

Design and Build a Website-Based Waste Alms Management Information System Using the Laravel Framework (Case Study of KSM Jameela Brang Biji Sumbawa)

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ABSTRAK

Pengelolaan sampah menjadi masalah krusial di berbagai daerah, termasuk Sumbawa. KSM Jameela Brang Biji berinisiatif mengelola sampah melalui program sedekah sampah. Namun, proses pencatatan, pengelolaan data donatur, dan pelaporan masih dilakukan secara manual, sehingga rentan terhadap kesalahan, kurang transparan, dan tidak efisien. Oleh karena itu, penelitian ini bertujuan merancang dan membangun Sistem Informasi Pengelolaan Sedekah Sampah berbasis website menggunakan framework Laravel guna memfasilitasi operasional KSM Jameela. Pengembangan perangkat lunak menerapkan metode Agile Scrum yang memungkinkan iterasi dan adaptasi cepat terhadap kebutuhan pengguna. Sistem ini dibangun dengan bahasa pemrograman PHP dan basis data MySQL. Pengujian kualitas perangkat lunak dilakukan menggunakan metode Black Box untuk memastikan seluruh fungsionalitas fitur berjalan sesuai spesifikasi, serta White Box untuk mengevaluasi struktur logika internal kode. Hasil penelitian menunjukkan bahwa sistem yang dikembangkan berhasil mendigitalisasi proses pengelolaan sedekah sampah, mulai dari registrasi donatur, pencatatan transaksi sampah, hingga pembuatan laporan secara real-time. Kesimpulannya, implementasi sistem ini terbukti meningkatkan efisiensi operasional, akurasi data, dan transparansi pengurus, sehingga dapat mendukung KSM Jameela dalam mengoptimalkan program sedekah sampah serta mendorong partisipasi masyarakat yang lebih luas.

ABSTRACT

Waste management remains a crucial issue in various regions, including Sumbawa. KSM Jameela Brang Biji took the initiative to manage waste through a garbage alms program. However, the processes of recording, managing donor data, and reporting are still conducted manually, making them prone to errors, lacking transparency, and highly inefficient. Therefore, this research aims to design and build a website-based Garbage Alms Management Information System using the Laravel framework to facilitate KSM Jameela's operations. The software development applies the Agile Scrum method, which allows for quick iterations and adaptation to user needs. This system was built using the PHP programming language and a MySQL database. Software quality testing was conducted using the Black Box method to ensure all feature functionalities operate according to specifications, and the White Box method to evaluate the internal logical structure of the code. The research results indicate that the developed system successfully digitalizes the garbage alms management process, ranging from donor registration and waste transaction recording to real-time report generation. In conclusion, the implementation of this system is proven to significantly improve operational efficiency, data accuracy, and management transparency, thereby supporting KSM Jameela in optimizing the garbage alms program and encouraging broader community participation.



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1. INTRODUCTION

Waste management problems are still a major challenge in various regions in Indonesia. Based on the 2024 report of the Ministry of Environment and Forestry, the total national waste stockpile reached 31.9 tons with 35.7% of which has not been properly managed [1]. According to data from the Sumbawa Central Statistics Agency, the volume of waste in the Sumbawa area increases by around 10% every year. The gap between the volume of waste and its management capabilities occurs mainly at the household and local community level where waste management infrastructure tends to be limited and has not been digitized.

Responding to this situation, the Jameela Non-Governmental Group (KSM) in Brang Biji Village, Sumbawa Regency initiated a waste alms program, which is an activity of residents donating waste that has been sorted to be managed and the results are redistributed in the form of community social programs [2]. KSM as a community-based social institution has a strategic role in empowering the community through waste management [3]. However, in its implementation, there are several basic obstacles: the recording process that is still carried out manually is vulnerable to data errors and document loss; there is no system for reporting alms results that can be accessed directly by residents, thus affecting transparency and participation; as well as the coordination of garbage pick-up which is still carried out through WhatsApp and is less efficient on a community scale.

Several previous studies have developed waste bank information systems. Susilawati et al. developed a website-based waste bank application using the waterfall method that successfully overcame the difficulty of recording customer data [4]. Afuan and Umayah built a waste bank information system in Paguyangan Village and proved that the use of information systems in community activities can improve operational efficiency, data orderliness, and reporting accountability [5]. Ramdhani et al succeeded in developing a waste bank information system that can be accessed through websites and mobile using the prototype method [6]. Hidayat et al developed a web-based customer savings service information system application with an object-oriented approach and obtained 100% valid test results [7]. Fitri et al. built an operational dashboard on the waste bank information system using the extreme programming method for target monitoring and monthly reporting [8]. Firnando et al. designed a web-based waste information and reporting application that offers comprehensive solutions in sustainable waste management [9].

Unlike the previous research that focused on the waste bank model with a customer savings system, this study focuses on the management of waste alms instead of savings. The system is designed for social-based communities and carries the principles of transparency and citizen participation with integrated assistance reporting and management features. Community-based digitalization allows for a more structured and sustainable management of social resources [10]. In particular, the need for a system that can support efficient recording, reporting, and data

management in KSM Jameela has been identified in previous studies [11]. Therefore, this research aims to design and build a website-based waste alms management information system using the Laravel framework which is expected to be a digital solution for KSM Jameela and make a real contribution to participatory, transparent, and sustainable waste alms management. The novelty of this research lies in the development of a web-based information system that specifically integrates waste alms management rooted in socio-religious values, the conversion of the economic value of waste into social programs, and a mechanism for citizen participation and transparency within a single digital platform built using the Laravel framework with the Agile Scrum method—an approach that has not been found in previous studies in the domain of community-based waste management information systems.

2. METHOD

2.1. Data Collection Methods

This study uses a qualitative research method, which is an approach oriented to the condition of the object being studied to understand social phenomena from the perspective of the individuals involved [12]. Data collection techniques include literature studies, observations, and interviews as recommended for scientific research on a qualitative approach [13].

The literature study was carried out by collecting references from journals, books, and articles that are in line with the research objectives related to the design of the waste alms management information system, community information system technology, and the Agile Scrum method. Observation was carried out by surveying the location and directly monitoring the field conditions of KSM Jameela's operational activities. Based on observations, data was found: residents who participated in the waste alms program were around 225 houses spread across the RW 04, RW 05, and RW 06 areas of Brang Biji Village, Sumbawa; the schedule for picking up organic waste on Mondays, Wednesdays, and Fridays while inorganic waste on Saturdays; However, there has been no data collection for incoming waste per day.

The interview was conducted with the Chairman of KSM Jameela, Mr. Ruli. The results of the interviews showed that the response of residents to waste alms activities was very good. KSM provides two containers for sorting organic and inorganic waste. Organic waste is processed into compost fertilizer and part for maggot cultivation, while inorganic waste is sold to waste collectors and its economic value is distributed to residents in need. KSM does not yet have individual citizen data collection and pick-ups are still reported via WhatsApp. KSM expressed its interest in having a website with features of managing citizen data, input of garbage alms, pick-up reporting, and assistance programs.

2.2. System Development Methods

The software development method used is Agile Scrum

from the System Development Life Cycle (SDLC). Several studies have proven the effectiveness of the Scrum method in the development of website-based systems, including the development of e-learning [15], sales information systems [16], and employee training management [17]. This method was chosen because it emphasizes a gradual, iterative, and flexible process of changing user needs, especially in the context of dynamic communities such as KSM Jameela [14].

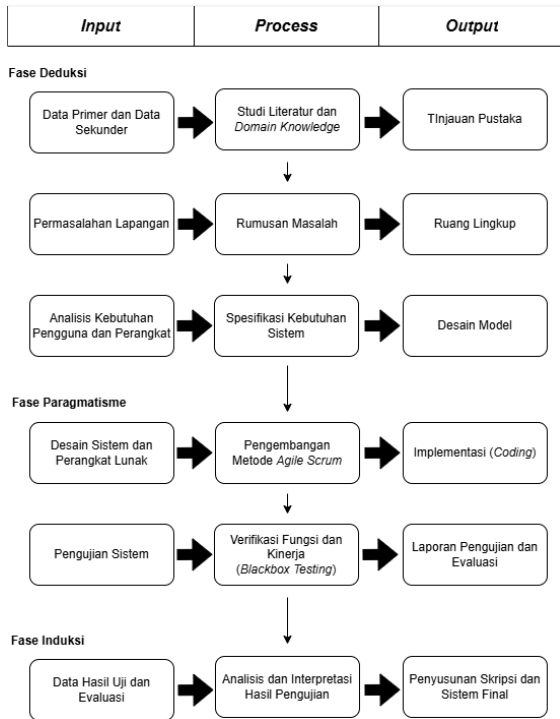


Fig. 1. Research flowchart

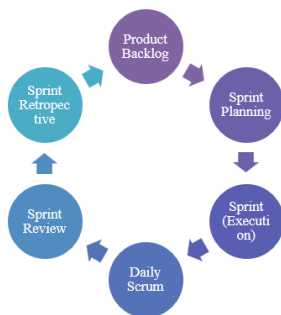


Fig. 2. System development method flow using Agile Scrum

The development stages in this study include six processes. First, Product Backlog: determines the specifications of the system based on a dataset from interviews, observations, and literature studies, compiled into a list of key features. Second, Sprint Planning: determining feature development priorities with a one-week time span for each sprint. Third, Sprint Execution: development is carried out based on sprint backlog with the principle of incremental delivery using the Laravel framework and MariaDB database. Fourth, Daily Scrum: a regular meeting between researchers and KSM Jameela resource persons both in person and via WhatsApp. Fifth, Sprint Review: presentation of the work results to KSM to

get feedback; If there are revisions, the item goes to the next sprint backlog. Sixth, Sprint Retrospective: evaluate the work process during the sprint to identify areas that need improvement in the next iteration.

2.3. System Planning

The system design uses the Unified Modeling Language (UML) which is a visual modeling standard to document, design, and communicate system design in a structured manner [18]. UML is widely used in the software industry because it is able to comprehensively describe the structure and behavior of systems [19]. The diagrams used include: (1) use case diagrams that provide an overview of the relationship between actors and systems from the user's point of view; (2) an activity diagram that describes the workflow of the activities carried out by the system; (3) a sequence diagram that describes the sequence of processing time and interaction between objects; and (4) a class diagram that visually represents the structure of the system's database.

2.4. Technologies Used

The system was built using Laravel 11 as a PHP framework based on the MVC (Model View Controller) architecture which excels in web service performance compared to other frameworks [23] and has a more organized structure [24]. MariaDB is used as a MySQL-compatible relational database management system [20], which is the most widely used open source database system due to its ability to support multi-threaded and multi-user [21]. Database management is supported by PHPMyAdmin [22]. Visual Studio Code is used as an Integrated Development Environment (IDE) that supports development productivity significantly [25].

2.5. System Testing

System testing uses the blackbox testing method, which is a method of testing software functionality in terms of requirements specifications without testing the design and program code [26]. Blackbox testing focuses on the specification of needs from the end-user's point of view without the need to analyze the internal code [27]. The test was carried out by Ahmad Jumadil S.Psi as the Manager and representative of KSM Jameela to verify the function and performance of the system in 15 test scenarios which included 7 admin scenarios and 8 citizen scenarios.

3. RESULT AND DISCUSSION

Result

3.1. Planning Result

The results of the system design produced a use case diagram that describes the interaction between two actors, namely admins and residents with the system.

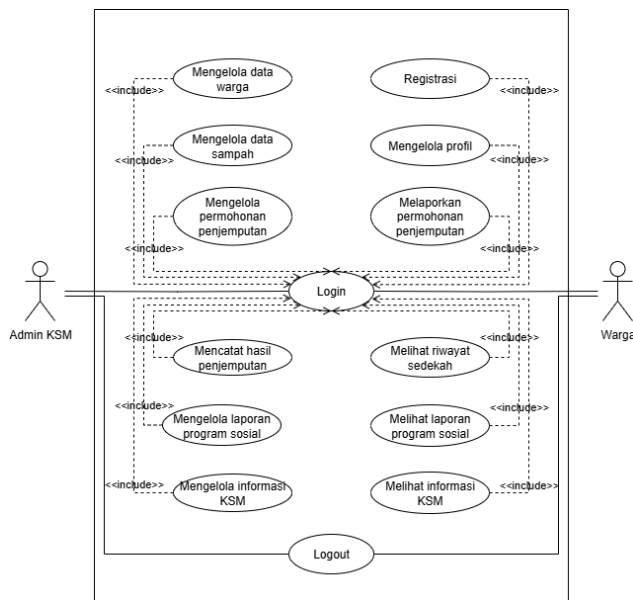


Fig. 3. Use case diagram of waste alms management information system

The admin has a logout login function, manages citizen data with the new citizen registration verification feature to see details and delete data, manages waste types with the add edit and delete feature, manages pick-up scheduling with the pending schedule and set schedule feature, manages waste transactions with the garbage amount input feature and calculates economic value conversion, and manages social programs with the plan and create program features. Residents have the function of registering, logging in, applying for a pick-up with the select date and writing a description feature, view pick-up history, view contributions with statistics per period and points, view notifications of submission progress, and edit profiles.

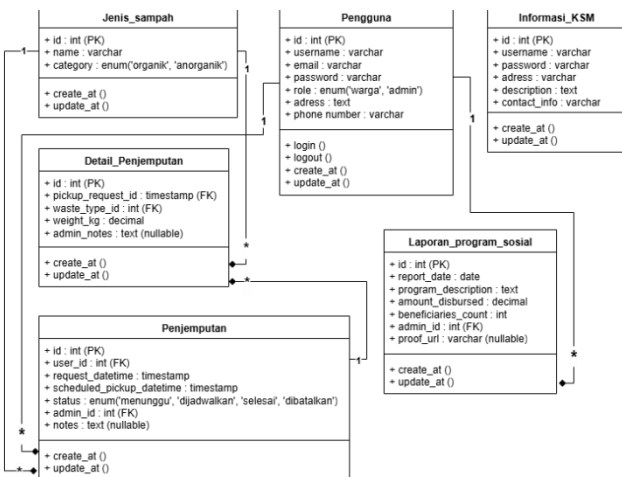


Fig. 4. System database structure diagram class

The class diagram shows the database structure with relationships between tables including users tables to store user data with id, name, email, password, role, and timestamps attributes, citizen (user) tables for citizen data with ID user_id NIK attributes, rt rw addresses, rw, no_telp status_verifikasi and timestamps, jenis_sampah table for garbage categories with nama_jenis harga_per_kg unit id attributes and timestamps, Pick-up tables for pick-up requests with ID attributes warga_id tanggal_pengajuan tanggal_penjemputan status records and timestamps, transaction tables for recording alms results with penjemputan_id jenis_sampah_id weight ID attributes nilai_ekonomi points and timestamps, and program_sosial

tables for social activities with ID attributes nama_program cost descriptions tanggal_pelaksanaan documentation and timestamps.

3.2. System Implementation

The implementation of the system produces a website-based application with an interface that is divided into two main parts, namely for admins and citizens.

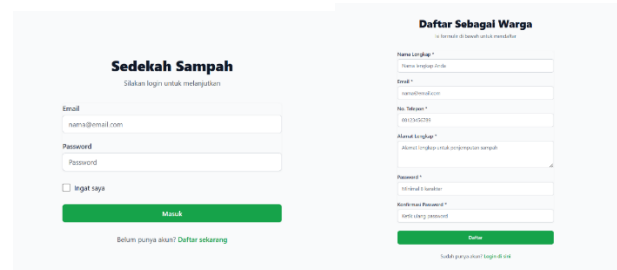


Fig. 5. Implementation of login & register page interface

The login and register page is the initial view of the system before entering the dashboard. Residents who do not have an account are required to register first and then can log in to their respective accounts.

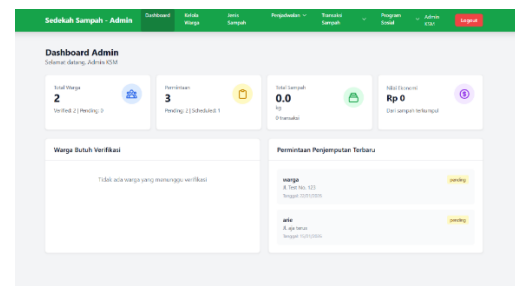


Fig. 6. Implementation of admin dashboard interface

The admin dashboard is the main control center for monitoring the system in a concise and real-time manner. There are four statistical summary cards that contain total citizens, demand, total waste, and economic value. Below it are two main panels, namely residents who need verification and the latest pick-up requests.

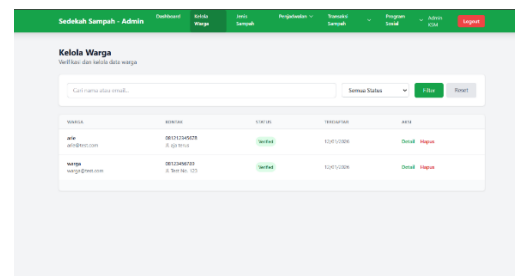


Fig. 7. Implementation of the citizen management menu interface

The manage residents menu allows admins to view details of citizen data, delete data, and find out the number of people who participated.

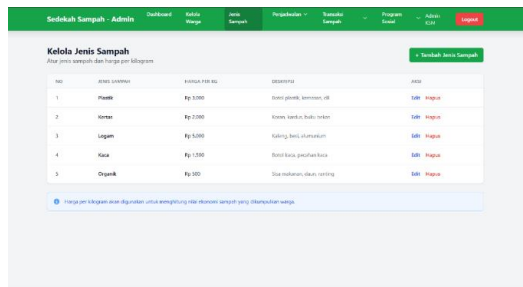


Fig. 8. Implementation of the trash type menu interface

The waste type menu is used to calculate the price per kilogram of garbage alms collected with the add-edit and delete feature.

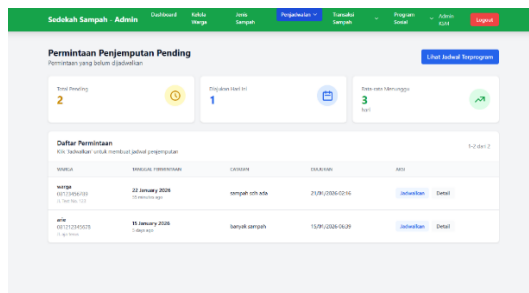


Fig. 9. Implementation of the schudeling menu interface

The scheduling menu allows admins to view all pick-up requests to create a pick-up schedule whose notifications will be sent to the respective citizen's account.

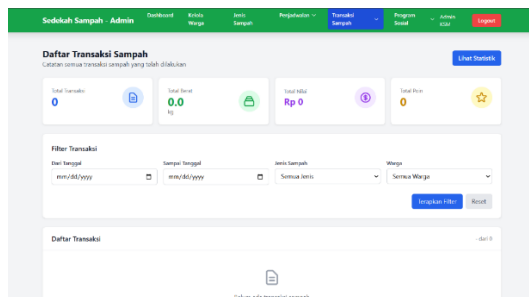


Fig. 10. Implementation of the waste transaction menu interface

The waste transaction menu converts waste alms to economic value by displaying statistics on total transactions, total weight, total value, and total points.

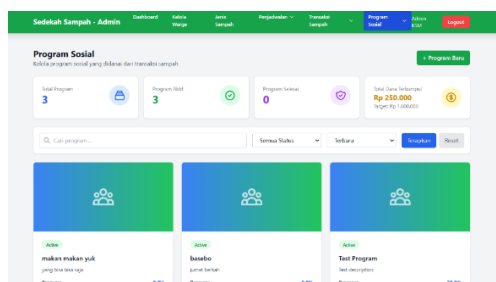


Fig. 11. Implementation of the social program menu interface

The social program menu allows admins to create social programs from the results of waste alms transactions by

determining the expenses needed for each program.

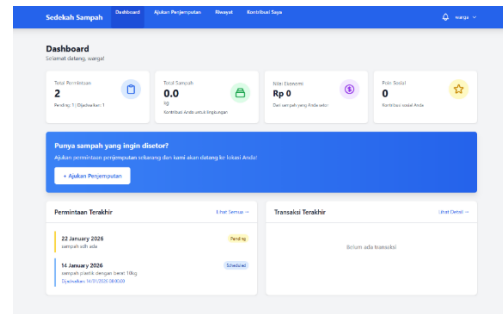


Fig. 12. Implementation of the citizen dashboard interface

The residents' dashboard is the main homepage to see personal information related to the waste alms that have been carried out.

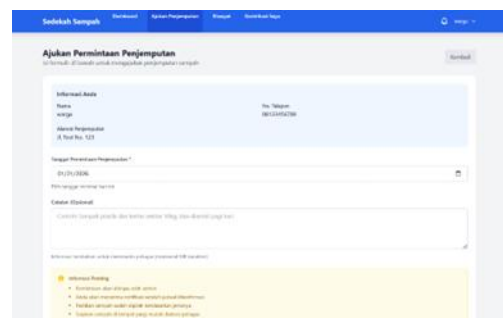


Fig. 13. Implementation of the pick-up request menu interface

The request pick-up menu displays residents' personal information in the form of names, addresses, and phone numbers as well as submission forms based on days, dates, and records.

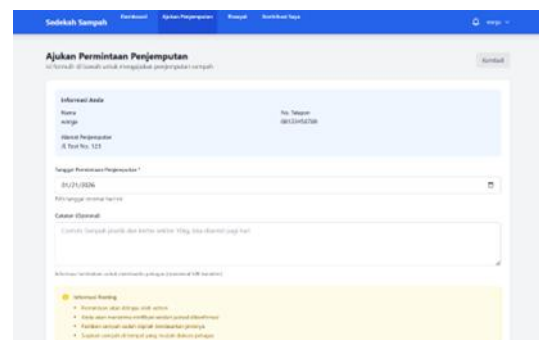


Fig. 14. Implementation of the history menu interface

The history menu shows all the submissions that have been made with five pick-up status stat cards.

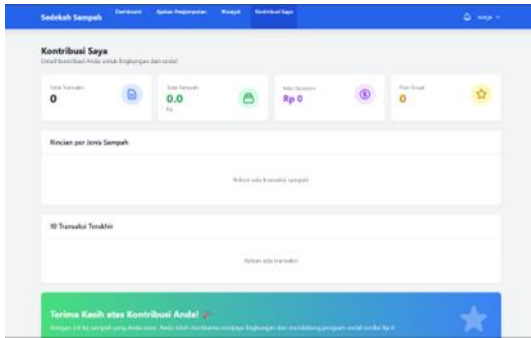


Fig. 15. Implementation of the contribution menu interface

My contribution menu displays four stat cards in the form of total transactions, total waste, economic value, and social points as well as a statistics panel of waste deposits per type.

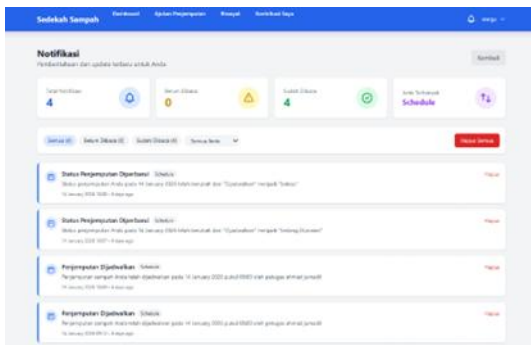


Fig. 16. Notificaion menu interface implementation

The notification menu allows residents to view notifications and notification history from admins related to pick-up requests.

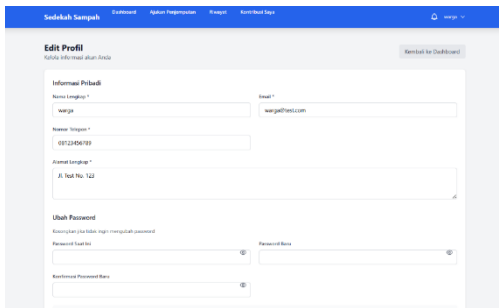


Fig. 17. Profile edit menu interface implementation

The edit profile menu gives citizens full access to edit and change personal data information in the system.

Table 1. System test result

Actors	Testing Scenarios	Results
Admin	Sign in with the correct credentials	Successful
	Manage citizen data	Successful
	Manage waste types	Successful
	Manage pickup scheduling	Successful
	Manage waste transactions	Successful
	Manage social programs	Successful

Residents	Login with the wrong credentials	Successful
	Register a new account	Successful
	Sign in with the correct credentials	Successful
	Apply for garbage pick-up	Successful
	View pickup history	Successful
	See the contribution of waste alms	Successful
	View pickup notifications	Successful
	Edit a user profile	Successful
Login with the wrong credentials		Successful

The results of the blackbox testing show that all scenarios are 100% successful according to the specifications of system requirements. The test includes 15 scenarios divided into 7 scenarios for admins and 8 scenarios for citizens. All features work well and are in accordance with user expectations from KSM Jameela.

Discussion

The waste alms management information system provided concrete solutions to the problems faced by KSM Jameela. Compared to the research of Susilawati et al. [4] which uses the waterfall method and focuses on reducing the number of data recording of waste bank customers, this system emphasizes more on community transparency and social programs. In contrast, the research of Ramdhani et al [6] who developed a website-based and mobile waste bank system using the prototype method, and the research of Hidayat et al [7] who used the waterfall method with an object-oriented approach. This research focuses on the management of social community-based waste alms which is not a conventional customer savings model.

The application of the Agile Scrum method provides an advantage of flexibility over the linear and sequential waterfall methods [29, 30]. With a one-week sprint, feedback from KSM can be implemented immediately, which is in line with the characteristics of a dynamic community. This is in line with the research results of Handayani et al. [14], Tumini & Fitria [15], and Noveandini et al. [16] which prove the superiority of Agile Scrum in accommodating iterative changes in user needs.

More specifically, the Sprint Review sessions conducted with KSM Jameela produced concrete feedback that directly shaped the evolution of several key features across sprints. During the first Sprint Review, the KSM team noted that the initial pick-up request form only contained a date field, which made it difficult for field officers to prepare for collection in advance. In response, the subsequent sprint introduced an optional notes field allowing residents to describe the type and estimated volume of waste to be collected, as reflected in the implementation of the Pick-Up Request Menu (Fig. 13). In the second Sprint Review, KSM representatives requested that the economic value conversion of waste contributions be made visible on the resident’s dashboard, not only on the admin side, so that residents could independently monitor their own contributions and feel a greater sense of ownership over the program. This feedback was accommodated through the development of the My Contribution Menu (Fig. 15), which displays personal statistics including total transactions, total waste weight, economic value, and social

points. These iterative refinements demonstrate that the Agile Scrum approach effectively aligned system development with the real and evolving needs of a community-based organization, producing a more contextually relevant and user-centered final product.

Specific feedback obtained during Sprint Review sessions further demonstrates the iterative value of Agile Scrum in this project. During the first Sprint Review, KSM Jameela noted that the initial pick-up request feature only included a date field with no description of waste contents, making it difficult for field officers to prepare for collection. Based on this feedback, a free-text optional notes field was added in the subsequent sprint, allowing residents to describe the type and estimated volume of waste to be collected—as reflected in the final implementation of the Pick-up Request Menu (Fig. 13). In the second Sprint Review, KSM also requested that the economic value conversion results be visible on the resident's dashboard, not only on the admin side, so that residents could independently monitor their own contributions. This was addressed through the development of the My Contribution Menu (Fig. 15), which displays personal statistics including total transactions, total waste weight, economic value, and social points. These iterative improvements confirm that the Agile Scrum approach effectively accommodated the evolving and context-specific needs of a community-based organization throughout the development cycle.

The implementation of the Laravel framework has proven to be effective due to its performance advantages over other frameworks [23, 24]. Combination with MariaDB as a database [20, 21] results in a stable and efficient system. The automatic notification feature and digital pick-up scheduling system overcome the coordination constraints previously carried out through WhatsApp, providing a real advantage over website-based information systems for different contexts such as school libraries [32] and inventory systems [31]. The feature of converting the economic value of waste into a social program is an innovation that distinguishes this system from conventional waste banks.

The test results showed a 100% success rate in all tested scenarios, in line with the results of Hidayat et al's research which also obtained 100% validation [7]. This system has advantages in terms of transparency through the reporting feature of social programs that are accessible to the public and the social point feature that motivates citizen participation in a sustainable manner. In the future, the application of database replication techniques can be considered to improve the availability and scalability of the system as the number of users grows [33].

4. CONCLUSION

This research successfully designed and built a website-based waste alms management information system using the Laravel framework for the Jameela Non-Governmental Group in Brang Biji Village, Sumbawa. The system was developed using the Agile Scrum method with a duration of one week and was designed using UML which includes use case diagrams, activity diagrams, sequence diagrams, and class diagrams. The technologies used are Laravel 11,

MariaDB, and Visual Studio Code.

The results of the study show that the system has succeeded in meeting all functional needs with two user roles, namely admin and citizen. Blackbox testing by KSM Jameela representatives showed 15 functional scenarios that were 100% successful according to the specifications of the needs. The system makes a tangible contribution to: (1) improving operational efficiency through the digitization of pick-up and pick-up scheduling; (2) increasing information transparency through reporting features that can be accessed by citizens; and (3) increase community participation through easy access, automatic notifications, and social point features.

For further development, it is recommended: development of the system to a mobile version to improve citizen accessibility; the addition of a more interactive gamification system for community performance management; development of reward and testimonial features to strengthen engagement; and the implementation of database replication to improve system scalability as users grow.

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