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Digitalization of Tourism Management through Tourism Information Systems and E-Ticketing to Enhance Efficiency and Competitiveness

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Abstract

This research aims to design and implement an integrated Tourism Information System and E-Ticketing platform for BUMDes Tirta Arum, to evaluate the effectiveness of an integrated digital system developed for tourism destinations managed by BUMDes. This study uses a Research and Development (R&D) approach using the System Development Life Cycle (SDLC) model, combined with a before-after quantitative evaluation framework to measure changes in operational performance indicators, including transaction processing time, reporting efficiency, error rate, service capacity, and digital visibility. The results show a significant improvement in performance after the implementation of the system. The average transaction processing time decreased by 83.33%, the reporting time increased by 91.67%, and the recording error rate decreased by 95%. In addition, daily transactions recorded increased by 66.67%, reflecting an increase in service capacity. From a digital marketing perspective, the website generated 15,000 impressions within three months with an average search ranking position of 8.9, indicating strong digital visibility, although a Click-through Rate of 0.8% indicates the need for further optimization to increase user engagement. These results highlight that the digitization-enabled automation of the system increases the efficiency, transparency, and competitiveness of the system and verifies that rural tourism digitalization is a digitally oriented upgrading in strategic institutional restructuring and not only the adoption of technology.
Keywords: BUMDes, digital transformation, e-ticketing, operational efficiency, rural tourism competitiveness, tourism information system.

1. Introduction

Tourism is one of the primary economic sectors, which is a significant contributor to the national income and provides the possibility for regional development. In fact, this opportunity was supported with great force of nature and cultural wealth in Indonesia. In order to optimize rural economic development, the government has encouraged the formation of Village-Owned Enterprises (BUMDes) as institutional forms of managing village assets, including village tourism assets, for boosting village prosperity [1].

BUMDes Tirta Arum as a village based enterprise, is an example of village-owned enterprise working on tourism, managing swimming pool-tourism in Pekalongan Regency. As a community based tourism destination, it is significant to have a role in serving as recreation facility as well as for the village income in general. Nevertheless, BUMDes Tirta Arum, having strategic potential, is also struggling to overcome managerial and competitive difficulties that delay how it can better the performance.

According to an interview with the Director of BUMDes Tirta Arum, 27 January 2024, the numbers of visitors have decreased from 5,138 in 2022 to 3,563 in 2023, which is 30.65%. This drop is mainly due to very restricted marketing activities and a very low online presence. The present marketing is: word of mouth and very minimal engagement on one Instagram account. In addition, the sale of tickets and the financial statements are still done by hand with double paper tickets and ledger book written logs. This is a typical system that can introduce errors, leave the system open to

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fraud, and delay the reporting processes, thereby reducing real-time surveillance and evidence-based policy making [2].

The rapid development of information technology has brought fundamental changes to consumer behavior in the tourism sector. Currently, tourists no longer rely on conventional methods, but prefer to use digital platforms to find destination information, book tickets, and complete transactions online [3]. In the midst of increasingly fierce competition, tourism industry players are required to be able to adapt and continue to innovate through the use of digital technology to remain competitive [4]. Thus, the implementation of a tourism information system that is integrated with technology-based applications is not only an effort to improve operational efficiency, but has become a strategic step in strengthening competitiveness.

Enhancing competitive advantage in tourism businesses is essential to secure and sustain market share [5]. A strategic way to enhance competitive aptitude is through the development of web-based information systems for tourism on the internet along with the e-ticketing system [6]. The growing population of internet users and widespread use of online transactions are additional factors that support the significance of online ticket booking in travel and entertainment domains [7]. Earlier researches also demonstrate that web-based systems of tourism information make the destination information more accessible for people and more effective in promotion of the destination [8] [9], and e-ticketing enables an effective ticket management and reporting procedures [10].

Although prior studies have widely acknowledged the benefits of digital tourism management, most empirical research focuses on urban destinations or large-scale tourism enterprises. Limited attention has been given to rural tourism destinations managed by village-owned enterprises, particularly regarding the integrated implementation of tourism information systems and e-ticketing as a unified digital management strategy.

In addition, most previous studies have addressed marketing aspects and operational efficiency separately. In fact, in practice, the two aspects are interrelated. There have not been many studies that have really examined how the tourism information system with the E-Ticketing Application can be integrated in increasing the visibility of destinations, improving operational performance, and encouraging transparency of governance in tourism marketing. Therefore, there is still a clear research gap, namely the lack of empirical investigation on how integrated tourism information systems and e-ticketing platforms can function as strategic digitalization models for tourism destinations managed by BUMDes, which integrally can overcome limited marketing, operational inefficiencies, and competitive challenges.

As a background and gap research above, this study aims to design and implement an integrated Tourism Information System and E-Ticketing platform for BUMDes Tirta Arum. This research aims to provide provide empirical evidence on how digital transformation can increase digital visibility, improve operational efficiency, strengthen financial transparency, and ultimately increase the competitiveness of tourism destinations.

2. Literature Review

Digitalization of Tourism Management through Information Systems and E-Ticketing

Digitalization of the tourism sector has been addressed in various research. Several studies indicate that the adoption of online-based tourism information systems and the use of e-ticketing have the potential to enhance the accessibility of tourist destinations worldwide. Now, tourists can more practically browse for information, place orders and make payments on the Internet. This convenience affect in increasing of tourist comfort, shortening of service time and finally to tourist satisfaction. In this regard, digital technology is not simply a trend to be adopted, it has evolved into a strategic lever to boost the image of destinations and deliver a competitive advantage in an increasingly technology-driven tourism market.

Besides the efficiency of service delivery, it is important for digitalization to contribute to governance enhancement in tourism management. Electronic transactions systems bring along improved data accuracy, traceable financial records, and auditing of those records, thus enabling reduction of fraud risks and human errors that are normally related to manual systems [11]. Understood in this way, tourism information systems are not just new technologies for tourists but also governance tools for transparency, accountability, and managerial control.

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In the sphere of community-based tourism, digitalization has been conceived as a potential tool to increase management professionalism and market access. Chorna et al (2024) contends that digital technology application in locally managed tourism destinations enhances market access and local economic participation. Similarly, Osman & Yatam (2024) stress that digital tourism management brings about enhanced productivity and improved destination competitiveness. These conjoint results allude to the potential of digital transformation for sustainable tourism development in local settings.

Despite these contributions, a number of significant limitations of the existing literature continue to become apparent. First, research on the digitalization of tourism has so far mainly been concerned with urban destinations, smart tourism cities, or large tourism attractions. Overall, there is a dearth of research on rural tourism operators, in particular village-owned enterprises (BUMDes). Second, the literature generally addresses tourism information systems and e-ticketing independently, with a focus on either marketing effectiveness or operational efficiency without combining both aspects in an integrated framework of digital management. Third, much of current and/or known rigourous research is still at best conceptual in nature and offers minimal empirical insights into the process of implementation, managerial adaptation, and the tangible or impact-factoring effects of digital system adoption, in micro-scale community based destinations.

Sezer & Ilban (2024) recognize the possible positive impacts of digitalization on the rural tourism industry but argue that more situational and empirical studies are still needed. In particular, there is a lack of studies on the impact of integrated tourism information systems and e-ticketing on the digital visibility, operational efficiency, governance transparency, and competitiveness of village tourism governance systems. Therefore, there is still a lack of empirical research that has been done on the integrated use of tourism information systems and e-ticketing on BUMDes rural tourism sites and the impact of the systems on marketing, operational, financial governance, and competitiveness.

This research has theoretical as well as practical implications. In terms of theory, it contributes to the digital transformation in tourism discourse, by presenting an integrated analytical framework, connecting digital visibility, operational efficiency, governance transparency and competiveness in a single rural community based tourism (CBT) context. This study, in contrast to earlier ones which argue that digital marketing and e-ticketing are two disjointed activities, considers digitalization as an integrated strategic management option within the governance framework of a village-owned firm. On the practical side, the research offers a digitalisation model that can be implemented by rural tourism destinations run by BUMDes. The results provide practical advice for destination managers and policy makers who need to improve efficiency, transparency and competitiveness with appropriate digital solutions in the context.

3. Research Method

The research was conducted at *BUMDes Tirta Arum*, located in Sumurjomblangbogo Village, Bojong District, Pekalongan Regency. This study employs a Research and Development (R&D) approach. The R&D method is a research methodology used to develop a specific product and evaluate its effectiveness. The process begins with a needs analysis to ensure that the product addresses real problems and continues with effectiveness testing to verify that the product can be applied and function effectively in a broader community context [15]. The development process adopts the structured System Development Life Cycle (SDLC) methodology, which supports systematic and efficient project management to ensure that the final system meets business objectives [16]. The Research Flow Diagram is illustrated in Figure 1.

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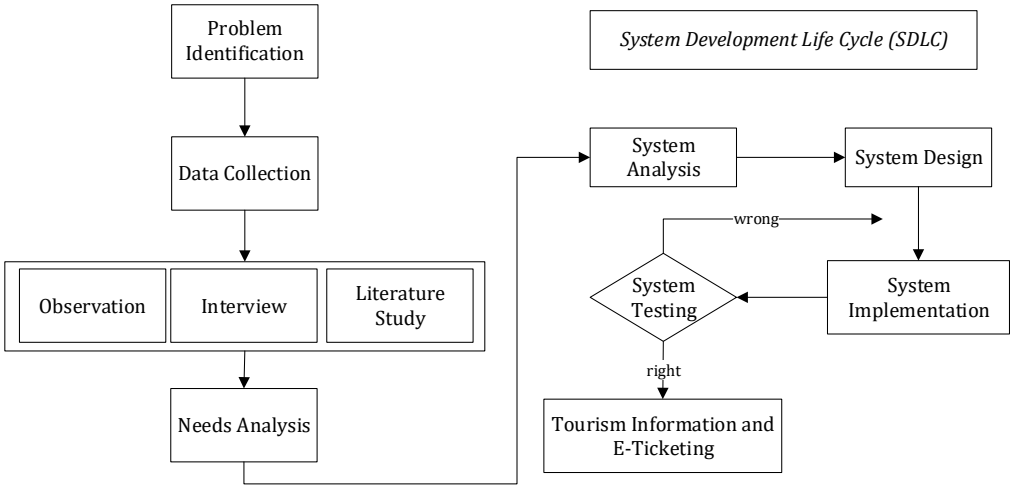

Figure 1 Research flow diagram

The research process follows a series of systematic stages to ensure that the tourism information system and e-ticketing system development meet the user and organizational requirements:

a. Problem Identification
The initial phase is problem identification, which consists in identifying, comprehending and articulating the what and the why of the problem underpins this research The fast growth in the tourism industry in the digital age provides good potential for BUMDes Tirta Arum to boost its income as well as support the local community. But there are a number of problems to be tackled, not least the decreasing numbers of visitors and the inadequacies of reporting on ticket sales.

b. Data Collection
In this phase, field observations are made at the organization to study the current business processes, as well as interviews with stakeholders are conducted. This strategy guarantees that the gathered data truly represent the real time situation and the challenges in operation of the company.

c. Requirements Analysis
The third stage is the requirements analysis - a pivotal point in system design process which determines precisely both functional and non-functional requirements.

d. System Analysis
The system analysis stage (stage 4) The research group investigates the current operational procedure of the swimming pool tourism management. The purpose of this stage is to gain insight into the old system and what the user needs, which will define the structure of the new system.

e. System Design
The first stage is system design, which converts the specified requirements to a software design before any coding is done. This can involve process design, interface design, database design and systems design.

f. System Implementation
The sixth phase is system implementation, where the previously specified data structures and processes are implemented as programming code. This step converts the theoretical system design, which is a solution model, into either a prototype or complete application.

g. System Testing
The last phase is system testing, which is to determine whether the application under development satisfies the design requirements and can accomplish what the user expect in the operational environment. Testing was performed in two phases: functionality testing and effectiveness testing. System testing validated that the entire system (ticket transactions, reporting features, and database integration) works as required. Black-box testing methodologies were used to test for correctness, consistency of data and usability of the interface.

A quantitative before–after study design was used to evaluate the effect on organization. Baseline performance (manual records) were assessed against system-based data for post-

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implementation. The tools consisted of the transaction logs, the automated financial reports, and the Google Search Console analytics. The key performance indicators were: average transaction processing time, time required to prepare a report in a day, recording error rate, daily transactions (serving capacity), search impressions, average ranking position, and click through rate (CTR).

We applied descriptive and comparative bivariate analysis to compute percentage of improvement across indicators. The system was deemed successful if it showed quantifiable improvements in processing time, error rates, service capacity, and digital visibility. This is a test framework to ensure system testing verifies not just technical functioning, but also tangible gains in efficiency, transparency, and competitiveness.

4. Results and Analysis

a. Proposed System

According to issues above, a development system designate by mapping the current operation system to the new system is proposed to reduce the possibility of gaps and serve the intended goals. For this mapping, a comparison has been made between the current system and the one proposed here. Table 1 shows the above analysis.

Table 1 Proposed system

Modul/Sub System	Current Business Process	Proposed System	Expected Outcomes
Pool Information	Marketing is currently carried out only through social media platforms such as Instagram and Facebook. As a result, information related to profiles, facilities, and other details is incomplete.	Tirta Arum Swimming Pool Website	The Tirta Arum Swimming Pool website will provide comprehensive information, increasing its attractiveness to visitors and improving online visibility through Search Engine Optimization (SEO).
Ticket Sales Transactions	Ticket sales transactions are conducted manually using paper tickets and recorded in a logbook, with daily reports sent to the manager via Excel.	E-Ticketing application (online ticket booking)	Ticket sales transactions can be processed automatically online and offline, resulting in more effective and efficient ticketing operations.
Ticket Booking	Tickets can only be booked through WhatsApp.	Online booking using E-Ticketing	Facilitates consumers in booking and paying for tickets more conveniently.
Reporting	Daily reports are sent to management in Excel format.	Real-time E-Ticketing reporting	Managers can monitor ticket sales reports and visitor numbers in real time, improving transparency and decision-making efficiency.

b. Requirements Analysis

This phase illustrates the analysis of system, where it has been analysed the components and the resources needed to build the Tourism Information System and the Tirta Arum Swimming Pool E-Ticketing application. The analysis considers functional as well as non-functional requirements to ensure the system meets the needs of its users and its operations while also contributing to the strategic goals of the organization.The detailed needs analysis can be seen in Table 2.

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Table 2 System requirements

Functional Requirements	Non-Functional Requirements
1. The system must provide comprehensive information about the swimming pool tourism site, including facilities, profiles, photo/video galleries, articles, FAQs, and other relevant information. 2. Visitors must be able to book and pay for tickets online easily and conveniently 3. The system must provide real-time ticket sales and financial reports to management	1. The system must ensure the security of user data and transactions, protecting them from unauthorized access. 2. The system must be capable of handling a high number of concurrent users without performance degradation. Ticket booking response time must be fast and efficient. 3. The application must be compatible with multiple devices (desktop, tablet, smartphone) and support various operating systems.

c. System Design

At this stage, the design of the proposed business process is carried out using a flowchart. The flow of the proposed ticket booking system process can be seen in Figure 2 below :

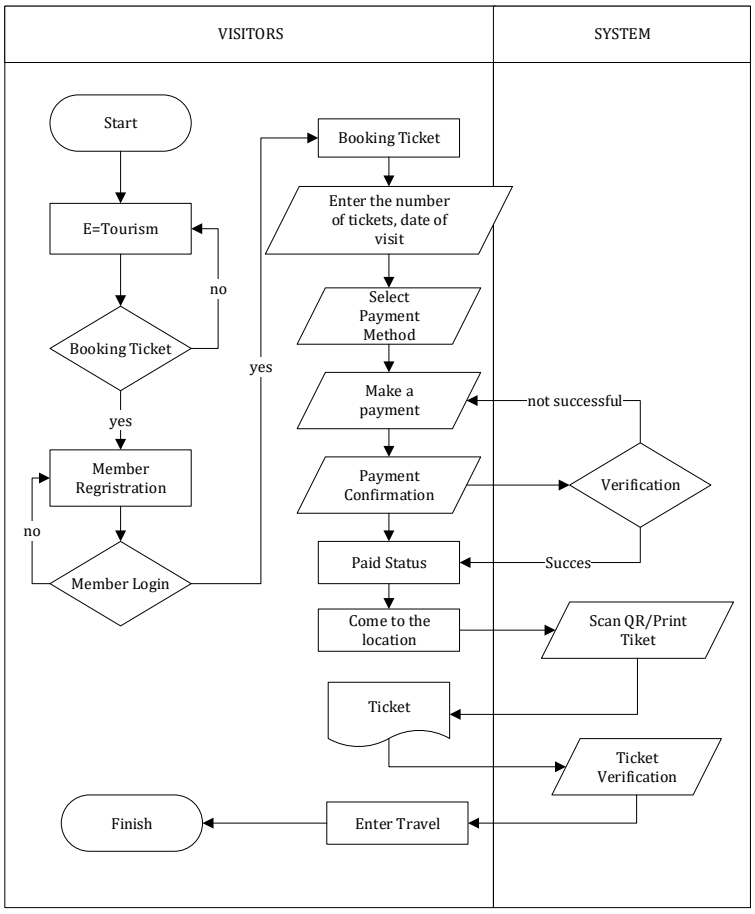

Figure 2 Flowchart e-ticketing

The system flow begins when visitors access the Swimming Pool Website, followed by the ticket ordering process which includes registering as a member, logging into the system, booking tickets, making payments, and confirming payments. The admin then verifies the payment and checks the ticket when visitors arrive at the location. The interaction between users/actors and the system is illustrated using a Use Case Diagram. This diagram is used to describe the system's functions, scope,

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and the interaction between the system and its actors. The interaction between the system and the actors (users) is shown in Figure 3 below.

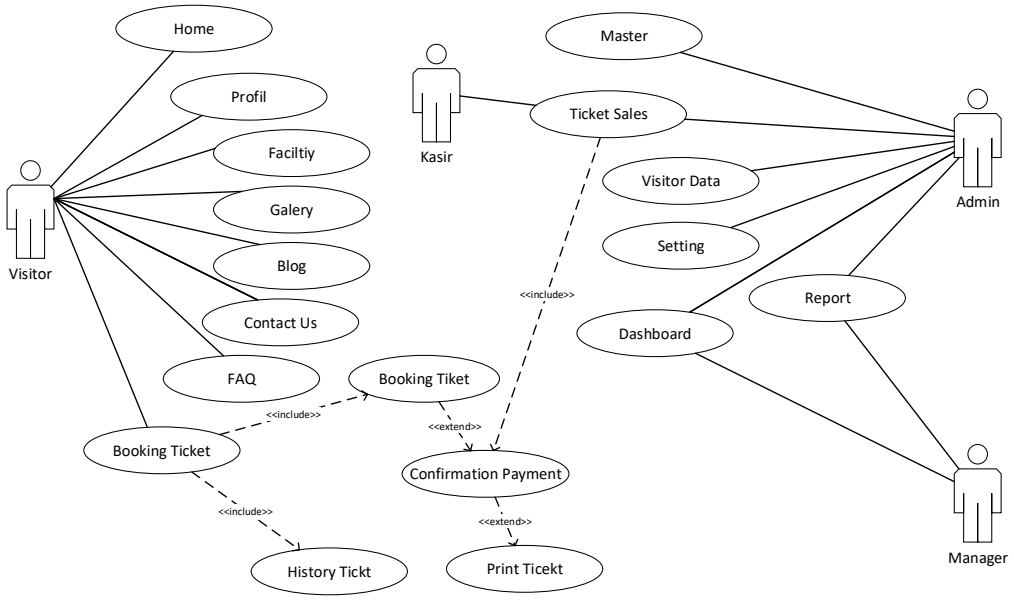

Figure 3 Use case diagram

The developed system consists of four types of users: admin, manager, cashier, and visitor. Visitors interact with the tourism information system, where they can access complete information about the swimming pool, book tickets online, confirm payments, and print tickets. The cashier can verify payments made by visitors. The admin has access to add, edit, and delete application features. The manager can monitor revenue reports and visitor statistics in real time.

d. System Development

The Tourism Information System is built using the WordPress CMS, while the E-Ticketing Application is developed using the CodeIgniter framework, PHP, and MySQL database. The interface of the Tourism Information System is shown in Figure 4, while the E-Ticketing Application is presented in Figures 5 and 6.

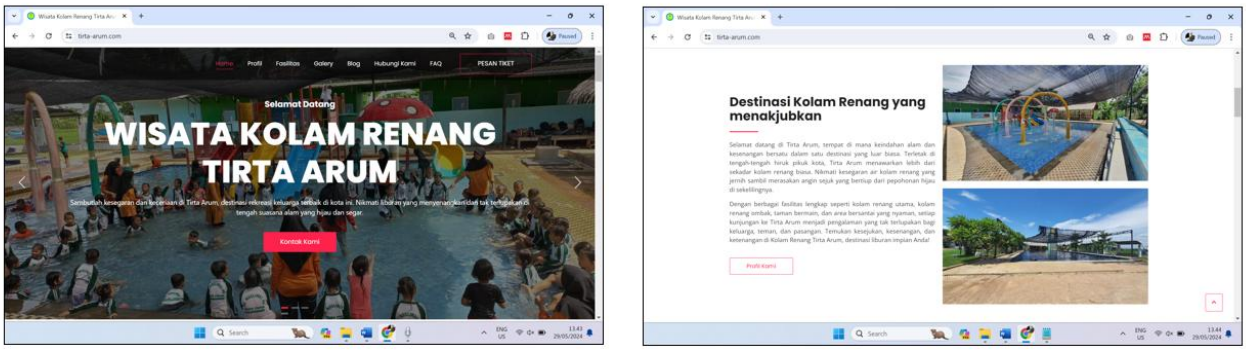

Figure 4 E-tourism website

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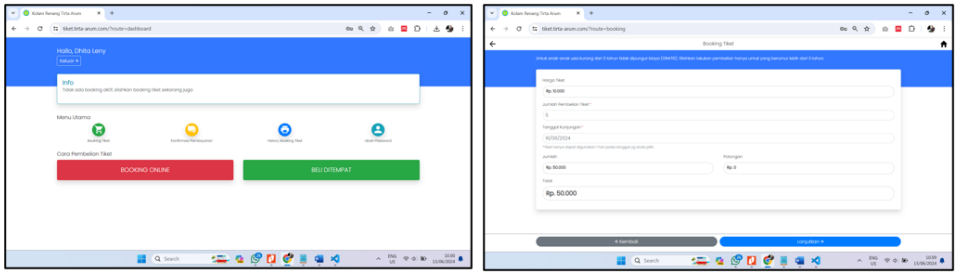

Figure 5 E-Ticketing application (consumer)

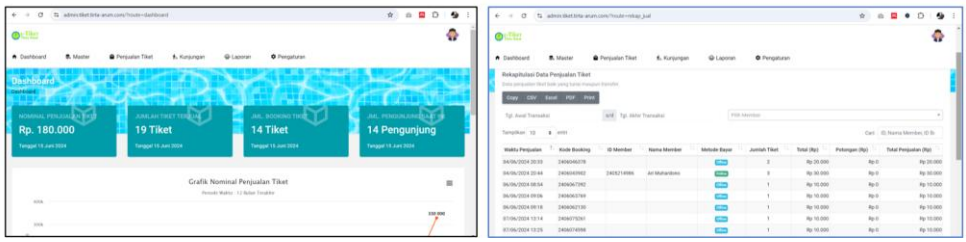

Figure 6 E-Ticketing application (admin)

e. System Testing

System testing was performed at the completion of the development of the system to verify the correctness of the application before deployment in the real environment. The objective of the test is to validate the functionality, performance and reliability of the system according to the expected specifications.The following are the results of the system testing shown in Table 3, Table 4 and Table 5:

Table 3 Results of the tourism information system testing

No.	Menu	Description	Test Results
1	Home	The main website page that contains complete information about the swimming pool	The Home page can be accessed properly via both desktop and smartphone devices
2	Profile	Displays the profile of the swimming pool tourism site	The Profile page can be accessed properly
3	Facilities	Displays the available facilities at the swimming pool	The Facilities page can be accessed properly
4	Gallery	Displays photo and video galleries of activities at the swimming pool	The Gallery page can be accessed properly
5	Blog	Contains articles, news, and information related to the swimming pool to support SEO	The Blog page can be accessed properly
6	Contact Us	Contains contact information of the swimming pool management and social media links	The Contact Us page can be accessed properly
7	FAQ	Contains a summary of frequently asked questions and answers from visitors	The FAQ page can be accessed properly
8	Ticket Booking	Provides an online ticket booking feature connected to the E-Ticketing Application	The Ticket Booking button can be accessed properly and is linked to the E-Ticketing Application

Table 4 Results of the e-ticketing system testing for visitors

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No.	Page/Menu	Test Results
1	Login/Register Member	Member registration was successfully completed and stored in the database. Subsequently, members can log in using their registered username.
2	Ticket Booking	The system runs well and users can book tickets, choose payment methods, confirm payments, check their ticket booking history, and show the Ticket QR Code that can be printed at the pool site.

Table 5 Results Of e-ticketing system testing for admin

No.	Page/Menu	Sub Menu	Test Results
1	Dashboard		The system functions properly and displays all summary reports in real-time and accurately.
2	Master		The system operates correctly; the admin can manage member data, manage bank account information, and configure ticket sales deductions.
3	Ticket Sales	On-site Ticket Sales	The system work fine The work of total sales and sales deduction and change are calculated correctly The ticket printing menu, input of visit confirmation and ticket sales list are also good..
		Online Ticket Sales	It works fine, the admin can accurately confirm a payment a member has made and see if the payment has been confirmed.
		Sales Recap	The system successfully displays sales recap data accurately for both offline and online ticket sales.
4	Kunjungan	Ticket Printing	It is a good system. Ticket printing is available in qr scan and manual booking input modes. Printer testing also work well.
		Ticket Verification	The system works fine. Admins can confirm the visitor information by qr code scanning or manual booking input (offline). Visitor data are shown correctly.
		Visitor Verification	It is working properly now. Admins have access to the data of their visitors for those whose tickets have been verified.
5	Report	Ticket Sales Report	Everything is fine with the system. The admin is able to successfully manage the ticket sales reports, to print reports and to download reports..
		Visit Report	The system is working fine. Visitors reportThe admin can manage visitor reports accurately such as printing reports and downloading detailed visit results.
6	Settings	Profile and Booking Information	The system is working fine. Settings are saved and Processed successfully
		User Level	The system operates correctly. User levels and access rights can be managed effectively.
		User Data	The system performs well. The admin can manage, add, and delete user data and set user access rights properly.
		Activity Log	The system is working fine.The users had been

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No.	Page/Menu	Sub Menu	Test Results
			logged both completely and detailed, so as to security monitor and control..

f. Effectiveness Testing

1) Tourism Information System

Evaluation of a information system's effectiveness is to determine the degree to which the system meets its objectives. When the E-Ticketing application had been implemented and technically verified, the following stage was to demonstrate that it could effectively support the high-level business goals of improving competitiveness and operational efficiency.

The result of this SEO optimization is that the webpage is easily found by the visitors on the first page of google with several keywords like “swimming pool in Pekalongan". This thought result is also great because there are a lot of swimming pool in Pekalongan, but Tirtar Arum Swimming Pool can compete and get on the first page of google search result. As a result, this success has a positive effect on the increase in website visiting on rates as shown in Figure 7.

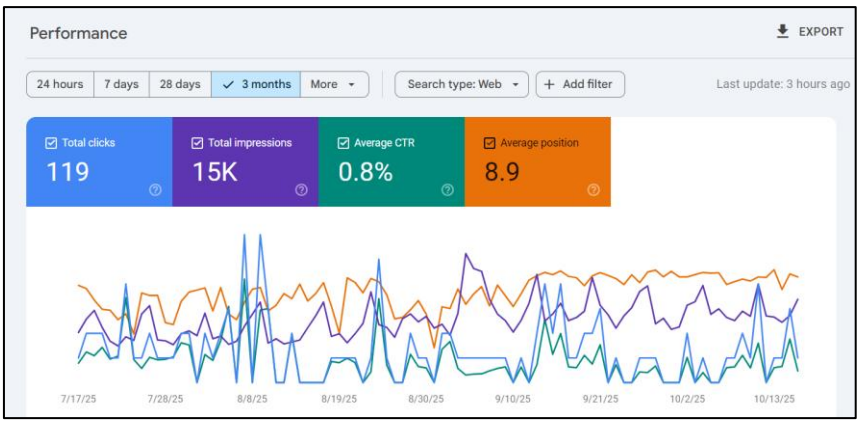

Figure 7 Website visit rate

The website performance is analysed through the last three months of data from Google Search Console. Over the time period, a total of 119 clicks and 15,000 impressions were registered on the website. Average CTR was 0.8% while Average Position for the website in Search Results was ranked 8.9. High total impressions is also an evidence that the website has really gotten well exposed in the search engines. A mean rank of less than 10 is a good indicator, since it means that most of the pages on a website tend to be on the first page of the search engine results, which is the strategic position to capture organic traffic. However, with CTR, which is still less than 1%, it is showing low-user participation to the search results. That is to say, the website is exposed a lot, but the users’ desire to click is still relatively weak.

Therefore, it can be concluded that although the website’s visibility on search engines is fairly good, the conversion rate from impressions to clicks still requires particular attention. The overall digital marketing and website branding would be positively influenced if the CTR and organic visitors are enhanced by due to holistic and evergreen SEO optimization

These findings are supported by studies Jusuf (2023) demonstrates that a good SEO strategy can massively increase the visibility and organic traffic to a website, which can lead to increased brand awareness, increased visitors, and potential for increased sales conversion and research by Sechele (2024) this study offers empirical support for the inclusion of SEO as a critical element of digital marketing strategy, and provides a meaningful framework for understanding best practices and determinants of SEO success.

2) E-Ticketing Application

With the E-Ticketing application, the management of the BUMDes has now become more effective and efficient, transparent(Figure 8). Through this system administrators can follow on line

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sale of tickets by laptops or smart phone to be sure that every transaction is documented and traceable. Going digital in ticketing has a two-fold benefit: manual errors and fraud potential are reduced, while the service at the entrance gates is sped up leading to a better visitor experience [19] .

In addition, the app also helps to generate instant reports on number of visitors, peak visiting hours and revenue, which could be considered as vital inputs for strategic decision making. Based on real data insights, management can track visitor behavior and tailor operations accordingly, such as personnel schedules, promotional activities, or ticket pricing strategies [20].

In general, the use of a E-Ticketing system contributes to protecting the environment as it reduces the use of paper- based tickets. Also, the study is consistent with the future-oriented digitalization goals of rural tourism management through the use of information technology for rural in community-based commerce [21]. In summary, application of E-Ticketing has a significant impact on both enhancing effectiveness in BUMDes management and its journe professionalization to maturity stage [22].

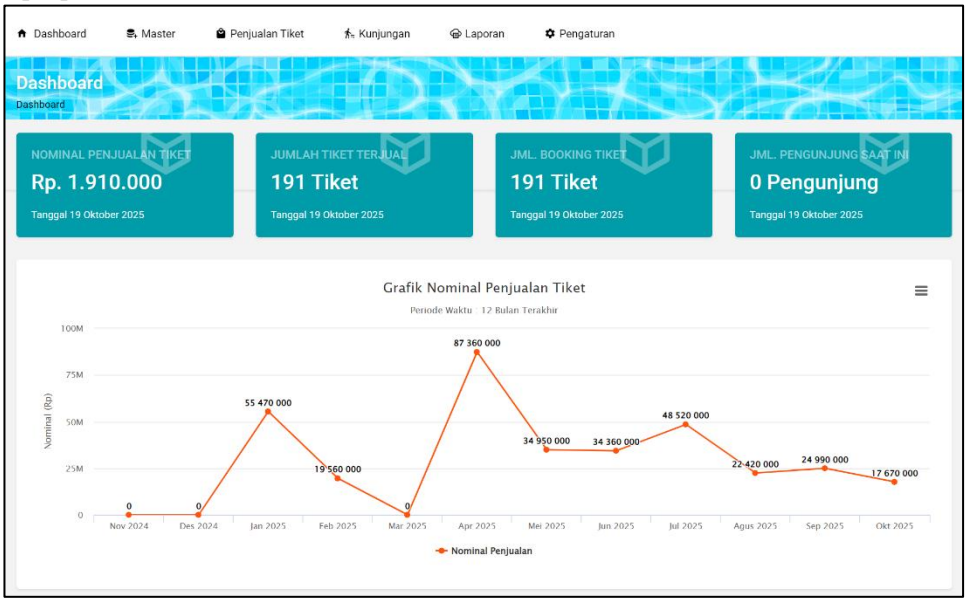

Figure 8 Ticket sales dashboard

3) Quantitative Evaluation of System Effectiveness

A comparative quantitative study was conducted to have an objective assessment on the effectiveness of the user friendly Toursim Information System and E-Ticketing system. This study presents performance measures in operation prior to and after the introduction of the system. The selected indicators represent a subset of the most relevant issues about efficiency, quality of reports, correctness of the raw data, and the productivity of services. This evaluation using a before–after comparison design is to demonstrate the quantifiable impact of the instrument on the performance of an organisation—i.e., a tourism site operated by BUMDes. Table 6 provides the different results of these performance measures including the mean elapsed transaction processing time, reporting efficiency, percentage error, and the number of daily recorded transactions.

Table 6 Comparative analysis of system performance before and after implementation

No.	Indicator	Before System	After System	Efficiency Level
1	Average transaction time (minutes)	3	0.5	83.33%
2	Report preparation time (minutes)	60	5	91.67%
3.	Recording error rate (%)	10%	0.5%	95.00%
4.	Average daily recorded transactions	50	150	66.67%

The result of the comparison to were the operations as such before and after the application of the TIS and the E-Ticketing system is shown in Table 6, indicating maximum improvements. Service

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efficiency: The average transaction time of the service efficiency was reduced from 3 minutes in the manual mode to 0.5 minutes in the digital mode. This is a 1/6 reduction i.e. 83.33% efficiency improvement. Since the processing time for transactions has been speeded up, the response of the services are improved and the waiting time of customers is minimized even when visitor numbers reach a peak.

A stronger improvement is seen in the reporting. Preparation time was reduced from 1 hour for the daily reports to only 5 minutes, an increase in efficiency of 91.67%. This shift implies that automated reporting systems dramatically reduce administrative burden, while providing faster managerial access to operational information. The capacity to produce near real-time reports enhances the responsiveness of decision-making and contributes to strengthening the internal control systems. From the managerial perspective, recording errors decreased from 10% in manual system to 0.5% after the adoption of digitalization, which corresponds to a 95% reduction in errors]. This significant reduction reaffirms that system automation is the key to minimize human error, the improvement of data accuracy and the enhancement of financial transparency. Because of improved reliability of transaction records, a stronger community–based tourism management accountability is possible.

Moreover, the daily average transaction recorded increased from 50 to 150 transactions. This corresponds to a 66.67% growth in the transaction volume, indicating better service ability and throughput of the operation. The dramatic upward trend suggests that the digital system increases efficiency for an individual organization and also potentially raises the total output of an organization. On the whole, the quantitative results support that the combined Tourism Information System and E-Ticketing system enables multi-facet performance improvements, such as increased efficiency, higher accuracy, faster reporting, and better service capacity. These results provide empirical support that digital transformation in rural community-based tourism (CBT) enterprises enhances both operational performance and institutional governance.

5. Conclusion

This research results have shown that the integration between Tourism Information System and E-Ticketing system to manage a rural tourism destination in a BUMDes can increase efficiency and good governance, and can empower digitally. The quantitative results show a positive impact on the performance metrics due to system implementation. Transaction processing time was reduced (from 3 min to 0.5 min), report production time was shortened (from 60 min to 5 min), and record error rates were greatly reduced (from 10% to 0.5%).

These findings demonstrate that digital integration measurably enhances speed of administration, data quality, and business productivity. In the eyes of s digital visibility, it took time to get 15000 impressions in three months through SEO with the average position being 8.9 which means the website successfully got a strategic first page position. Yet the CTC of 0.8 % indicates that some optimization is needed in the page to increase the user engagement and the conversion rate. In summary, the research concludes that structured digital integration modernize operational processes and institutional governance and competitive positioning within the community-based tourism enterprises. As for the results, it was confirmed that digital transformation in rural tourism management, from a systemic approach based on the organization workflows, could be implemented as a strategic tool to enhance organizational efficiency, stewardship and competitiveness.

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