

# *Development of a Mobile-Based Ruminant Livestock Monitoring System at Sarwa Adem Mulya Multi-Party Cooperative*

Pengembangan Sistem Monitoring Ternak Ruminansia Berbasis Mobile pada Koperasi Multi Pihak Sarwa Adem Mulya

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**Abstract** - The Sarwa Adem Mulya Multi-Party Cooperative, located in Dusun Petung Wulung, Toyomarto Village, Singosari District, Malang Regency, oversees more than 80 ruminant livestock farmers with 13 key livestock management activities. Until now, record-keeping has been conducted semi-manually using Google Forms, which presents several challenges: slow processing, low accuracy, and limited accessibility for farmers with low digital literacy. This community service program aims to develop a mobile application based on a Progressive Web App (PWA) that facilitates real-time livestock recording, integrates with the cooperative's dashboard, and can be used offline. The implementation methodology includes socialization, training, technology deployment, mentoring, and evaluation. As a result, over 70% of cooperative members participated in the training, and 57 farmers actively used the application, recording more than 1,200 activity entries within the first three months. Evaluation indicates a 25% improvement in data recording accuracy, a significant reduction in data duplication, and the availability of an analytical dashboard for the cooperative. This program supports SDG (Sustainable Development Goals) 2 (Zero Hunger), SDG 3 (Good Health and Well-Being), SDG 8 (Decent Work and Economic Growth), as well as SDG 13 and 15 (Climate Action and Life on Land).

**Keywords:** Livestock, Monitoring, Mobile Application, Cooperative, Community Service

**Abstrak** – Koperasi Multi Pihak Sarwa Adem Mulya, yang berlokasi di Dusun Petung Wulung, Desa Toyomarto, Kecamatan Singosari, Kabupaten Malang, menaungi lebih dari 80 peternak ruminansia dengan 13 kegiatan utama dalam manajemen ternak. Hingga saat ini, pencatatan masih dilakukan secara semi-manual menggunakan *Google Form*, yang menimbulkan beberapa kendala yaitu pemrosesan yang lambat, akurasi rendah, serta keterbatasan akses bagi peternak dengan literasi digital rendah. Program pengabdian masyarakat ini bertujuan untuk mengembangkan aplikasi *mobile* berbasis *Progressive Web App* (PWA) yang memfasilitasi pencatatan ternak secara *real-time*, terintegrasi dengan *dashboard* koperasi, dan dapat digunakan secara *offline*. Metodologi pelaksanaan mencakup sosialisasi, pelatihan, penerapan teknologi, pendampingan, dan evaluasi. Hasilnya, lebih dari 70% anggota koperasi berpartisipasi dalam pelatihan, serta 57 peternak secara aktif menggunakan aplikasi dengan mencatat lebih dari 1.200 entri kegiatan dalam tiga bulan pertama. Evaluasi menunjukkan adanya peningkatan akurasi pencatatan data sebesar 25%, pengurangan signifikan pada duplikasi data, serta tersedianya *dashboard* analisis bagi koperasi. Program ini mendukung SDG (*Sustainable Development Goals*) 2 (Tanpa Kelaparan), SDG 3 (Kehidupan Sehat dan Sejahtera), SDG 8 (Pekerjaan Layak dan Pertumbuhan Ekonomi), serta SDG 13 (Penanganan Perubahan Iklim) dan SDG 15 (Ekosistem Daratan).

**Kata Kunci:** Peternakan, Monitoring, Aplikasi Mobile, Koperasi, Pengabdian Masyarakat

## 1. INTRODUCTION

The ruminant livestock industry in Indonesia plays an important role in fulfilling the demand for animal protein, creating employment opportunities, and driving regional economic growth. In the digital era, the implementation of technology in livestock management has

become a necessity to enhance efficiency, accuracy, and productivity. One form of organization that supports livestock development is the cooperative, which can empower farmers through a structured system of guidance and monitoring [1].

The Sarwa Adem Mulya Multi-Party Cooperative (Figure 1), located in Petung Wulung Hamlet, Toyomarto Village, Singosari District, Malang Regency, is a cooperative engaged in ruminant livestock farming. The cooperative was originally named Balakosa Farm and later transformed into a multi-party cooperative to have a broader business scope and remain competitive in the integrated livestock industry. Currently, the cooperative mentors more than 80 farmers in the Greater Malang area through a monitoring system covering 13 main activities in livestock care, namely: care and assignment of ID numbers for new livestock; care for sick or special livestock; livestock relocation between pens; mating colony process; care of livestock in the mating colony; care for pregnant livestock; care for birthing and nursing livestock; recording the process and number of livestock births; care and assignment of ID numbers for newly born calves; care for calves aged 1–5 months; care for weaned or fattening livestock; recording livestock deaths; and recording livestock sales.



Figure 1. Profile of Sarwa Adem Mulya Cooperative

The development of a mobile-based monitoring system is also relevant to the Sustainable Development Goals (SDGs), such as SDG 2 (Zero Hunger) through increased production of animal protein, SDG 3 (Good Health and Well-being) through improved quality of livestock products, SDG 8 (Decent Work and Economic Growth) by enhancing farmers' productivity, as well as SDG 13 and 15, which are related to environmental sustainability in livestock management [2], [3].

Although a monitoring system has been implemented, the method used is still semi-manual via Google Forms. This creates challenges for the farmers, particularly due to their varied educational backgrounds, making it difficult to fill out forms and record data accurately. Additionally, this process requires more time for data processing and carries a high risk of input errors. These conditions lead to delayed detection of livestock health issues, slow managerial decision-making, and low productivity [4], [5]. This gap highlights the need for a mobile-based monitoring system that is more efficient, user-friendly, and capable of providing

real-time data to enhance productivity and transparency in livestock management [6], [7].

To address this issue, the Student Creativity Program (PKM) team developed a Progressive Web App (PWA) with offline functionality, voice input, and a user-friendly admin dashboard. This system enables farmers to record and monitor livestock activities in real-time via smartphones, ensuring that data is stored in an integrated manner for further analysis. The implementation of this technology is expected to improve the accuracy of data recording, accelerate decision-making, enhance operational efficiency, and produce livestock products of higher quality. Moreover, this initiative serves as a concrete example of technology utilization in the livestock sector that can be scaled more broadly to promote the advancement of the livestock industry in Indonesia.

This community service activity aims to develop a mobile-based monitoring system that can assist farmers in recording and monitoring livestock activities more practically. With this system, farmers can directly input data through an application on their smartphones, which will then be integrated into the cooperative's system for further analysis. The use of this technology is expected to improve data accuracy, accelerate decision-making processes, and optimize livestock production outcomes.

## 2. METHODS

This activity is a community service program, aimed at developing a mobile-based livestock monitoring system for the Sarwa Adem Mulya Multi-Party Cooperative in Petung Wulung Hamlet, Toyomarto Village, Singosari District, Malang Regency. The target of this program is more than 80 cooperative-assisted farmers who carry out ruminant livestock care activities, covering 13 stages, from caring for new livestock to recording sales.

The approach used is participatory, actively involving farmers and cooperative administrators in all stages of the activities, from planning to evaluation [8]–[10]. The activity methodology was designed through five main stages:

### *Socialization and Identification of Partner Needs*

The initial stage was carried out through socialization activities involving cooperative management and representative partner farmers. The main objective of this stage was to introduce the concept of a mobile-based livestock

monitoring system and to explore users' technical needs and preferences. The implementation team identified field challenges, including aspects of digital literacy, interface design, and functional requirements of the application. This information served as an essential foundation for designing a system that aligns with field conditions and user characteristics.

#### ***Training on the Use of the Monitoring System***

Following the socialization stage, training sessions were conducted for farmers on how to use the application. The training was organized in the form of face-to-face workshops with hands-on practice using mobile devices. The training materials covered livestock ID registration, management of sick animals, documentation of births and deaths, and the use of voice and photo input features. To support continuous learning, the team provided training modules in the form of video tutorials and written guides that farmers could access independently at any time.

#### ***Technology Implementation***

The technology implementation phase involved the development of a mobile application based on a Progressive Web App (PWA), allowing access across various devices, including Android and iPhone, without requiring additional installation from the Play Store or App Store. The application was tested with a group of farmers as a pilot project. The trial results demonstrated that the application functioned well for both manual recording and voice input, automatically saving data to the cooperative's server whenever an internet connection was available. A web-based admin dashboard enabled cooperative management to monitor data in real-time and analyze livestock health and productivity.

#### ***Initial Assistance and Evaluation***

After the system was deployed, intensive assistance was provided during the first month to ensure that farmers could operate the application effectively. During this stage, the team monitored application usage, provided direct technical support, and collected user feedback. The initial evaluation aimed to assess system effectiveness and identify both technical and non-technical challenges in the field, which then became the basis for subsequent feature improvements.

#### ***Program Sustainability***

The final stage focused on the sustainability of the program through advanced training for cooperative administrators to enable them to act as system administrators. Furthermore, collaboration with academics and

technology developers was initiated to support continuous system development. This collaboration is expected to expand the system's functions, including integration with the cooperative's financial recording system.

#### ***Resolution of Managerial and Technical Aspects***

For managerial aspect, the cooperative appointed two administrators who were specially trained to manage the web dashboard, validate data, and monitor farmers' activities. The administrators are responsible for ensuring that incoming data is complete and accurate, as well as providing technical guidance when needed.

For technical aspect, improvements were made to the synchronization feature to ensure greater stability even with weak internet connections. Data security was enhanced through server-side encryption to maintain the confidentiality and protection of farmers' information.

The development of this application also refers to previous experience in the study "Mobile Application Development for Chronic Diseases Recording of Army Members" [11], which utilized a PWA and the SDLC methodology to ensure system reliability, accessibility, and compatibility.

### **3. RESULTS AND DISCUSSION**

#### ***Results***

The main output of this community service activity is a mobile-based ruminant livestock monitoring application integrated with the cooperative's web dashboard. This application is designed to assist cooperative-affiliated farmers in recording livestock activities, while also providing cooperative administrators with access to real-time monitoring and data analysis. Thus, the application not only functions as a recording tool but also as a decision support system that can improve the effectiveness of livestock management.

The primary users of this system are cooperative administrators and farmers. Administrators have full access to the web dashboard to validate data, generate recapitulations, and prepare livestock development reports within a certain period. Meanwhile, farmers use the mobile application to record various livestock management activities, including births, weaning, fattening, pen transfers, and health records.

#### ***Socialization and Identification of Partner Needs***

The results revealed that most farmers expressed a preference for an application



featuring a simple and user-friendly interface, intuitive icons, and the ability to record livestock-related activities easily without requiring advanced digital skills. These findings provided a critical foundation for tailoring the system's design to reflect the real conditions in the field and the digital literacy level of the target users. The documentation of the socialization activity is presented in Figure 2.



Figure 2. Socialization and Identification of Partner Needs

### Training of the Monitoring System Usage

The training achieved participation from more than 70% of cooperative members, indicating strong enthusiasm and engagement in adopting the new technology. Farmers successfully learned to record new livestock IDs, manage health conditions, and document births and deaths using the mobile application. They were also able to utilize the voice and photo input features effectively to simplify data entry. To support continuous learning, video tutorials and written guides were provided, enabling farmers to continue practicing independently. The documentation of the training activity is presented in Figure 3.



Figure 3. Training Using the Monitoring System

### Technology Implementation

The pilot implementation demonstrated that the Progressive Web App (PWA)-based application functioned effectively across various devices without requiring installation. Farmers were able to record livestock data both manually and through voice input, with all information automatically synchronized to the cooperative's server when connected to the internet. Furthermore, the web-based dashboard allowed coope-

orative administrators to monitor livestock conditions and productivity in real time. The documentation of the field trial activities is presented in Figure 4.



Figure 4. Technology Implementation in the Field

The implementation of this system can be observed through the following interface documentation:

#### a. Application Dashboard

The application dashboard (Figure 6) displays the main menu, which is divided into three major categories: Livestock Management, Livestock Farming, and Lamb and Care, along with an additional Master Data menu for general management. In the Livestock Management menu, farmers can record new livestock IDs, report sick animals, transfer livestock between pens, and document colony mating processes. Furthermore, the Livestock Farming menu provides features for recording various important activities such as birthing, weaning, fattening, maturation, and growth control. In the Lamb and Care menu, the application offers functions for registering new lamb IDs and their care, fattening care, monitoring colony mating care, as well as recording care for pregnant and birthing livestock. Meanwhile, the Master Data menu allows users to manage injection data, user data, and pen data. The entire interface is designed to be simple, with intuitive icons that make it easier for farmers, especially those with limited digital literacy, to operate the application effectively.



Figure 6. Application Dashboard

### b. Livestock Data

This page (Figure 7) displays a structured list of livestock IDs that have been recorded in the system. Each animal has a unique ID number that serves as its primary identity, making data management and tracking much easier. Both farmers and administrators can search for specific livestock based on the ID number and view detailed activity histories, such as health status, birth records, pen transfers, and other maintenance activities previously recorded.

The search feature is particularly useful when managing a large number of livestock, as users no longer need to go through records manually one by one. With this digital system, the tracking process becomes faster, more accurate, and more efficient, while also reducing the risk of manual recording errors that often occurred with traditional methods. In addition, the simple and well-organized data display is designed to make it easier for users to read and interpret information, whether for farmers with limited digital literacy or administrators who need to access large amounts of data for analytical purposes.



Figure 7. Livestock Data

### c. Livestock Management Chart

The application also provides data visualization in the form of a donut chart (Figure 8), which categorizes livestock into two groups: pre-weaning and post-weaning. This chart can be accessed by category or by a specific year, enabling cooperatives to easily analyze livestock productivity trends. Furthermore, the visualized data can be downloaded in Excel format, allowing administrators to compile it into periodic reports or use it as reference material for cooperative meetings.



Figure 8. Livestock Management Chart

### d. Application Settings

The settings section (Figure 9) allows users to adjust application preferences, such as availability status, notification settings, and display modes. This menu also provides a logout option to ensure the security of user accounts. The presence of these features is essential to guarantee user comfort and flexibility in accessing the application.

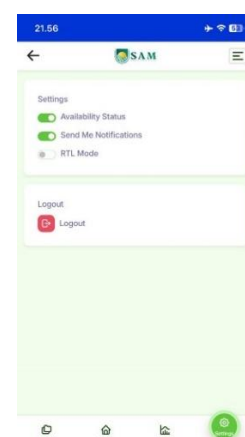


Figure 9. Application Settings

Overall, the implementation results of this livestock monitoring system demonstrate that the application can be effectively operated by

both farmers and administrators. The integration between the mobile application and the web-based dashboard enables faster, more accurate, and transparent data recording, monitoring, and analysis. The documentation in Figures 6–9 illustrates that the developed system is not merely a prototype but has indeed functioned as a digital solution that supports the effectiveness of cooperative livestock management.

### Discussion

Based on the results of the implementation of the mobile-based livestock monitoring application and web dashboard, this system has proven capable of supporting the modernization of livestock management in Indonesia. The application enables farmers and cooperative administrators to record and monitor livestock activities digitally, replacing manual methods that are prone to errors and time-consuming [12]. With this digital system, livestock data is recorded accurately and in real-time, making the information management process more efficient, as demonstrated in Fadlurrahman [13] study on a mobile-based poultry monitoring system. The application dashboard provides data visualization in the form of charts, such as a donut chart based on weaning status, which facilitates administrators in analyzing livestock productivity trends and preparing periodic reports, consistent with the findings of Kurniawan [14] in cricket livestock management. Furthermore, the application's simple interface with intuitive icons allows farmers with limited digital literacy to operate the system easily, while also supporting offline data management with automatic synchronization when an internet connection is available [15]. The implementation of this system not only improves the accuracy and efficiency of livestock management but also supports data-driven decision-making, thereby contributing significantly to the development of sustainable livestock management in Indonesia [12].

### 4. CONCLUSION AND RECOMMENDATIONS

The development program for a mobile-based ruminant livestock monitoring system has been successfully implemented at the Sarwa Adem Mulya Multi-Party Cooperative. Through a series of activities, including socialization, training, technology implementation, and mentoring, the program has improved the accuracy of livestock activity recording by reducing input errors commonly found in manual methods, accelerated cooperative management processes through a web-based dashboard accessible in real time, and enhanced farmers' digital literacy

as part of the broader digital transformation in the ruminant livestock sector. In addition, the application's implementation has delivered positive impacts on farmers' welfare, cooperative operational efficiency, and the achievement of the Sustainable Development Goals (SDGs). Based on these outcomes, it can be concluded that the mobile monitoring application, developed as a Progressive Web App (PWA), has proven to be an innovative and sustainable solution for improving the efficiency, productivity, and governance of ruminant livestock farming. The recommendations of this program include expanding the application's implementation to all cooperative members as well as other cooperatives in the Greater Malang area, developing additional features such as notifications, financial integration, and AI-based analytics, and conducting periodic long-term impact evaluations on livestock productivity at least every six months.

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