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Development of a Google Apps Script-Based Transaction System with Business Intelligence for Sales Trend Analysis at *Dapoer Mba Nina* MSME

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Abstract: Dapoer Mba Nina is a culinary micro, small, and medium-sized enterprise (MSME) that still relies on manual transaction recording using a cash book, which creates risks of recording errors, difficulties in monitoring sales trends, and challenges in making data-driven business decisions. This study aims to design and develop a web-based transaction system using Google Apps Script integrated with a Business Intelligence dashboard based on Chart.js to analyze sales trends at Dapoer Mba Nina. The study employed an applied research approach using the Waterfall system development model, which consists of requirements analysis, system design, implementation, testing, and evaluation. The developed system uses Google Apps Script for data processing and the web application, Google Sheets as a cloud-based data storage medium, and Chart.js for visualizing sales data on the dashboard. System testing was conducted using Black Box Testing to validate system functionality and User Acceptance Testing (UAT) to assess user acceptance and the suitability of the system for operational needs. The implementation results show that the system can automate sales transaction recording, generate daily, weekly, and monthly sales reports, and display sales trends and best-selling products through an interactive dashboard. The Black Box Testing results show that all tested scenarios operated as designed, while User Acceptance Testing achieved a score of 96%, categorized as very good. The developed system can help improve transaction data management efficiency and support data-driven business decision-making at Dapoer Mba Nina.

Keywords: Google Apps Script; Business Intelligence; Chart.js; Transaction System; MSMEs.

1. Introduction

The development of information technology has encouraged businesses, including micro, small, and medium-sized enterprises (MSMEs), to adopt digital sales information systems as an alternative to manual transaction recording. For small businesses, transaction data are not only needed as daily sales records but also as a basis for monitoring business performance, preparing reports, and making operational decisions. Web-based sales information systems can provide more structured and accurate transaction data, support easier data retrieval, and help business owners use recorded information for data-driven decision-making (Putra & Suprianto, 2024).

Dapoer Mba Nina is a culinary MSME located in West Jakarta that still relies on manual transaction recording using a cash book and messaging applications. Initial observations and interviews with the business owner indicated that the conventional recording process makes sales data difficult to organize and analyze

consistently. The owner has difficulty monitoring best-selling products, daily, weekly, and monthly sales trends, and performance comparisons across periods because the available records are not automatically summarized. These conditions limit the owner's ability to make timely operational decisions, such as determining raw material requirements, evaluating menu performance, and planning promotional activities based on actual sales information. Manual recording also increases the possibility of recording errors and makes historical transaction data less accessible for further analysis.

Similar problems have been reported among other MSMEs in Indonesia. A study on the development of a Google Apps Script-based information system for a grocery store found that transaction recording automation could reduce manual recording errors and accelerate the reporting process (Rindho & Dirgahayu, 2024). In addition, the application of Business Intelligence in MSMEs has been reported to support strategies for developing superior products based on actual sales data rather than estimates (Herdiana *et al.*, 2022). Another study on MSME data management based on the Business Intelligence Development Model Framework emphasized the need to connect transaction recording with data analytics to support the management of micro and small businesses (Primadewi *et al.*, 2021). These studies indicate that digital transaction management becomes more useful when sales records are not only stored, but also processed into information that can support business monitoring and evaluation.

Although previous studies have addressed transaction systems, Google Apps Script, and Business Intelligence applications, their implementation in a single solution for a micro-scale culinary MSME remains limited. This study addresses this gap by developing an integrated transaction system using Google Apps Script and a Chart.js-based dashboard designed according to the operational needs of Dapoer Mba Nina. Google Apps Script is used to process transaction data and provide the web application, while Google Sheets serves as the cloud-based data storage medium. Chart.js is applied to present sales information through interactive visualizations, including sales trends and best-selling products. This approach enables transaction recording, report generation, and sales visualization to be provided in one web-based system without requiring dedicated server infrastructure.

Based on these problems, this study aims to design and develop a web-based transaction system using Google Apps Script integrated with a Business Intelligence dashboard using Chart.js to support sales trend analysis at Dapoer Mba Nina. The study also evaluates the functionality of the developed system through Black Box Testing and assesses user acceptance through User Acceptance Testing (UAT). The expected contribution of this study is to provide a practical system for more structured transaction recording, sales monitoring, and data-driven operational decision-making at Dapoer Mba Nina. In addition, the study provides an implementation example that responds to the digital readiness challenges faced by many MSMEs in Indonesia (Anatan & Nur, 2023).

2. Related Work

This section reviews the theoretical concepts and previous studies related to the development of a Google Apps Script-based transaction system integrated with a Business Intelligence dashboard. The theoretical review focuses on Google Apps Script, Business Intelligence, and Chart.js as the main technologies and concepts used in this study. Previous studies are reviewed to identify the technical and methodological approaches relevant to the development of transaction systems, data management, and sales visualization for MSMEs.

2.1 Google Apps Script and Business Intelligence

Google Apps Script (GAS) is a cloud-based development platform that enables integration and automation across Google services, including Google Sheets, Google Forms, and Gmail. It can also be used to develop web applications without requiring a dedicated server. Through HTML Service, developers can create web-based user interfaces, while server-side JavaScript can be used to process application logic and manage data stored in Google Sheets (Rindho & Dirgahayu, 2024). These characteristics make GAS suitable for micro-scale MSMEs that require a practical information system without complex server infrastructure (Rosanti & Swalaganata, 2024). Business Intelligence (BI) refers to methods, processes, architectures, and technologies used to transform raw data into meaningful information for business decision-making. Conceptually, BI involves data sources, data processing, and information presentation or visualization. The presentation layer enables users to interpret business patterns and trends based on processed data (Primadewi *et al.*, 2021). Google Looker Studio is one example of a data visualization and reporting platform that can connect with Google Sheets and provide interactive dashboards (Hidayattullah *et al.*, 2025; Florencondia *et al.*, 2024). Previous research has shown that interactive dashboards can help non-technical users understand sales information and use it to support business analysis (Hidayattullah *et al.*, 2025). In this study, the BI concept is implemented through the processing of transaction data and its presentation in an interactive dashboard.

Google Apps Script handles application logic and data processing, while Google Sheets serves as the cloud-based data storage medium. Chart.js is then used to visualize processed sales data directly within the web application. This approach allows the dashboard to be developed as part of the transaction system without requiring a separate dashboard platform.

2.2 Chart.js

Chart.js is an open-source JavaScript library for creating data visualizations in web applications. The library supports various chart types, including bar, line, area, pie, doughnut, bubble, radar, polar area, and scatter charts. These capabilities allow developers to select visualizations according to the characteristics of the data and the information requirements of users (Chart.js, 2025). Chart.js receives structured data through JavaScript configuration objects that define chart types, labels, datasets, and display options. In the system developed in this study, data processed through Google Apps Script can be retrieved from Google Sheets and passed to the client side for visualization using Chart.js. This integration allows sales information to be displayed through interactive charts within the web application. Previous studies have demonstrated the use of Chart.js for sales and business information visualization. Evrita and Tony (2023) developed a sales management dashboard using Chart.js to visualize customer distribution, sales percentages by product, and repeat-purchase factors. Another study developed an interactive dashboard using Chart.js and Grid.js to analyze vending machine sales, including sales trends, best-selling products, and payment-method preferences (Fadhillah *et al.*, 2025). In the context of retail inventory and transactions, Rahim *et al.* (2025) applied Laravel and Chart.js to visualize inventory and sales information, including high-margin products and potential stock shortages. These studies support the use of Chart.js for presenting sales information in an interactive format. In the BI-oriented architecture of this study, Chart.js functions primarily as the visualization component. Google Apps Script processes transaction data, Google Sheets stores the data, and Chart.js presents the processed information through an interactive dashboard. The combination is intended to provide sales trend information and identify best-selling products for Dapoer Mba Nina.

2.3 Previous Studies

Previous studies have addressed Google Apps Script, web-based information systems, Business Intelligence, and data visualization from different perspectives. Table 1 summarizes studies that are relevant to the technical and methodological development of the present system.

Table 1. Summary of Previous Studies

No.	Title / Focus	Researchers (Year)	Summary of Findings	Research Gap	Position of This Study
1	Development of a Google Apps Script-Based Grocery Store Information System at Toko Asih	Rindho & Dirgahayu (2024)	Developed a GAS-based information system for a grocery store.	Focuses on a grocery-store information system rather than an integrated culinary sales and analytics system.	Applies GAS to transaction management and sales analytics for a culinary MSME.
2	Implementation of Google Apps Script for Data Input in a Master Data Database	Rosanti & Swalaganata (2024)	Developed a GAS-based interface for master-data input.	Limited to master-data input and does not cover transaction processing and sales reporting.	Extends GAS to transaction processing, reporting, and dashboard visualization.
3	Google Apps Script for Laboratory Information System Development	Haryadina Putra & Dirgahayu (2025)	Developed a laboratory information system using GAS.	The application context is an academic laboratory rather than a retail or culinary business.	Applies GAS to transaction management in a micro-scale culinary business.
4	Web-Based Inventory Stock Information System Development	Wahyudin & Bela (2021)	Developed a web-based inventory system.	Focuses on inventory management rather than sales recording and trend analysis.	Connects sales transactions with sales trend visualization.

5	Inventory Information System Using the Waterfall Method	Aji & Pratmanto (2019)	Developed an inventory system using Waterfall and UML.	Does not address the integration of cloud-based GAS and sales analytics.	Applies a cloud-based GAS and Google Sheets approach for a culinary MSME.
6	Business Intelligence Planning for MSME Superior Product Development Strategies	Herdiana *et al.* (2022)	Developed a BI planning framework for MSMEs.	Focuses on BI planning rather than technical implementation of an operational dashboard.	Implements a sales dashboard for operational analysis at a culinary MSME.
7	Micro, Small, and Medium Enterprises' Readiness for Digital Transformation in Indonesia	Anatan & Nur (2023)	Examined MSME readiness for digital transformation.	Provides a general discussion of digital readiness rather than a technical system implementation.	Provides a practical implementation of a web-based transaction system and dashboard for one MSME.

Based on the reviewed studies, the existing research covers Google Apps Script, Business Intelligence, inventory systems, and data visualization from different perspectives. However, the reviewed studies do not specifically address the integration of daily sales transaction recording with a Chart.js-based sales analytics dashboard for a micro-scale culinary MSME. This study addresses this gap by developing a Google Apps Script-based web transaction system integrated with a Business Intelligence-oriented dashboard using Chart.js, tailored to the operational needs of Dapoer Mba Nina.

3. Methodology

This study employed an applied research approach to develop a transaction system for Dapoer Mba Nina. The methodology covers the research object and approach, data collection techniques, Waterfall-based system development, system requirements analysis, system design, and system testing to evaluate system functionality and user acceptance.

3.1 Research Approach and Object

This study used an applied research approach with the Waterfall system development model. The Waterfall model organizes system development into sequential stages, from requirements analysis to system testing and implementation, and can be applied when system requirements are relatively clear and defined (Handrianto & Sanjaya, 2020). The research object was Dapoer Mba Nina, a culinary MSME located in West Jakarta, while the primary research subject was the business owner as the main system user.

3.2 Data Collection Techniques

Data were collected through observation, interviews, documentation, and literature review, as summarized in Table 2.

Table 2. Data Collection Techniques

No.	Technique	Data Source	Purpose	Output
1	Observation	Operational activities at Dapoer Mba Nina	To understand transaction and sales recording processes	Description of the existing system
2	Interview	Owner of Dapoer Mba Nina	To identify problems and user requirements	System requirements
3	Documentation	Manual records, photographs, and supporting documents	To support findings from observation and interviews	Documentation of the existing conditions
4	Literature review	Journals, books, and previous studies	To establish the theoretical and methodological basis	Scientific foundation of the study

3.3 System Development Stages

The system was developed using a Waterfall-based procedure consisting of six stages: (1) requirements analysis to identify the existing process and user needs through observation, interviews, and documentation; (2) system design covering system architecture, process flows, UML modeling, and Google Sheets data structure; (3) application development using Google Apps Script, Google Sheets, HTML, CSS, and JavaScript; (4) system testing using Black Box Testing to evaluate functions such as login, transaction input, automated reports, and dashboard access; (5) system implementation at Dapoer Mba Nina accompanied by user assistance; and (6) evaluation through User Acceptance Testing (UAT) and an assessment of the initial system impact. The six stages should be presented as the procedure used in this study unless the cited Waterfall reference explicitly defines them as six standard Waterfall phases.

3.4 System Requirements

The requirements analysis identified nine functional requirements and six non-functional requirements, as presented in Tables 3 and 4.

Table 3. Functional System Requirements

Code	Functional Requirement
F-01	The system provides a login process to restrict user access.
F-02	Users can manage product/menu data and selling prices.
F-03	Users can record sales transactions using a shopping-cart process, calculate the transaction total and change, and record the payment method.
F-04	The system automatically stores sales transaction details in Google Sheets.
F-05	The system automatically generates daily, weekly, and monthly sales reports.
F-06	The system identifies best-selling products based on sales data.
F-07	The system provides access to a Chart.js-based Business Intelligence dashboard.
F-08	Users can view recorded transaction history.
F-09	The system displays revenue summaries and performance comparisons across periods.

Table 4. Non-Functional System Requirements

Code	Category	Requirement
NF-01	Usability	The interface is designed to be simple and intuitive for the business owner without a technical background.
NF-02	Performance	The system is expected to process transaction records and display reports within an acceptable time under a normal internet connection.
NF-03	Security	System access is restricted through login authentication and valid user credentials.
NF-04	Reliability	The system is expected to store transaction data consistently in Google Sheets during the recording process.
NF-05	Compatibility	The system can be accessed through a web browser on laptops and Android smartphones without installing an additional application.
NF-06	Maintainability	The system structure is organized to facilitate future maintenance and feature development.

3.5 System Design

The system design consists of three main components: system architecture and process flow, UML modeling, and data structure design. Users access the web application through a browser on a laptop or smartphone. The interface is developed using HTML, CSS, and JavaScript, while user requests are processed through Google Apps Script functions. Transaction data are stored in Google Sheets and subsequently used to generate sales reports and dashboard visualizations using Chart.js. The Google Sheets data structure is divided into seven functional sheets: users, produk, penjualan, detail_penjualan, laporan_harian, laporan_mingguan, and laporan_bulanan. This structure separates user data, product data, transaction details, and periodic reports to support organized transaction management.

3.6 Testing Techniques

System functionality was evaluated using Black Box Testing, which assesses system behavior based on input and output without examining the internal source code. This approach was used to verify whether functions such as login, transaction input, report generation, and dashboard access operated according to the specified requirements (Zen *et al.*, 2024). User Acceptance Testing (UAT) was also conducted with the owner of Dapoer Mba Nina as the primary user to assess system acceptance, ease of use, and suitability for daily

operational needs. Similar approaches have been applied to evaluate user acceptance of web-based information systems (Wahyudi & Alameka, 2023; Fahrullah *et al.*, 2025).

Table 5. System Implementation Environment

No.	Component	Description
1	User devices	Laptop and Android smartphone
2	Operating systems	Windows and Android
3	Web browser	Google Chrome
4	Development platform	Google Apps Script
5	Interface technologies	HTML, CSS, and JavaScript
6	Data storage	Google Sheets
7	Report visualization	Chart.js
8	Primary user	Owner of Dapoer Mba Nina
9	Internet connection	Internet

4. Result and Discussion

This section presents the results of implementing the transaction system at Dapoer Mba Nina and discusses the findings in relation to the research objectives and previous studies. The results cover system implementation, Google Sheets data storage, functional testing using Black Box Testing, and user acceptance evaluation using User Acceptance Testing (UAT).

4.1 Results

The sales transaction information system for Dapoer Mba Nina was developed as a web application using Google Apps Script. The application can be accessed through a web browser on laptops and Android smartphones, so the business owner does not need to install an additional application or manage a dedicated server. Transaction data are entered through the web interface, processed by Google Apps Script, and stored in Google Sheets. The implemented system consists of several main modules, including login, product management, sales transaction recording, automated sales reports, best-selling product identification, transaction history, and a Chart.js-based analytical dashboard. These modules are connected to support the recording, processing, storage, and presentation of sales data in a single web-based environment. The system uses Google-based services as its main implementation environment, as described in Table 5, which allows the application to operate without additional server infrastructure or special hardware for daily use.

Sales transaction data are stored in Google Sheets using separate sheets for transaction headers and transaction details. The penjualan sheet stores the main transaction information, while the detail_penjualan sheet records the individual products included in each transaction. Both sheets are connected through the id_penjualan field, allowing one sales transaction to contain multiple product items while preserving the details of each item sold. In addition to the transaction sheets, the system uses three aggregation sheets, namely laporan_harian, laporan_mingguan, and laporan_bulanan. These sheets summarize transaction totals, sales revenue, and best-selling products for each reporting period. This structure keeps detailed transaction records available for traceability while also providing summarized data for periodic reports and dashboard visualization.

Black Box Testing was conducted to verify whether the main functions of the developed system operated according to the specified requirements. The testing covered user login, product management, transaction recording, automated sales reports, transaction history, best-selling product identification, and dashboard access. As shown in Table 6, all tested scenarios produced outputs that matched the expected results, resulting in a 100% pass rate. The testing focused on system behavior based on input and output without examining the internal program code, which is consistent with the purpose of Black Box Testing (Zen *et al.*, 2024).

Table 6. Black Box Testing Results

No.	Function	Test Scenario	Expected Result	Actual Result	Status
1	Login	User enters valid login credentials	System grants access to the main page	System grants access to the main page	Pass
2	Product Management	User adds, edits, or manages product data	Product data are stored and displayed correctly	Product data are stored and displayed correctly	Pass
3	Transaction Recording	User records a sales transaction through the shopping cart	Transaction total, payment, and change are calculated	Transaction is processed and stored correctly	Pass

			correctly and transaction data are stored		
4	Sales Report	User accesses daily, weekly, or monthly reports	System displays the corresponding sales report	Reports are displayed correctly	Pass
5	Transaction History	User accesses previously recorded transactions	System displays the transaction history	Transaction history is displayed correctly	Pass
6	Best-Selling Products	User accesses product sales information	System identifies products with the highest sales	Best-selling products are displayed correctly	Pass
7	Dashboard	User accesses the sales dashboard	System displays sales trends and related sales information	Dashboard displays the required information	Pass

User Acceptance Testing (UAT) was conducted with the owner of Dapoer Mba Nina as the primary system user. The assessment was intended to evaluate user acceptance, ease of use, system functionality, suitability for daily operational needs, and the clarity of interface and information presentation. The UAT produced an overall score of 96%, which was categorized as very good based on the assessment criteria used in this study. This result indicates that the system was well received by the business owner and that its main functions were considered suitable for supporting daily sales transaction recording, product management, automated reporting, transaction history access, and sales trend visualization.

Table 7. User Acceptance Testing Results

No.	Assessment Aspect
1	Ease of use
2	System functionality
3	Suitability for operational needs
4	Interface and information presentation
5	Overall system acceptance
Overall UAT Score	96%

The 96% UAT score indicates a high level of acceptance from the business owner. This finding is consistent with previous research reporting high user acceptance of web-based information systems with simple and intuitive interfaces (Fahrullah *et al.*, 2025). However, because the UAT involved the primary business user of Dapoer Mba Nina, the result should be interpreted as an evaluation from the owner's perspective rather than as a general measure of acceptance among MSME users.

4.2 Discussion

The implementation of the system changes the transaction recording process at Dapoer Mba Nina from manual cash-book recording to digital transaction recording. Through the developed application, sales data can be recorded through a web-based interface, stored in Google Sheets, summarized into daily, weekly, and monthly reports, and visualized through a Chart.js dashboard. Compared with the previous manual process, this workflow provides the owner with more structured transaction information and makes sales records easier to access for operational monitoring. This finding is consistent with Rosanti and Swalaganata (2024), who demonstrated the use of Google Apps Script for data input and management. However, the present study extends the use of Google Apps Script beyond data input by connecting transaction recording with automated reporting and sales visualization in a single system. This integration allows transaction data stored in Google Sheets to be processed into sales information that can be used directly for analysis. In this context, Google Apps Script functions not only as a data input tool but also as the application logic that connects transaction processing, data storage, and information presentation.

The use of Chart.js supports the presentation of sales information through visual representations of sales trends and best-selling products. This result is in line with Rahim *et al.* (2025), who applied Chart.js to visualize transaction and inventory information for business decision-making. In the present study, the visualization is directed specifically toward the operational needs of a culinary MSME, particularly monitoring daily, weekly, and monthly sales patterns and identifying products with higher sales performance. The dashboard output can therefore help the owner read sales conditions more quickly than relying only on tabular or handwritten records. The resulting sales information can support operational decisions related to raw material planning, menu evaluation, and promotional activities based on recorded sales data. However, this study does not

directly measure changes in the quality or speed of the owner's business decisions. Therefore, the contribution of the system should be interpreted as support for data-driven decision-making rather than as evidence that decision-making performance has quantitatively improved. This finding is relevant to the digital readiness challenges faced by MSMEs in Indonesia, particularly the need for practical digital tools that match the resource limitations and operational characteristics of micro-scale businesses (Anatan & Nur, 2023).

5. Conclusion and Recommendations

Based on the system design, implementation, and testing results, this study concludes that the web-based transaction system using Google Apps Script was developed to support digital sales transaction recording at Dapoer Mba Nina. The system replaces the previous manual cash-book recording process with a digital workflow in which transaction data are recorded through the web application and stored in Google Sheets. The integration of the transaction system with a Business Intelligence dashboard using Chart.js provides daily, weekly, and monthly sales information, along with the identification of best-selling products. These features provide the business owner with more structured sales information and support operational decision-making based on recorded transaction data. Black Box Testing showed that the tested system functions operated according to the specified requirements. User Acceptance Testing (UAT) resulted in a score of 96%, which was categorized as very good based on the assessment criteria used in the study. This result indicates that the system was well received by the business owner and was considered suitable for the operational requirements of Dapoer Mba Nina, particularly for product management, transaction recording, automated reporting, transaction history access, and sales trend visualization.

The developed system provides a practical alternative for managing sales transaction data without requiring a dedicated server for system operation. It supports more structured transaction recording, automated sales reporting, and access to sales information through the dashboard. However, this study does not include quantitative before-and-after measurements of transaction processing time, reporting time, or business performance. Therefore, the findings should be interpreted as evidence that the system supports transaction management and data-based decision-making, rather than as proof of quantified improvement in operational efficiency or business performance. Future research can extend the system by adding an integrated raw-material inventory management module because the current study focuses on sales transactions and does not include raw-material stock management. Further studies can also evaluate the system over a longer implementation period to measure changes in transaction processing time, reporting efficiency, sales turnover, and other operational indicators. Research involving several culinary MSMEs can be conducted to assess the applicability of the proposed system to businesses with different operational characteristics.

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