

# P2GS Web-Based E-CRM with WhatsApp API for MSME Customer Engagement

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**Abstract**—This study discusses the development, implementation, and user guide of the web-based Electronic Customer Relationship Management (E-CRM) P2GS system integrated with the WhatsApp API as an innovative solution for customer relationship management in Micro, Small, and Medium Enterprises (MSMEs). The system was developed using the System Development Life Cycle (SDLC) Waterfall model, comprising requirement analysis, design, implementation, testing, and evaluation stages. The trial was conducted on five MSMEs that are members of Perkumpulan Pengusaha Gading Sukowati (P2GS) in Sragen. Key features include a dashboard, sales management, purchase management, product master data, stock-taking, reporting, and store settings. The WhatsApp API integration enables automated messaging to customers, enhancing retention and engagement. Evaluation results indicate a 23% increase in customer retention, an 18% reduction in marketing costs, and a 12% increase in monthly revenue. The system's usage is documented in the P2GS E-CRM Application User Guide to facilitate adoption and training. This study demonstrates that integrating popular technologies into E-CRM systems can significantly improve efficiency and performance in MSMEs

**Keywords**—E-CRM; WhatsApp API; MSME Empowerment

## I. INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) play a pivotal role in fostering national economic growth and employment generation. In Indonesia, however, many MSMEs continue to encounter substantial challenges in adopting digital technologies for effective customer relationship management [1], [2], [3], [4]. Empirical studies consistently report low levels of digital literacy among micro and small enterprises, highlighting the urgent need for targeted strategies to enhance their digital capabilities [1], [5], [6].

Managerial digital literacy and the availability of skilled human resources are widely acknowledged as essential determinants of successful digital transformation [7], [8], [9]. Nevertheless, MSMEs often face persistent barriers such as limited workforce capacity, inadequate technological proficiency, and the perceived high cost of system development. Although Customer Relationship Management (CRM) has been established as a systematic approach for building and sustaining long-term customer relationships [10], [11], its adoption is disproportionately concentrated among large corporations [12], [13]. MSMEs remain hindered by deficits in technical skills,

concerns over data security, and insufficient managerial support.

Given these constraints, the widespread penetration of WhatsApp as a primary communication platform in Indonesia offers a promising opportunity to develop more accessible and affordable E-CRM solutions. The integration of the WhatsApp Business API into a web-based system enables automated messaging, transaction notifications, and real-time customer interaction—functionalities that can substantially improve communication efficiency and customer engagement [14], [15], [16], [17].

This study aims to design, implement, and evaluate a web-based E-CRM system integrated with the WhatsApp API to enhance customer management practices in MSMEs, with a specific case study of the P2GS business community in Sragen. A design and development research methodology is employed, encompassing needs analysis, system design, prototype development, and user acceptance testing. The evaluation results will be benchmarked against prior empirical findings on the influence of E-CRM on customer loyalty and firm performance.

The contributions of this study are threefold:

1. Proposing an adaptive, cost-effective E-CRM model that leverages widely adopted communication channels to facilitate MSME adoption;
2. Providing replicable technical guidelines for implementation across various business sectors; and
3. Presenting empirical evidence on the capability of WhatsApp API integration to address traditional barriers to CRM adoption.

These contributions are firmly anchored in contemporary literature on CRM implementation, digital literacy limitations, and the business integration of messaging platforms, thus offering both theoretical enrichment and practical value for MSME digital transformation initiatives.

## II. RESEARCH METHODS

This study adopted a software engineering approach utilizing the System Development Life Cycle (SDLC) with the Waterfall model, which comprises five sequential stages: requirement analysis, system design, implementation, testing, and evaluation.

### A. Requirement Analysis

The requirement analysis phase was conducted through surveys and semi-structured interviews involving 50 members of Persatuan Pengusaha Gading Sukowati (P2GS) MSME community in Sragen. The process aimed to identify existing challenges in customer management, including data handling inefficiencies, limited automation, and difficulties in maintaining consistent customer engagement.

#### B. System Design

The system architecture was developed using MySQL as the relational database management system, a PHP-based interface for web application development, and WhatsApp Business API integration for automated communication. The design included data flow diagrams, entity-relationship diagrams, and interface wireframes to ensure system usability and scalability.

#### C. Implementation

The implementation stage involved the development of seven main modules:

1. **Dashboard:** Displays sales summaries, invoices, top-selling products, stock levels, receivables, and payables.
2. **Sales:** Contains cashier sub-menus (retail, wholesale type 1, wholesale type 2), customer data management, invoice generation, and receivable tracking.
3. **Purchases:** Manages purchase transactions, supplier records, purchase invoices, and payable tracking.
4. **Master Data:** Handles product categories, units, and items, including automatic barcode generation.
5. **Stock-Taking:** Facilitates inventory checks and stock adjustments.
6. **Reports:** Generates analytical reports such as cashier performance, customer lists, sales and purchase summaries, stock movement, and best-selling products.
7. **Settings:** Configures store details and invoice templates.

#### D. Testing

Functional validation was conducted using the black-box testing method, focusing on verifying that all system features operated as intended without examining the underlying source code. Test cases were derived from the requirement specifications to ensure coverage of all critical functionalities.

#### E. Evaluation

The system's effectiveness was evaluated by measuring changes in customer retention rates, marketing costs, and average monthly revenue after system deployment. Comparative analysis was performed using pre-implementation and post-implementation data to assess the system's impact on business performance.

### III. RESULT AND DISCUSSION

#### A. Initial Digital Adoption Assessment

Survey results indicated that 82% of respondents had never used a CRM system in their business operations. The primary barriers identified included limited human resources (74%), high system development costs (65%), and low technological literacy (53%). These findings align with prior studies highlighting the human capital and cost-related constraints as persistent inhibitors of digital adoption among MSMEs in Indonesia [1], [7]. The relatively high proportion of MSMEs citing low technological literacy reflects the need for digital tools that require minimal training and are compatible with existing workflows. Similar findings are reported in international contexts, where digital transformation among SMEs requires affordable, user-friendly systems that align with limited technical skills [18], [19].

#### B. Post-Implementation Business Performance

The E-CRM system integrated with the WhatsApp API was piloted in five MSMEs operating in the culinary and fashion sectors. After three months of use, notable performance improvements were recorded:

1. Customer retention increased from 42% to 65% (+23%), indicating stronger repeat purchase behavior.
2. Marketing costs declined from IDR 2.5 million to IDR 2.05 million per month (−18%), primarily due to reduced reliance on manual promotion and more targeted outreach through automated messaging.
3. Monthly revenue grew from IDR 12.5 million to IDR 14 million (+12%), suggesting that enhanced communication and customer engagement translated into higher sales volume.

These findings are consistent with [20], showing that E-CRM can strengthen customer loyalty, and with [21], highlighting automation's cost-saving potential. Recent studies also confirm that WhatsApp and similar messaging platforms significantly improve SME engagement and marketing performance in emerging economies [16], [17].

#### C. Communication and Engagement Dynamics

The integration of the WhatsApp Business API emerged as a key success factor. Given WhatsApp's widespread use in Indonesia, both entrepreneurs and customers exhibited minimal resistance to adopting it as the primary communication channel. Automated notifications for transactions, promotions, and follow-ups ensured timely interactions without significantly increasing the business owner's workload. The embedded analytics module enabled MSMEs to identify customer interaction patterns—such as peak inquiry times and high-response promotions—allowing for data-driven marketing adjustments. Comparable results are found in international literature, which highlights the importance of aligning CRM platforms with widely used communication tools to maximize adoption [16], [17], [22].

#### D. Technical Performance and Usability

Black-box testing validated that all core modules—ranging from dashboard, sales, purchases, inventory management, to reporting—functioned as specified in the requirements. User feedback highlighted three main usability strengths:

1. User-friendly interface, minimizing the learning curve for non-technical users.
2. Mobile compatibility, enabling access via smartphones, which are the primary devices used by MSME owners.
3. Seamless API integration, ensuring stable and fast message delivery without requiring additional configuration by end users.

Black-box testing confirmed that all core modules functioned as required. User feedback emphasized ease of use, mobile compatibility, and stable API integration—factors identified by [14] as essential for MSME technology adoption.

While the system demonstrated clear strengths, it is also important to critically evaluate its limitations and the challenges it presents:

Strengths:

1. The integration of WhatsApp API as the main customer communication tool directly addresses MSME user habits, reducing adoption resistance.
2. The inclusion of core business modules (sales, purchases, stock management, reporting) within the E-CRM platform provides an end-to-end solution rather than a standalone CRM.
3. Mobile compatibility and ease of use align with MSME resource constraints and technology readiness.

Weaknesses:

1. The system relies heavily on stable internet connectivity; poor network conditions can disrupt customer communication and operations.
2. WhatsApp Business API has inherent limitations, such as message templates and quota restrictions, which may reduce flexibility in some use cases.
3. Current analytics capabilities remain basic, offering descriptive insights but lacking advanced predictive or AI-driven recommendations.
4. The platform is web-based only, limiting functionality for users who may require offline access in areas with inconsistent internet coverage.

Challenges:

1. Scalability remains an open question: while effective for small groups of MSMEs, further testing is needed to ensure performance with larger user bases.
2. Data security and privacy issues are critical, especially given the sensitivity of customer transaction records stored within the system.
3. Long-term sustainability requires ensuring MSMEs or business associations like P2GS can maintain, update, and independently operate the system.

4. Overcoming persistent adoption barriers, such as digital skills gaps, requires continuous training and support beyond initial implementation.

This critical perspective highlights that while the P2GS Web-Based E-CRM with WhatsApp API delivers measurable benefits, further refinement is necessary to enhance resilience, scalability, and advanced functionality.

E. Practical Implications

The findings suggest that E-CRM systems leveraging familiar communication channels can substantially reduce adoption barriers for MSMEs. By aligning technology design with user habits, the system bridges the gap between advanced CRM functionalities and the resource constraints of small enterprises. Furthermore, the inclusion of analytics empowers business owners with actionable insights that were previously unavailable, thus enhancing decision-making quality.

F. Limitations and Future Work

While the pilot demonstrated positive business and technical outcomes, the sample size was limited to five MSMEs within two sectors. Therefore, results may not be fully generalizable to other industries or larger business scales. Additionally, the three-month observation period may not capture long-term behavioral and financial impacts. Future studies should involve a broader range of sectors, longer evaluation periods, and comparative analysis with alternative E-CRM platforms to strengthen the empirical evidence base.

#### IV. CONCLUSION

This study successfully designed, developed, and implemented the web-based P2GS E-CRM system integrated with the WhatsApp Business API to address the customer management challenges faced by MSMEs. By leveraging a widely adopted communication platform, the system provided an adaptive and cost-effective solution that aligns with the digital habits of both entrepreneurs and customers. Empirical evaluation demonstrated significant business performance improvements among pilot MSMEs, including a 23% increase in customer retention, an 18% reduction in marketing costs, and a 12% growth in monthly revenue. The availability of a comprehensive user guide further facilitated rapid adoption and enabled the potential replication of the system across diverse MSME sectors.

The novelty of this study lies in the development of a web-based E-CRM integrated with the WhatsApp Business API as the primary customer communication channel, which differs from previous studies that mainly relied on standalone or email-based CRM systems. The system is specifically tailored to MSMEs with limited digital literacy, human resources, and financial capacity, making it both adaptive and cost-effective. Another distinctive contribution is the community-based approach through the case of the Gading Sukowati Entrepreneurs Association (P2GS), and the integration of essential business modules (sales, purchases, inventory, reporting, and store settings) with automated WhatsApp messaging

to strengthen engagement and customer retention. Moreover, unlike many prior studies that stop at the design or prototype stage, this research provides quantitative evidence of tangible business impact and a practical user guide that supports replication and broader adoption in the MSME sector.

Future work should focus on extending system capabilities by incorporating machine learning-based recommendation engines for personalized marketing, as well as chatbot integration to provide round-the-clock customer service. Broader and longer-term evaluations across multiple industries are also recommended to validate scalability and sustainability.

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