sustainability considerations. The integration of conservation objectives with community economic development through digital platforms represents a practical application of social-ecological systems thinking [47]. Future research directions emerge from both the study's contributions and limitations. Longitudinal impact assessments employing robust evaluation frameworks are essential to determine whether initial platform deployment translates into sustained increases in visitor awareness, tourism visitation, conservation support, and community economic benefits. Comparative studies examining platform effectiveness across varying conservation contexts, organizational capacities, and regional tourism environments would elucidate contextual factors moderating intervention success. Investigation of emerging technologies, including mobile applications, virtual reality experiences, and artificial intelligence-powered chatbots, could identify opportunities for future platform enhancement while considering implementation feasibility in resource-constrained settings. Finally, research examining optimal strategies for maintaining and evolving community-managed conservation platforms over multi-year periods would provide valuable insights regarding long-term sustainability and continuous improvement processes essential for enduring impact.

V. CONCLUSION

This study aimed to develop and implement a comprehensive website-based information system for the Mutiara Laut Masaran Turtle Conservation through participatory design methodology to enhance public awareness, visitor engagement, and sustainable conservation funding. The research successfully delivered two primary innovations addressing the identified information dissemination deficiencies: first, a fully functional WordPress-based conservation website featuring real-time activity updates, educational content, seasonal event calendars, and

multimedia documentation of conservation processes including egg relocation, incubation monitoring, and hatchling releases; second, integrated social media platforms utilizing Instagram and Facebook API connections to amplify marketing reach and stakeholder engagement. The implementation achieved measurable outcomes, including the training of 17 conservation personnel across eight weeks, encompassing website management, digital marketing, and technical maintenance competencies, the establishment of a four-member digital marketing team with demonstrated operational proficiency, and the attainment of 300+ social media followers within the initial implementation phase. These quantifiable results validate the efficacy of participatory action research approaches in facilitating technology adoption within resource-limited community conservation contexts.

The website and social media platforms collectively function as an integrated digital infrastructure supporting dual objectives of environmental education dissemination and sustainable ecotourism promotion, positioning the conservation site to generate visitor-derived revenue streams that offset operational expenditures while advancing biodiversity protection mandates. Future research should prioritize longitudinal impact assessment tracking website analytics, tourism visitation patterns, and revenue generation over multi-year periods to evaluate sustained effectiveness and identify platform evolution requirements. Additionally, comparative studies examining similar digital platform implementations across diverse conservation sites would enhance understanding of context-dependent success factors and facilitate broader applicability. Investigation of emerging technologies, including virtual reality educational modules, augmented reality species identification tools, and artificial intelligence-powered visitor inquiry systems, represents promising directions for enhancing conservation tourism engagement while maintaining accessibility principles. The replicable framework established through this research, encompassing needs assessment, collaborative tool selection, comprehensive capacity building, and sustainability planning, provides actionable guidance for conservation organizations globally seeking to leverage digital technologies for advancing conservation objectives while supporting community socioeconomic development.

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DATA AVAILABILITY

No datasets were generated or analyzed during the current study.

AUTHOR CONTRIBUTION

Fidinova Ika Putri Sang'adji conceptualized and designed the study, conducted data collection, and participated in data analysis and interpretation. Silvia Prasetyowati and Mohammed Ismath contributed to the development of the educational media, oversaw the implementation of the intervention, and contributed to manuscript writing and revisions. Sunomo Hadi assisted with data analysis and interpretation and provided critical feedback on the manuscript. Ida Chairanna Mahirawatie participated in the literature review, data collection, and manuscript editing. Anggara Trisna Nugraha, Devina Puspita Sari, Galih Anindita, Edy Setiawan, Aminatus Sa'diyah, Purwidi Asri, Ni'matut Tamimah, Ii' Munadhif, Ponti Almas Karamina, Syafiuddin, Suci Indaryani, Mukhammad Jamaludin, Muhammad Bilhaq Ashlah, Muhammad Izzul Haj, Diego Ilham Yoga Agna, Salsabila Ika Yuniza, Faris Riyadi, Fajar Rahmat Adzani, Andika Aldo Pratama, Rahman Firdiansyah, and Laili Agustin Widyaningrum assisted with data collection, intervention implementation, and manuscript preparation. All authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work, ensuring its integrity and accuracy.

DECLARATIONS

ETHICAL APPROVAL

Ethical approval is not available.

CONSENT FOR PUBLICATION PARTICIPANTS

Consent for publication was obtained from all participants.

COMPETING INTERESTS

The authors declare no competing interests.

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