



## Developing a Web Based Sales Monitoring and Forecasting System for Digital Transformation of Rural MSMEs

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### Abstract

Micro, Small, and Medium Enterprises (MSMEs) in Indonesia face significant hurdles in digital adoption, with only 30% to 32% currently utilizing digital management tools. To address this challenge, this research focuses on Dapur Ovaltin, an agribusiness MSMEs in Ciwidey, West Java, that previously relied entirely on manual sales recording. The primary objective of this study is to design and implement a web-based monitoring and forecasting system to enhance operational efficiency. Developed through a hybrid framework integrating Design Thinking and the Prototyping SDLC, the resulting application streamlines sales management and applies Simple Linear Regression to transactional data for precise inventory forecasting. This implementation yielded a comprehensive platform featuring digital product catalogs, transaction management, and interactive data visualization. Ultimately, the deployed system successfully transformed manual operations into a cohesive digital process, replacing fragmented logs with a centralized database that empowers data-driven decision-making for sustainable enterprise growth.

Keywords: web, simple linier regression, design thinking, prototype, digital transformation, MSMEs

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### 1. Introduction

Micro, Small, and Medium Enterprises (MSMEs) in Indonesia are currently navigating a critical digital divide. While approximately 64 million MSMEs exist, only 30% to 32% have successfully integrated digital management tools into their operational workflows [1]. This underutilization is not merely a technical limitation but a systemic operational vulnerability; limited financial resources and low technical literacy force rural enterprises to rely heavily on manual record-keeping. This traditional practice exposes businesses to significant risks—including data redundancy and information loss—while precluding the possibility of rigorous trend

analysis. Consequently, the lack of a structured foundation for inventory planning hinders sustainable growth, making digital transformation a strategic imperative for rural business continuity.

Within this broader rural landscape, MSMEs operating in the agribusiness sector face distinct structural vulnerabilities, including seasonal revenue fluctuations and a historical reliance on localized market channels [2]. Although the post-pandemic economic environment necessitates integrated, technology-driven business models, digital adoption frequently encounters resistance due to disparate levels of digital literacy among rural stakeholders [3], [4]. To address these barriers, recent scholarship

advocates for Asset-Based Community Development (ABCD) models [5], where digital interventions are designed to directly amplify existing local assets, thereby fostering long-term operational resilience.

The development of digital platforms for this sector must evolve beyond conventional administrative record-keeping. Literature suggests that the conceptualization of web-based portals has shifted from static catalogues to active, data-driven “digital storefronts” [6]. While early agribusiness e-commerce focused primarily on transaction-oriented mechanisms—such as product logging and inventory queues—these systems fail to capture the dual nature of agribusiness, which demands both commercial profiling and experiential engagement. Modern frameworks indicate that enterprise profiling must transcend administrative logs by integrating operational indicators (e.g., capacity limits, organic certifications, and seasonal metrics) with an overarching business identity [7]. Beyond consumer-facing storefronts, digital transformation has become a strategic necessity for internal operational efficiency. Despite evidence that digital systems significantly improve performance monitoring and data-driven decision-making, adoption among Indonesian MSMEs remains limited. To bridge this usability gap, modern information systems increasingly adopt Design Thinking, a methodology that prioritizes empathy for the user’s operational context and cognitive limitations [8].

*Dapur Ovaltin*, an agribusiness MSMEs specializing in strawberry products in Ciwidey, exemplifies this operational challenge. The enterprise currently lacks an integrated digital system and relies entirely on manual ledgers. The owner faces significant difficulties in tracking periodic sales growth and planning production based on historical data—a capability that is essential for managing highly perishable agribusiness goods. Without a dedicated system, the enterprise remains vulnerable to inaccuracies in stock procurement and missed market trends. To address this operational gap, this study proposes a targeted, web-based sales monitoring and forecasting system.

Existing implementations often remain fragmented, failing to fully bridge the gap between technical capability and practical application. While current literature acknowledges that digital solutions can significantly optimize operational efficiency and information quality [8], a notable divide persists. Previous research has introduced various Point of Sale (POS) applications and generic inventory systems; however, these tools frequently prioritize technical complexity over end-user accessibility [9]. Consequently, a distinct research gap remains rural agricultural MSMEs require simplified, predictive decision-support systems that synthesize historical data with intuitive interfaces [10], [11], [12]. Most

contemporary digital platforms necessitate a level of technical fluency that remains a significant barrier for many rural entrepreneurs, highlighting the urgent need for more accessible, user-centric digital frameworks. As illustrated in Table 1, previous research has largely segmented MSME digital interventions into specific functional domains, ranging from inventory management [9], basic organizational mentoring [11], inventory management [9], generic promotional platforms [13] to retail price dissemination [14]. While these studies address isolated operational pain points, they frequently lack a holistic integration of predictive intelligence and real-time operational feedback.

Table 1. Related Research in MSME Digitalization

| REF                                                                                                                                  | MO | PF | DT/HC | RA |
|--------------------------------------------------------------------------------------------------------------------------------------|----|----|-------|----|
| Subianto et al. (2023) [9]                                                                                                           | √  | X  | X     | X  |
| Sitorus et al. (2024) [11]                                                                                                           | X  | X  | X     | √  |
| Purwati et al. (2025) [13]                                                                                                           | √  | X  | X     | X  |
| Sipahutar et al. (2025) [14]                                                                                                         | X  | √  | X     | X  |
| <i>Proposed Study</i>                                                                                                                | √  | √  | √     | √  |
| REF = Reference; MO = Monitoring Operation; PF = Predictive Forecasting; DT = Design Thinking/Human Centric; RA = Rural Agribusiness |    |    |       |    |

Table 1 demonstrates that a distinct research gap persists, as there is an absence of holistic decision-support systems that simultaneously integrate real-time sales monitoring and predictive forecasting, engineered specifically through a human-centric Design Thinking methodology to accommodate the digital literacy constraints of rural agribusiness MSMEs. To address this, the research utilizes a hybrid Design Thinking and Prototyping methodology to ensure the final system is the result of direct collaboration and empathy with the MSMEs proprietor. By integrating this human-centric framework with agile Prototyping models, the system design facilitates iterative feedback loops, ensuring that the final product is both functional and aligned with the user’s specific capabilities [15]. Furthermore, by treating data quality as a strategic asset, the system employs the Model-View-Controller (MVC) design pattern within the Laravel framework to decouple business logic from the user interface, ensuring long-term maintainability.

The system enhances these technical foundations by embedding predictive capabilities—specifically Simple Linear Regression—directly into the administrative dashboard, enabling a seamless transition from manual, retrospective record-keeping to proactive inventory and sales forecasting [16], [17]. Simple Linear Regression was selected as the foundational analytical engine due to its

computational transparency and suitability for the MSME's current data maturity [18]. Given the proprietor's limited historical dataset and the need for a low-barrier entry to digital transformation, simple linear models offer an interpretable, “white-box” approach that aligns with the proprietor's cognitive workflow.

Unlike advanced machine learning architectures, which often require extensive, high-frequency historical data runways and significant hyperparameter tuning, Simple Linear Regression provides immediate, actionable baselines with minimal data noise interference. This pragmatic choice ensures that the initial phase of digital adoption prioritizes usability and system trust, establishing the essential data infrastructure required to deploy more complex, non-linear forecasting models in subsequent research phases.

Ultimately, this study bridges the existing literature gap by synthesizing the transactional efficiency of the Prototyping SDLC with the analytical foresight of linear regression to create a decision-support environment tailored to the demands of perishable-goods agribusiness. While technical frameworks such as the MVC architecture and linear regression algorithms are well-established independently, the scientific novelty of this study lies in their direct synthesis into a highly accessible, cognitively tailored platform.

The core innovation is rooted not in algorithmic complexity, but in overcoming the usability gap through an adaptive interface that actively mitigates the high system-rejection rates typical of rural digital implementations. This intervention represents more than a technical upgrade; it is a strategic implementation designed to embed proactive, data-driven decision-making into daily operations, thereby fostering long-term sustainability for rural agribusinesses.

## 2. Research Design: A Hybrid Framework

This research employs a hybrid methodological framework that systematically integrates the human-centric paradigm of Design Thinking with the technical scaffolding of the Prototyping Software Development Life Cycle (SDLC). Traditional sequential models, such as the waterfall approach, often lack the adaptive flexibility required for resource-constrained environments where user literacy and business needs remain dynamic [19].

To navigate these constraints, Design Thinking—encompassing Empathize, Define, Ideate, Prototype, and Test—serves as the primary operational lens for user-centric problem formulation [20]. This ensures that system development is rooted in the proprietor's real-world experience, mitigating the risk of delivering technically sound software that remains

cognitively inaccessible. Simultaneously, the Prototyping SDLC operationalizes these conceptual insights via a structured development pipeline: initial requirements, design, prototyping, customer evaluation, iterative review, development, testing, and maintenance [21]. The synergy between these frameworks creates a robust methodology that bridges the divide between contextual empathy and technical rigor [22]. As illustrated in Figure 1, this approach guarantees that the resulting web-based system achieves both architectural stability and precise alignment with the end-users' cognitive capacities.

The system architecture is engineered to balance technical maintainability with actionable analytical foresight. By adopting the Model-View-Controller (MVC) pattern within the Laravel framework, the application ensures a clean separation between business logic, data management, and the user interface, which is critical for long-term scalability [23]. Beyond facilitating efficient data storage, the architecture integrates a predictive engine powered by Simple Linear Regression directly into the administrative dashboard. This implementation shifts the enterprise's operational paradigm; the system no longer serves as a static repository for historical data, but as a dynamic tool that converts raw transactions into forward-looking projections. Consequently, the proprietor is empowered to move beyond retrospective record-keeping, utilizing automated forecasting to align procurement and production cycles with projected sales demand. Fundamentally, this hybrid methodology mitigates the failure risks inherent in applying rigid development models to resource-constrained environments, ensuring that the system is aligned with user capabilities to foster sustainable digital integration.

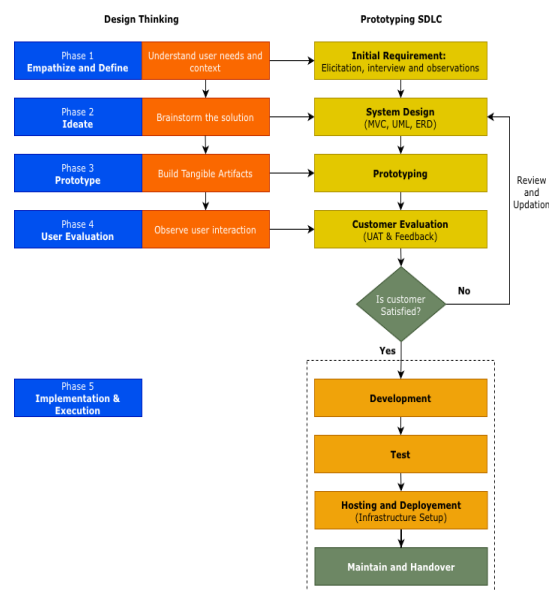


Figure 1. Hybrid Framework for Website Development

## 2.1 Phase 1: Empathize and Define

During the initial requirements stage, qualitative observations and interviews revealed that *Dapur Ovaltin* relied heavily on manual sales recording and unstructured WhatsApp communications. This absence of centralized data management severely hindered the owner's capacity to evaluate business performance or accurately anticipate future production volumes. Consequently, these operational bottlenecks established the baseline requirements for the engineered to be both technically robust and cognitively accessible for users navigating digital literacy constraints.

## 2.2 Phase 2: Ideate

In the System Design phase, the technical blueprint was established using the Model-View-Controller (MVC) architecture within the Laravel framework. To accommodate distinct user roles, the system architecture was logically partitioned into two primary interfaces:

### 2.2.1 Front-end (Consumer Interface)

Engineered as a dynamic digital storefront, this module integrates the MSME's enterprise profile with a comprehensive product catalogue for strawberry-based goods (e.g., *dodol*, jelly, and jam). It further incorporates customer testimonials and direct WhatsApp integration to streamline the transaction funnel.

### 2.2.2 Back-end (Administrator Dashboard)

Designed as a secure, centralized management hub, this component enables the enterprise owner to authenticate credentials, systematically manage inventory listings, and seamlessly record daily sales transactions.

## 2.3 Phase 3: Prototype

The Prototyping phase operationalized the architectural blueprint through the development of core web interfaces and a backend analytical engine. This stage yielded two critical deliverables designed to facilitate data-driven decision-making:

### 2.3.1 Centralized Sales Dashboard

This module transforms raw transactional inputs into interactive data visualizations, generating automated performance reports and bar charts that immediately identify high-velocity products.

### 2.3.2 Predictive Analytics Module

To elevate the platform from a conventional tracking ledger to a robust Decision Support System (DSS), a forecasting engine was integrated. The system employs Simple Linear Regression [18], mathematically defined as:

$$Y = a + bX \quad (1)$$

where (Y) represents the dependent variable sales volume, (X) denotes the independent variable (time period), (a) is the (Y)-intercept (the constant

representing the value of when is 0), and (b) indicates the regression coefficient (the slope). By analyzing historical sales data, this algorithm projects future consumption trends. The prototype visualizes these predictive metrics via automated line graphs and data tables, calculating precise inventory requirements for the subsequent 30-day operational cycle.

## 2.4 Phase 4: User Evaluation and Refinement

The evaluation phase was structured into user-centric validation and technical verification to guarantee comprehensive system robustness:

### 2.4.1 User Acceptance Testing (UAT)

The MSME owner actively interacted with the prototype within a simulated operational environment. This human-centric assessment evaluated three primary dimensions: the cognitive simplicity of the user interface, navigational fluidity, and the functional alignment of the dashboard with daily sales monitoring requirements.

### 2.4.2 Functional Verification

Black Box Testing was executed to rigorously validate the software's technical integrity. This methodology assessed the input-output mechanics across all core modules, verifying that data persistence and computational algorithms operated seamlessly without structural anomalies.

### 2.4.3 Iterative Refinement (Review and Updating)

Leveraging the continuous feedback loop established during UAT, the prototype underwent systematic, agile modifications. This iterative adjustment process was sustained until optimal functional alignment and user satisfaction were achieved, formally validating the system's readiness for production deployment.

## 2.5 Implementation and Execution

Following successful prototype validation, the methodology advanced to the Implementation and Execution phase, formally transitioning the artifact into a production-ready enterprise system. This terminal phase encompassed four structured stages:

### 2.5.1 Production Development

The finalized system was engineered utilizing the PHP programming language within the Laravel framework. The local development environment was provisioned using Laragon as the web server and MySQL for relational database management, facilitating the seamless integration of the centralized dashboard, predictive engine, and product catalogue.

### 2.5.2 Pre-Deployment Testing

To ensure technical reliability prior to migration, a secondary phase of Black Box Testing was executed within the localized environment. This evaluation rigorously verified that core production functions—including administrator authentication, catalogue

rendering, and database queries—produced accurate, error-free outputs.

### 2.5.3 Hosting and Deployment

The deployment protocol initiated with infrastructure provisioning, requiring the acquisition of a dedicated domain and shared hosting to establish public web accessibility for Dapur Ovaltin. Concurrently, a comprehensive data migration was executed, populating the production database with authentic enterprise data, high-resolution product imagery, and historical sales records.

### 2.5.4 Handover and Maintenance

The formal handover protocol included a targeted capacity-building session for the MSME owner. This training encompassed critical administrative workflows: system authentication, inventory synchronization, the interpretation of predictive analytics, and WhatsApp order management. Following a successful operational trial, full administrative autonomy was transferred to the proprietor, marking the commencement of the continuous maintenance lifecycle to ensure long-term digital sustainability.

## 3. Result and Discussion

To serve both public consumers and internal administrators efficiently, the system architecture was meticulously partitioned into a dual-interface structure utilizing the MVC framework. Crucially, the overarching design prioritized cognitive simplicity to ensure rapid, seamless adoption by users with baseline digital literacy.

### 3.1 Public-Facing Digital Storefront (Front-End Architecture)

The user-facing interface was strategically engineered to maximize market reach, enhance operational transparency, and cultivate consumer trust.

#### 3.1.1 User Dashboard

Functioning as a comprehensive digital storefront, the primary dashboard seamlessly integrates enterprise profiling with engaging multimedia elements. Specifically, it features an introductory video that highlights the MSME's agribusiness potential, establishing an immediate visual connection with prospective customers (see Figures 2a, 2b, and 2c).



Figure 2(a). Welcome Dashboard



Figure 2(b). MSMEs Profile



Figure 2(c). Video profile

### 3.1.2 Product Catalogues

To facilitate intuitive navigation and seamless browsing, the user interface integrates a dynamic catalogue that systematically displays the enterprise's strawberry-based commodities. As depicted in Figure 3, this module extends beyond simple visual representation by embedding comprehensive product metadata—such as pricing structures, inventory status, and detailed descriptions. Furthermore, it incorporates direct transactional links to streamline consumer procurement.

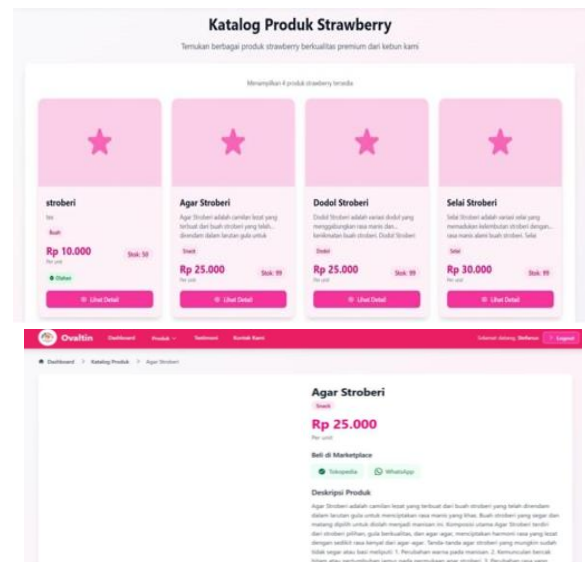


Figure 3. Product Catalogue and Description

### 3.1.3 Customer Review

To cultivate digital credibility and establish social proof, the front-end architecture structurally reinforces consumer trust through a dedicated

testimonial module. As shown in Figure 4, this feature aggregates and highlights verified customer feedback alongside transparent rating metrics. This provides prospective buyers with authentic evaluations, thereby mitigating perceived purchasing risks.

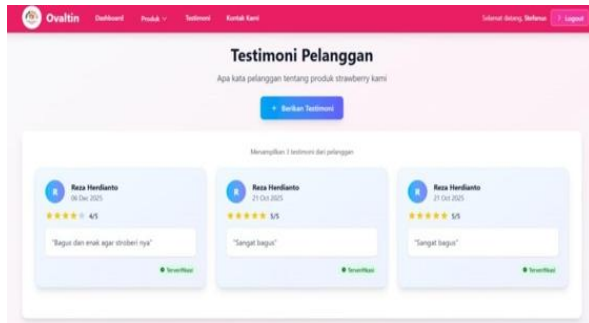


Figure 4. Customer Review

### 3.1.4 Communication Chanel.

To optimize user engagement and minimize transactional friction, the system integrates a direct communication portal. As illustrated in Figure 5, this module establishes essential enterprise transparency by displaying defined operational hours and precise geolocation data. By simultaneously embedding direct WhatsApp routing, this strategic integration ensures an uninterrupted transition from product discovery to the final ordering process, enhancing overall operational efficiency.

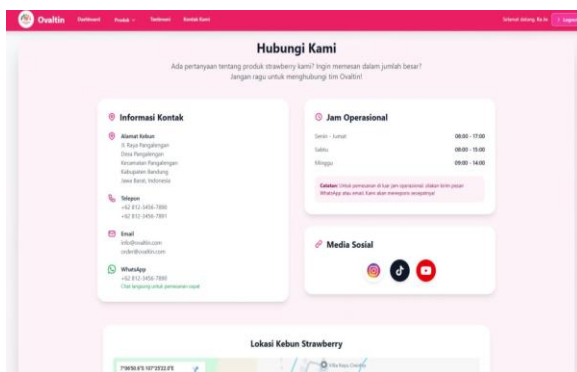


Figure 5. Communication Portal and Location Information

## 3.2 Secure Administrative Console (Back-End Architecture)

The backend infrastructure is engineered to transcend traditional, manual record-keeping by functioning as a centralized Decision Support System (DSS). This architecture is specifically calibrated to empower the MSME proprietor with robust, data-driven management capabilities through the following core operational modules.

### 3.2.1 Secure Authentication & Executive Dashboard

Access is strictly governed by a secure authentication gateway (Figure 6), ensuring data

integrity while directing the administrator to a centralized analytical hub.

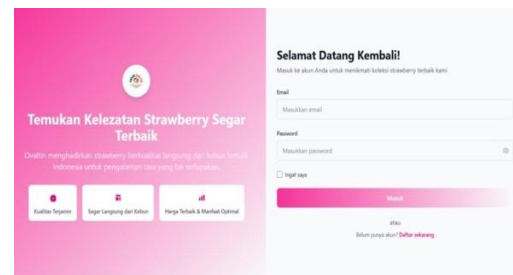


Figure 6. User Login and Authentication

This dashboard provides a comprehensive operational overview by instantly visualizing critical enterprise metrics, including continuous data aggregation on user growth trajectories and cumulative testimonial ratings (Figure 7).

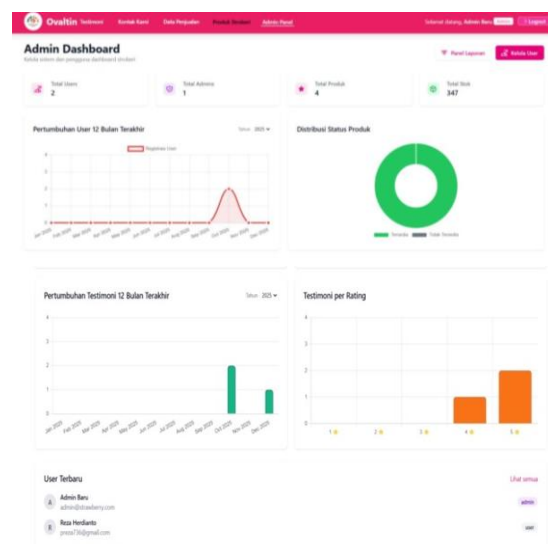


Figure 7. Executive Dashboard

### 3.2.2 Workflow Optimization via CRUD Interface

To streamline daily administrative processes, the architecture incorporates intuitive CRUD (Create, Read, Update, Delete) interfaces localized within quick-action menus. As illustrated in Figure 8, this design effectively eliminates technical barriers, enabling the proprietor to effortlessly manage product listings, adjust inventory, and record daily transactions with minimal navigational friction.

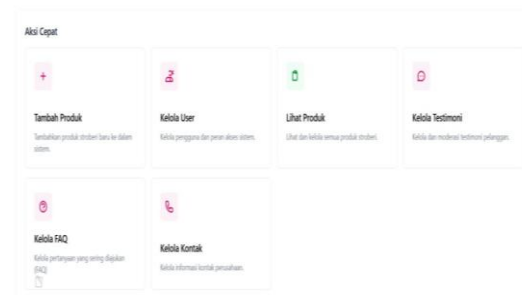


Figure 8. Manage Product Records (a)

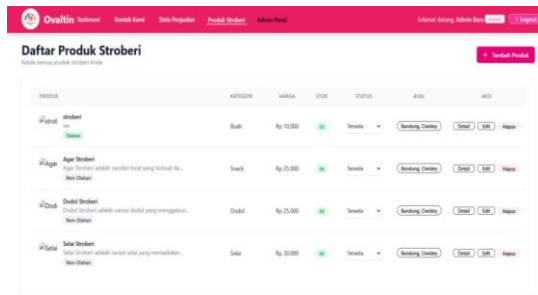


Figure 8. Manage Product Records (b)

**3.2.3 Automated Analytics and Visual Reporting.** Addressing the cognitive limitations associated with manual data processing, the architecture autonomously synthesizes raw transactional inputs to render interactive visual analytics. As depicted in Figure 9, this module dynamically ranks top-performing products, empowering the MSME proprietor to rapidly pinpoint critical revenue streams while eliminating the operational friction and time expenditure inherent in complex manual data synthesis.



Figure 9. Sales Data Visualization

### 3.3 Predictive Analytics and Sales Forecasting

The most significant technological advancement within the prototype is the integration of a predictive forecasting module, which structurally elevates the system from a descriptive digital ledger to a proactive Decision Support System (DSS). Recognizing that historical data visualization alone is insufficient for inventory planning, the architecture incorporates a forecasting engine driven by a Simple Linear Regression algorithm.

#### 3.3.1 Algorithmic Modelling and Dashboard Integration

The module processes aggregate historical transaction data to model future sales trajectories for individual product categories, prominently displayed on the forecasting dashboard (Figure 10).

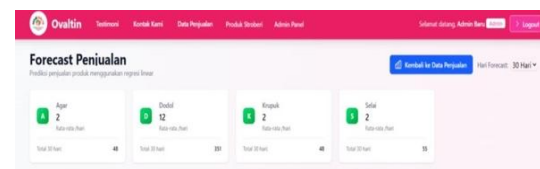


Figure 10. Sales Forecasting

#### 3.3.2 Visualizing Future Demand and Statistical Evaluation

To bridge the gap between advanced analytical processing and end-user comprehension, the system translates statistical predictions into interactive graphical representations (Figure 11).

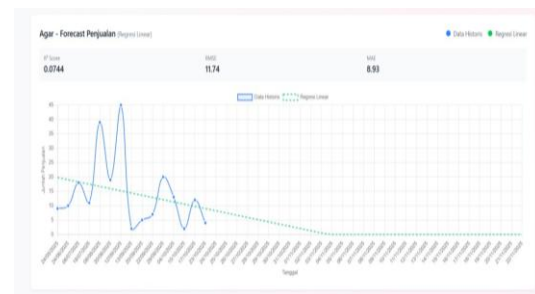


Figure 11. Sales Baseline and Prediction

Quantitatively, the application of the Simple Linear Regression model yielded a  $R^2$  coefficient of 0.0744, which explicitly demonstrates that the temporal independent variable accounts for merely 7.44% of the total variance in sales volume. Academically and statistically, an  $R^2$  of this magnitude indicates a poor linear fit, revealing that 92% of the data variance remains unexplained by a univariate model. In traditional econometric modelling, such performance would classify the model as a weak predictor. However, within the paradigm of early-stage digital transformations in resource-constrained rural agribusiness, this statistical limitation must be critically evaluated through an operational and socio-technical lens rather than purely deterministic

metrics. The high residual variance observed is an empirical reflection of the highly volatile, non-linear environment characteristic of rural agribusiness. Sales of highly perishable strawberry-based commodities in tourist-dependent regions like Ciwidey are inherently subject to severe exogenous shocks. These include irregular weekend tourist surges, sudden micro-climatic shifts altering harvest and spoilage rates, and unrecorded community events—none of which are mathematically captured by a baseline time variable.

Consequently, the conclusion that this forecasting module is a “success” is explicitly decoupled from high-precision statistical fit; instead, it is defined by its paradigm-shifting *architectural and operational utility*. Prior to this intervention, the enterprise operated within a data vacuum, relying entirely on retrospective, manual guesswork that offered zero forward-looking visibility. The integration of the regression engine establishes a functional, *directional baseline* that transforms the proprietor's cognitive workflow from reactive panic to structured, proactive planning. Furthermore, from an information systems development perspective, this low serves as a critical diagnostic asset. It empirically exposes the insufficiency of linear, univariate assumptions in agribusiness supply chains, thereby providing the necessary scientific justification for the enterprise to engage in systematic, centralized data collection. This baseline framework establishes the essential data infrastructure required to deploy advanced, non-linear multivariate algorithms (such as SARIMAX or Random Forest) in subsequent research phases once a robust historical data runway has been accumulated.

### 3.3.3 Actionable Data Tables

Complementing the graphical visualizations, the system generates precise, tabular predictive reports as shown in Figure 12. This component details exact sales volume estimations correlated with specific upcoming dates.

| Tanggal    | Jumlah | Status | Waktu | Lokasi | Total |
|------------|--------|--------|-------|--------|-------|
| 20/10/2025 | 5      | 10     | 5     | 10     | 40    |
| 21/10/2025 | 7      | 10     | 8     | 10     | 40    |
| 22/10/2025 | 7      | 10     | 7     | 10     | 38    |
| 23/10/2025 | 5      | 10     | 5     | 10     | 38    |
| 24/10/2025 | 5      | 17     | 5     | 10     | 38    |
| 25/10/2025 | 8      | 17     | 8     | 10     | 38    |
| 26/10/2025 | 4      | 16     | 7     | 10     | 37    |
| 27/10/2025 | 3      | 16     | 7     | 10     | 36    |
| 28/10/2025 | 2      | 15     | 7     | 10     | 35    |
| 29/10/2025 | 1      | 15     | 6     | 10     | 32    |

Fig. 12: Sales Prediction Tables

Ultimately, this predictive intelligence directly addresses the MSME's operational bottlenecks. By transforming raw data into actionable foresight, the module empowers the owner to optimize raw material procurement, mitigate the risks of

overstocking or product spoilage, and strategically align inventory levels with projected consumer demand.

### 3.4 Validation and Evaluation

The system underwent a comprehensive through User Acceptance Testing (UAT) To ensure the web-based prototype fulfilled the MSME's operational requirements,

#### 3.4.1 System Validation and User Acceptance

The initial assessment phase employed User Acceptance Testing (UAT) to empirically validate the prototype's operational efficacy. Table 2 systematically catalogs the qualitative and functional outcomes resulting from this direct user validation.

Table 2. UAT Outcome

| Validation Category     | Testing Focus                                           | Key Findings & User Acceptance                                                                                                        |
|-------------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Functional Verification | Core system modules                                     | All core modules operated optimally without fatal technical anomalies or bugs.                                                        |
| Interface Usability     | Graphical User Interface (GUI) and daily task execution | The interface highly intuitive, specifically noting the ease of inputting daily sales data and managing inventory.                    |
| Forecasting Utility     | Simple Linear Regression predictive engine              | The module successfully delivered actionable intelligence for projecting stock targets.                                               |
| Digital Distribution    | Front-end product catalogue                             | The digital catalogue was validated as highly representative and effective for direct consumer sharing via WhatsApp and social media. |

To complement this technical validation, a questionnaire-based evaluation was conducted to gauge stakeholder reception and the perceived utility of the platform. The results indicate a highly favorable reception, with 86.67% of responses categorized as “Strongly Agree” regarding the system's ability to meet operational requirements. Furthermore, the unanimous support for the continuation of these digital initiatives underscores the platform's perceived value and its potential to foster sustainable, long-term digital integration for the enterprise. These findings validate the research's human-centric approach, confirming that the system is not only technically robust but also intuitively aligned with the user's cognitive and operational context.

### 3.5 Deployment and Infrastructure Realization

The deployment phase marked the critical transition of the application from a controlled development

environment to a live, production-ready state, thereby establishing public accessibility for Dapur Ovaltin (operationalized at <https://dapurovaltin.com>). Infrastructure provisioning was strategically executed through the acquisition of a dedicated domain and a cost-effective shared hosting environment, securing a reliable and scalable foundation for continuous operational accessibility. A pivotal component of this deployment was a meticulous data migration strategy. By seamlessly populating the centralized production database with verified product imagery, comprehensive item descriptions, and legacy historical sales datasets, the transition mitigated downtime. Seeding the system with this empirical data was essential not only to guarantee immediate operational readiness but also to instantly activate the system's predictive forecasting capabilities, thereby facilitating a frictionless digital transformation for the MSME.

### 3.6 System Handover, User Adoption, and Sustainability

The effectiveness of a digital intervention is measured not only by its architectural robustness but by its successful integration into daily business workflows. Recognizing the digital literacy constraints identified during the research phase, the handover protocol prioritized a comprehensive, user-centric knowledge transfer.

#### 3.6.1 Knowledge Transfer

The training session served as a bridge between the system's technical capabilities and the owner's administrative needs. It encompassed critical system operations, including secure user authentication, inventory management, and the interpretation of predictive sales analytics.

#### 3.6.2 Workflow Integration

The system was purposively designed to mirror existing business practices, such as WhatsApp-based order management, ensuring that the transition to digital did not disrupt established customer communication channels.

#### 3.6.3 Operational Sustainability

Upon the successful conclusion of the operational trial, full administrative control was transferred to the owner. This transition initiates the periodic maintenance lifecycle, which is essential for ensuring the system's long-term sustainability and reliability in a dynamic economic environment.

## 4. Conclusion and Future Works

This study has successfully engineered and implemented a scalable, web-based sales monitoring architecture for Dapur Ovaltin. By leveraging the Model-View-Controller (MVC) framework, the system ensures a robust separation of business logic from the user interface, providing a foundation for

sustainable digital expansion. The solution transcends conventional geographical constraints through the integration of a digital catalogue, enterprise profiling, and a centralized content management module, thereby optimizing commercial visibility. Furthermore, the architecture advances beyond static digital ledgers by embedding a predictive analytical module, which translates historical transaction data into actionable sales trajectories.

Notwithstanding these achievements, this study acknowledges inherent methodological and functional constraints. Methodologically, the reliance on a foundational Simple Linear Regression algorithm renders predictive accuracy sensitive to the consistency of manual data inputs and incapable of capturing complex, non-linear market fluctuations. Functionally, the transactional infrastructure lacks full autonomy, as the current architecture necessitates manual routing of consumer orders via WhatsApp, precluding a closed-loop, automated financial transaction ecosystem.

To address these limitations and enhance predictive precision, future iterations of this research will prioritize the integration of advanced computational models. Specifically, efforts will focus on transitioning from univariate linear models to sophisticated time-series forecasting techniques, including Autoregressive Integrated Moving Average (ARIMA) and Long Short-Term Memory (LSTM) networks. While ARIMA excels in capturing linear temporal dependencies, the incorporation of LSTM—a specialized recurrent neural network architecture—is essential for modelling long-term, non-linear patterns within the data. LSTM networks are uniquely capable of learning from historical sequences and identifying complex dependencies, which is critical for agribusiness datasets characterized by non-stationary behaviour and irregular seasonal shocks.

Furthermore, to mitigate the impact of exogenous variables—such as localized tourism cycles, micro-climatic shifts, and community-driven demand spikes—future work will prioritize the implementation of Multivariate Regression algorithm and Random Forest algorithms.

The integration of these diverse machine learning approaches will enable the system to synthesize multi-dimensional datasets, moving beyond simple temporal sequences to create a holistic view of market demand. By evolving the platform into a high-fidelity, autonomous Decision Support System (DSS), these advanced deep learning and ensemble models will provide the capacity to better navigate the inherent volatility of rural agribusiness. Ultimately, this progression will foster superior inventory optimization, reduce the fiscal risks

associated with product spoilage, and instil a level of strategic resilience that empowers MSMEs proprietors to make evidence-based decisions in increasingly dynamic and unpredictable economic landscapes.

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