



DESIGN AND CONSTRUCTION OF A WEB-BASED SAGO WASTE MANAGEMENT AND MARKETING INFORMATION SYSTEM TO SUPPORT A LOCAL CIRCULAR FOOD ECONOMY

RANCANG BANGUN SISTEM INFORMASI PENGELOLAAN DAN PEMASARAN LIMBAH SAGU BERBASIS WEB GUNA MENDUKUNG EKONOMI SIRKULAR PANGAN LOKAL

Deril Alfiance Kaligis^{1*}, Nurul Qisti²

¹ Teknologi Rekayasa Multimedia, Politeknik Dewantara

² Teknologi Rekayasa Pangan, Politeknik Dewantara

* Correspondent Email: alfiankaligis1@gmail.com

Abstract

Sago processing waste, particularly sago pulp, often poses environmental problems due to inadequate disposal management, despite its significant economic potential within a circular economy framework. The main obstacles to its utilization are the availability of decentralized production data and limited market access for local food businesses. This research aims to design and build a web-based system to manage and market sago waste, facilitating transactions between waste producers and industrial users. The system development method used is the Waterfall method, which includes requirements analysis, system design using UML, coding in PHP and MySQL, and testing. The results show that this information system successfully integrates real-time waste data collection and provides a transparent marketplace feature. Black Box testing confirmed that all system functions operate according to user requirements. The implementation of this platform can support a circular economy by converting waste into an economically valuable resource while reducing negative environmental impacts on the local food ecosystem.

Keywords: *Circular Economy, Sago Waste, Marketplace, Information System, Web.*

Abstrak

Limbah pengolahan sagu, khususnya ampas sagu, sering kali menjadi permasalahan lingkungan karena manajemen pembuangan yang kurang optimal, padahal memiliki potensi ekonomi besar dalam kerangka ekonomi sirkular. Kendala utama dalam pemanfaatannya adalah ketersediaan data produksi yang tidak terpusat serta terbatasnya akses pasar bagi pelaku usaha pangan lokal. Penelitian ini bertujuan untuk merancang dan membangun sistem informasi pengelolaan dan pemasaran limbah sagu berbasis web guna memfasilitasi transaksi antara produsen limbah dan industri pengguna. Metode pengembangan sistem yang digunakan adalah *Waterfall*, yang meliputi tahap analisis kebutuhan, desain sistem menggunakan UML, pengodean dengan PHP dan MySQL, serta pengujian. Hasil penelitian menunjukkan bahwa sistem informasi ini berhasil mengintegrasikan pendataan limbah secara *real-time* serta menyediakan fitur *marketplace* yang transparan. Pengujian *Black Box* mengonfirmasi bahwa seluruh fungsi sistem berjalan sesuai dengan kebutuhan pengguna. Implementasi platform ini mampu mendukung ekonomi sirkular dengan mengubah limbah menjadi sumber daya bernilai ekonomi, sekaligus mengurangi dampak negatif terhadap lingkungan pada ekosistem pangan lokal.



Kata Kunci: *Ekonomi Sirkular, Limbah Sagu, Marketplace, Sistem Informasi, Web.*

INTRODUCTION

Sago (*Metroxylon sagu*) is a strategic local food commodity in Indonesia with significant potential for maintaining national food security (Pattirane *et al.*, 2025). As the country with the largest sago plantations in the world, it produces significant amounts of waste, including pulp and liquid, during sago processing. However, managing this waste remains an environmental challenge as it is often discharged directly into rivers without treatment (Putra *et al.*, 2021).

On the other hand, sago waste has economic value as animal feed or organic fertilizer, aligning with the circular economy concept of minimizing waste and maximizing resource value (Kementerian Lingkungan Hidup dan Kehutanan, 2021). The main obstacles are the lack of production data and the absence of a marketing platform that connects sago waste producers with potential buyers. Digitization through a web-based information system can facilitate access to data and enable transparent transactions (Utami *et al.*, 2023). This research aims to design a web-based information system for sago waste management and marketing, creating a circular economy ecosystem that provides added value for local food businesses.

RESEARCH METHODS

The research stages were carried out linearly as follows:

Requirements Analysis

The initial stage involved observations and interviews with sago-processing businesses and livestock farmers as potential users. Data collected included the volume of waste generated, current marketing flows, and features needed to support a circular economy.

System Design

Based on the analysis results, a system architecture was designed using Unified Modeling Language (UML). This includes:

1. Use Case Diagram: To define the interactions between actors (Admin, Waste Producers, and Buyers).
2. Activity Diagram: To illustrate the management and transaction process flow.
3. Entity Relationship Diagram (ERD): To design the MySQL database structure.

Implementation

This stage involves translating the design into a programming language. The system was built using:

1. Programming Language: PHP with the Laravel Framework (for security and speed).
2. Database: MySQL (as centralized data storage).



3. Frontend: Bootstrap or Tailwind CSS for a responsive display.
4. Testing: The system was tested using the Black Box Testing method. The testing focused on feature functionality, including waste data input, stock display on the marketplace, and the waste order checkout process.
5. Maintenance: The final stage was system evaluation based on user feedback to ensure the platform truly supports efficient sago waste marketing.

Research Subjects and Objects

1. Subjects: System administrators, sago processing business owners (as waste providers), and livestock farmers/fertilizer factories (as buyers).
2. Objects: The distribution and marketing management process for sago waste in local food centers.

Circular Economy Framework in the System

This information system is designed to manifest a circular economy by:

1. Digital Traceability: Tracking the location of waste from upstream to downstream.
2. Waste to Value: Converting waste data into commodities that can be traded transparently through e-marketplaces.

RESULTS AND DISCUSSION

A. Results

Use Case Diagram

The system has three main actors:

1. Admin: Manages user validation and environmental impact statistical reports.
2. Producer (Sago Factory): Inputs daily waste quantities and production dates to ensure quality (food aspect).
3. Buyer (MSME/Livestock): Searches for waste based on the nearest location and makes transactions.

Entity Relationship Diagram (ERD)

The data structure is designed to support traceability:

1. Users (id, name, role, address, contact)
2. Waste (id, waste_name, nutritional_content, description)
3. Stock (id, producer_id, waste_id, tonnage, production_date)
4. Transaction (id, buyer_id, stock_id, payment_status)

Web Implementation

This web system displays an interactive dashboard that maps sago waste production points. The "Waste Catalog" feature includes technical information on food, such as moisture content and processing potential, to help buyers determine the appropriate processing method.



Figure 1. SimLisg Connect home page

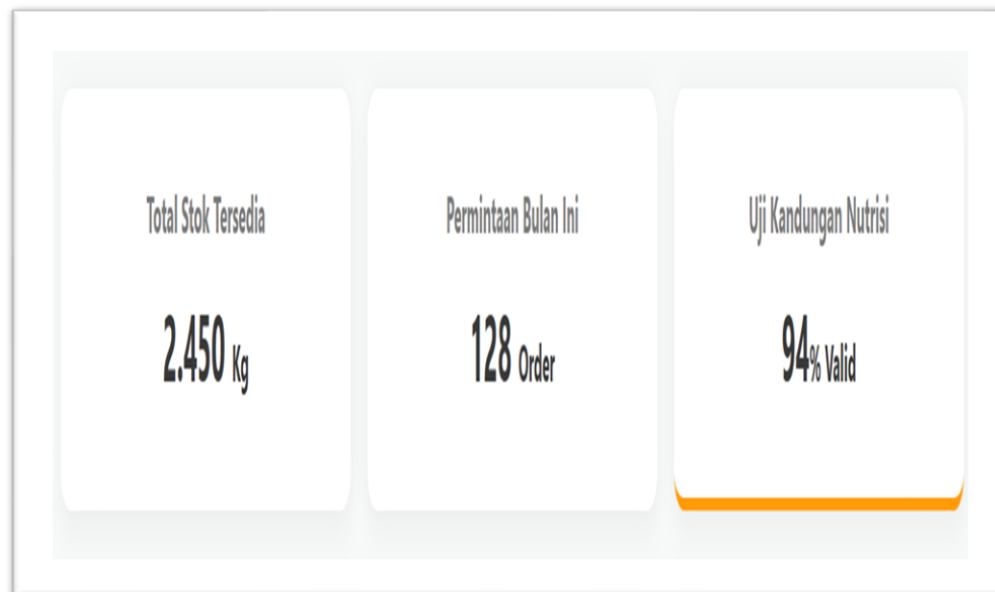


Figure 2. Stock Monitoring page on SimLisg Connect



Katalog Limbah Produksi Real-Time

ID Batch	Jenis Limbah	Kandungan Pati	Stok (Kg)	Status Produksi	Aksi
#SGO-001	Ampas Sagu (Ela)	12.5%	800	Baru (Hari Ini)	<button>Pesan Sekarang</button>
#SGO-002	Kulit Sagu Kasar	2.1%	1.200	Tersedia	<button>Pesan Sekarang</button>
#SGO-003	Limbah Cair Sagu	5.8%	450	Proses Fermentasi	<button>Pesan Sekarang</button>

Figure 3. Production Waste Catalog Data on SimLisg Connect

Form Pemesanan

Produk: Ampas Sagu (Ela) - Batch #SGO-001

Kandungan Pati: 12.5% (Cocok untuk Pakan Ternak)

Lokasi: Pabrik Pengolahan Desa A

Nama Pengolah/Pembeli

Contoh: Kelompok Tani Maju

Tujuan Pengolahan

-- Pilih Tujuan --

Jumlah Pesanan (Kg)

100

Alamat Pengiriman

Alamat lengkap lokasi pengolahan...

Estimasi Biaya Operasional: **Rp 50.000**

Konfirmasi & Ambil Limbah

[Kembali ke Dashboard](#)

Figure 4. Sago Pulp Order Form on SimLisg Connect



Figure 5. Coarse Sago Husk Order Form on SimLisg Connect



Figure 6. Coarse Sago Liquid Waste Order Form on SimLisg Connect

B. Discussion

This research successfully designed and implemented a web-based sago waste management and marketing information system using the Waterfall method. Based on Black



Box testing results, all system functions, from waste data collection and stock monitoring to marketplace transactions, met user needs. This demonstrates the effectiveness of the Waterfall method in producing a structured and reliable information system (Pressman, 2015; Sommerville, 2011).

The developed system supports the circular economy concept by transforming sago waste, previously an environmental burden, into an economically valuable commodity. Through the marketplace feature, waste producers can connect directly with buyers, resulting in more efficient, transparent distribution and broader market access. These results align with the Ministry of Environment and Forestry (2021), Handayani *et al.* (2026), and Utami *et al.* (2023), which state that digitalization can improve the efficiency of waste management while supporting a circular economy.

In addition to providing economic benefits, this system also contributes to environmental sustainability through real-time waste data collection and traceability features that facilitate monitoring of waste distribution from producers to users. The use of sago waste as a raw material for animal feed and organic fertilizer is expected to reduce environmental pollution caused by direct waste disposal and support the achievement of sustainable development goals (Putra *et al.*, 2021; Mangera & Jamaludin, 2024). Overall, this information system has the potential to serve as a digital model for agricultural waste management that improves distribution efficiency, increases the economic value of waste, and promotes environmental sustainability. However, further research is recommended to evaluate usability, system security, and user acceptance to optimize system implementation.

CONCLUSION

Based on the research results and discussions conducted, it can be concluded that:

1. **Design Success:** This research has successfully designed and implemented a Web-Based Sago Waste Management and Marketing Information System using the Waterfall method. This system integrates structured management of sago pulp waste data, from production volume data collection by sago processors to digital transaction processing.
2. **Support for the Circular Economy:** This platform has proven effective in supporting the circular economy concept in the local food sector by transforming previously worthless waste (an environmental burden) into an economic commodity. Through its marketplace feature, the system shortens the supply chain between waste producers and industrial users (such as livestock farmers and organic fertilizer producers), thereby increasing distribution efficiency and price transparency.
3. **System Effectiveness:** Test results using the Black Box Testing method indicate that all system functions, at the admin, producer, and buyer levels, function well according to functional requirements. This digitalization addresses the information-access constraints that have hampered the reuse of sago waste.



REFERENCES

- Agung. (2020, April 11). *Sagu sebagai Penyelamat Pangan Ditengah Pandemi Virus Corona*. Badan Pangan Nasional.
- Badan Pusat Statistik. (2023). *Produksi Tanaman Perkebunan Menurut Provinsi dan Jenis Tanaman: Sagu (Ton)*. BPS Indonesia.
- Handayani, D., Saputra, A., & Nugroho, W. (2026). Implementasi Bank Sampah Digital Sebagai Pendukung Ekonomi Sirkular Masyarakat Berbasis Website. *Journal of Computer Science Contributions (JUCOSCO)*, 6(1), 103–112. doi.org.
- Kementerian Lingkungan Hidup dan Kehutanan. (2021). *Ekonomi Sirkular: Solusi Pengelolaan Sampah dan Dampak Lingkungan*. Situs Resmi KLHK.
- Mangera, Y., & Jamaludin. (2024). Pemanfaatan Limbah Sagu Sebagai Bahan Baku Pembuatan Pupuk Organik (Bokashi) dan Pakan Ternak. *Jurnal Pengabdian Kepada Masyarakat*, 5(2). ejournal.utp.ac.id.
- Nuraini. (2015). *Limbah Sagu Fermentasi sebagai Pakan Alternatif Ternak Unggas*. Padang: LPTIK Universitas Andalas. repo.unand.ac.id.
- Pattirane, C. P., Cenning, D., & Luwu, U. (2025). Potensi Sagu Sebagai Sumber Pangan Strategis di Desa Cenning, Luwu Utara. *Jurnal Pengabdian Masyarakat Bangsa*, 3(9). doi.org.
- Pressman, R. S. (2015). *Software Engineering: A Practitioner's Approach* (8th ed.). New York: McGraw-Hill Education.
- Putra, A., Rahim, M., & Sari, N. (2021). Analisis Dampak Limbah Cair Industri Pengolahan Sagu terhadap Kualitas Air Sungai Martapura. *Jurnal Riset Industri Hasil Hutan*, 13(1). ResearchGate.
- Sommerville, I. (2011). *Software Engineering* (9th ed.). Boston: Pearson Education.
- Utami, K., Pratama, R., & Wahyuni, S. (2023). Pengembangan Sistem Manajemen Bank Sampah berbasis Web untuk mewujudkan keberhasilan ekonomi Sirkular di Masyarakat. *Indonesian Journal of Computer Science*, 12(1). doi.org.
- Yusuf, M., et al. (2024). Analisis Penerimaan Pengguna Marketplace Limbah Pertanian Menggunakan Technology Acceptance Model (TAM). *Jurnal Sistem Informasi dan Teknologi*, 6(2), 45-52.