

# DATAWAVE<sup>2024</sup>

"Data-Driven and AI-powered Solutions for MSMEs: Fueling Growth with Innovation"

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## The Secret Ingredient: Empowering a Brighter Future for Filipino Micro-Bakeries with YEAST AI

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## INTRODUCTION

Local micro-bakeries in the Philippines play a vital role in their communities, providing accessible food options and employment opportunities, thereby contributing to regional economic stability. However, these micro-bakeries often face significant challenges in financial management and loan utilization due to limited financial literacy (Rupasingha et al., 2019). This knowledge gap can lead to cash flow issues, operational inefficiencies, and difficulties in meeting financial obligations, as highlighted by Gaoat (2023). The perishable nature of bakery products and market volatility (Anggadini et al., 2023) further exacerbate these challenges, impacting their financial stability. Additionally, traditional banking products often lack the flexibility and affordability required to effectively serve micro-bakery businesses. This study introduces a tailored financial solution aimed at empowering micro-bakery owners by enhancing their financial literacy and decision-making capabilities. This intervention seeks to bolster their resilience and support local economic development.

## METHODOLOGY

### Phase 1: Chatbot Setup and Data Infrastructure

- Deployment and Configuration:** YeastAI, deployed on Facebook Messenger via Python and its API, will use conditional logic and message templates to facilitate financial assessments, recommendations, and customer support.
- Database and Security Setup:** A secure connection to the Supabase database will be established to store bakery profiles, financial histories, and assessment data collected through Google Forms. Encryption protocols and access controls will be implemented to safeguard user privacy and ensure compliance with data security standards.
- Database Storage and Retrieval:** Loan data and business strategy documents will be embedded and retrieved using vector storage for fast, context-driven retrieval. This scalable structure will enable efficient integration of new data sources as the system expands.

### Phase 2: Data Integration and AI Processing

- User Data Collection:** Google Forms will be integrated to automatically link assessment results with user profiles in Supabase. Unique user IDs will connect form responses to chatbot interactions, ensuring seamless data updates.
- Loan Data Standardization:** Python scripts will be used to scrape, parse, and clean loan data, standardizing it for compatibility with the recommendation engine.
- Embedding Strategy Documents:** Strategy documents will be vectorized, transforming them into searchable embeddings for personalized recommendations.
- AI Integration:** The AI model will be trained with prompts to provide real-time insights on cash flow, seasonal forecasts, and loan suggestions. The chatbot will be coded to offer loan and inventory recommendations based on sales and market data.

### Phase 3: Model Processing

- YeastAI Model Processing:** The data pipeline will feed user profile data, loan options, and embedded strategies into the YeastAI model.
- AI-Powered Recommendations:** Functions will be coded to tailor loan suggestions and business strategies to each bakery's unique profile, covering operations, marketing, and financial management based on the model's predictions.
- Output Delivery:** Recommendations will be delivered through Messenger in a clear, concise, and user-friendly format.

### Phase 4: Testing, Launch, and Optimization

- Testing for Usability and Accuracy:** The system will undergo rigorous testing, beginning with unit tests for message flows, database interactions, and model outputs. Alpha testing will assess financial tracking, AI recommendation accuracy, and system stability. Beta testing with bakery owners will validate usability and functionality, gathering feedback for further improvements.

- Chatbot Launch and Support:** The chatbot will be deployed on Messenger with load balancing to ensure high performance and reliability. User guides, tutorials, and chat-based support will be provided to assist users with essential functions like cash flow tracking, inventory management, and loan insights.
- Continuous Learning and Model Updates:** A feedback loop will capture user responses and outcomes, refining prompts and improving model predictions. The model will be regularly retrained using updated financial and industry trends to maintain relevance and accuracy. Predictive features will be gradually expanded through coding sprints to integrate new capabilities based on user feedback and evolving needs.

This phased methodology ensures that the chatbot remains adaptable, user-centered, and continuously improving, effectively supporting micro-bakeries in their financial management journey.

## RESULTS

### Understand customer classification and segmentation.

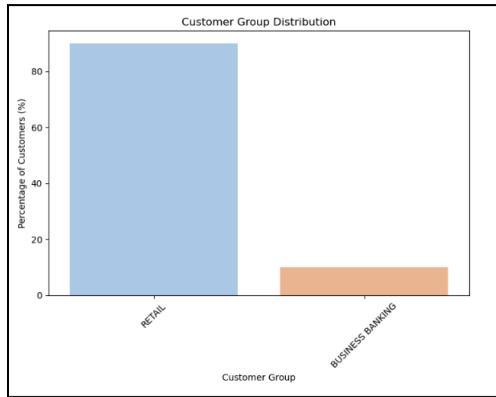


FIGURE 1. Customer Group Distribution

The graph reveals that the majority of customers, approximately 80%, belong to the Retail segment. This insight highlights the dominance of Retail customers and provides valuable information for strategic decision-making. By understanding this customer distribution, businesses can tailor their marketing efforts, product development, and customer experiences to cater to the needs of the larger Retail segment.

### Analyzing transaction types, transaction flow, and costs associated with business banking.

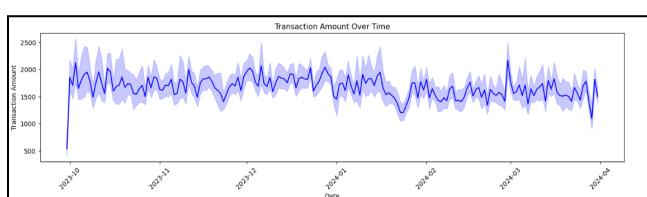


FIGURE 2. Transaction Amount Over Time

The line graph depicts the monthly transaction amount trend over a six-month period. It shows a fluctuating pattern with peaks in October 2023 and January 2024,

and troughs in December 2023 and February 2024. This suggests that transaction activity is not consistent throughout the months, possibly influenced by seasonal factors or specific events.

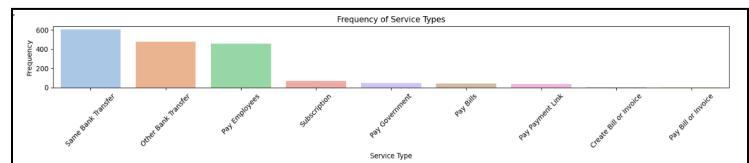


FIGURE 3. Frequency Graph of Service Types

The bar chart shows the frequency of different service types offered by a bank or financial institution. The most frequent service type is "Same Bank Transfer," followed by "Other Bank Transfer" and "Pay Employees." The remaining service types, such as "Subscription," "Pay Government," "Pay Bills," "Pay Payment Link," "Create Bill or Invoice," and "Pay Bill or Invoice," have significantly lower frequencies.

### Understanding consumer spending behavior, payment preferences, and channel choice (online vs. physical)

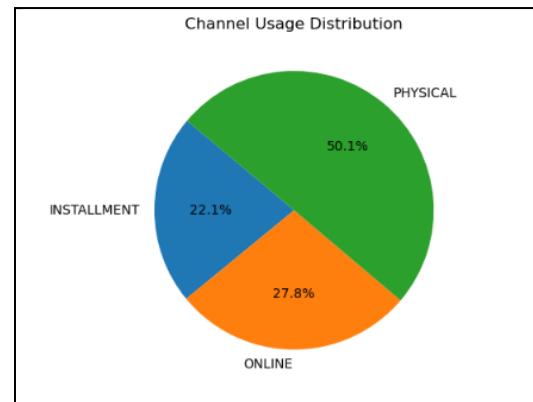


FIGURE 4. Distribution of Channel Usage among Customers

The pie chart illustrates the distribution of channel usage, with physical channels being the most preferred method, accounting for 50.1% of usage. Online channels follow closely with 27.8%, and installment payments constitute 22.1%.

### Understanding loan usage patterns and repayment behaviors

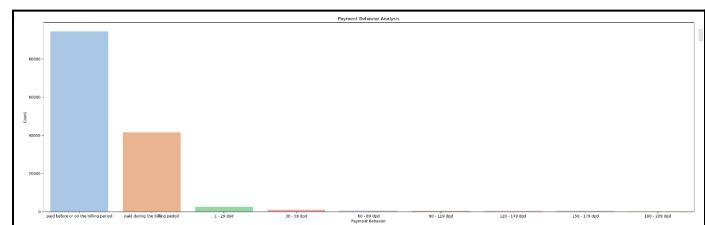


FIGURE 5. Graph of Payment Behaviour Analysis

The bar chart shows most customers pay on time or within 30 days, with a smaller group delayed by 31-60 days. Fewer delays beyond 60 days suggest a low risk of major loan defaults. This data can refine credit risk assessments, target outreach to delayed customers, and encourage timely repayments.

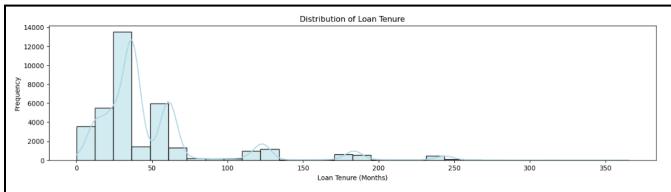


FIGURE 6. Histogram for the Distribution of Loan Tenure

The histogram displays the distribution of loan tenures in months. The data appears to be right-skewed, with a majority of loans having shorter tenures. There are peaks around 30 and 60 months, suggesting popular loan terms. A few loans have significantly longer tenures, extending beyond 200 months. This distribution indicates a mix of short-term and long-term loans, with a preference for shorter-term options.

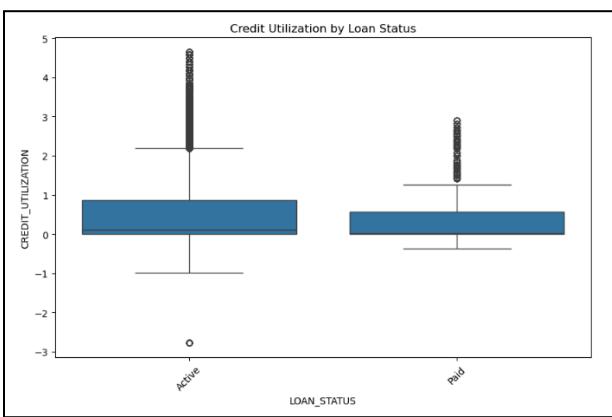


FIGURE 7. Credit Utilization by Loan Status Graph

The box plot shows a clear difference in credit utilization between active and paid loans. Active loans have a higher median credit utilization and a broader range, indicating that borrowers with active loans generally use more credit. This insight can help lenders assess credit risk, adjust marketing strategies, and develop products suited to different customer segments.

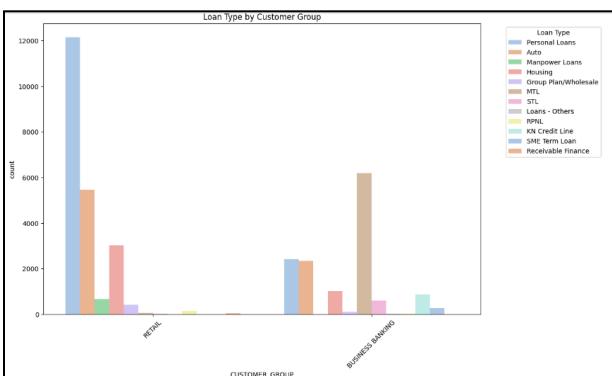


FIGURE 8. Bar Graph showing the Count of Loan Types by Customer Group

The graph shows retail customers favor Personal Loans (over 12,000 counts), followed by Auto Loans and Receivable Finance. In contrast, business banking customers mainly use Receivable Finance (over 6,000 counts), with other loan types like SME Term Loans being less common. This highlights the distinct loan preferences between retail and business clients.

## DISCUSSION

### Leveraging Banking Data for Bakery Financial Management:

BPI's data reveals opportunities for YeastAI to support micro-bakeries. The dominance of retail customers and the growth of business banking highlight the need for efficient financial tools. Consumer spending patterns and the rise of online transactions underscore the demand for tailored digital services. While most customers manage credit well, a segment's reliance on credit and minimum payments necessitates targeted financial literacy interventions within YeastAI. Strong loan repayment behavior and BPI's flexible loan tenures offer a positive outlook for micro-bakery financing. The increasing adoption of digital banking emphasizes the need for continuous innovation in user experience and functionality, areas where YeastAI can play a key role. The popularity of traditional banking products and cross-selling opportunities suggest avenues for expanding financial services for micro-bakeries. Additionally, analysis of debit card spending and interbank transfers can inform targeted marketing strategies and reveal potential partnerships.

### Simulating Bakery Finances with Banking Data:

- Sales Forecasting and Inventory Management -** YeastAI analyzes card transactions to identify seasonal trends and peak demand, helping bakeries optimize inventory and reduce waste. For example, recognizing holiday pastry demand lets bakeries adjust production and avoid overstocking or understocking.
- Cash Flow Forecasting-** Tracking interbank transfer data gives bakeries a clear financial view. Analyzing cash flow patterns helps predict shortfalls or surpluses, enabling proactive planning, such as adjusting borrowing and optimizing budgeting during high expenditure periods for lean, profitable months.

### Creating Detailed Customer Profiles:

- Personalized Marketing -** Segmenting customers by behavior and demographics enables bakeries to create targeted campaigns with personalized promotions, like wedding cake discounts or seasonal items for health-conscious buyers. This understanding of preferences drives engagement and sales while minimizing marketing costs.
- Product Development -** Analyzing customer preferences and feedback helps bakeries adapt to trends. Monitoring social media and reviews reveals rising demands, like gluten-free or vegan products, guiding new offerings to stay competitive.

### Assessing Creditworthiness and Financing Needs:

- Loan Eligibility -** By analyzing credit card and loan data, YeastAI assesses creditworthiness, helping bakeries access capital and optimize loan terms. Strong credit and steady revenue enable better rates and larger loans for expansion, guiding informed financing decisions.

- **Financial Health Monitoring-** Ongoing monitoring of key financial metrics like revenue, expenses, and profit margins helps bakeries stay on top of their financial health. By tracking these, bakeries can spot risks early and take corrective actions, such as adjusting prices or cutting costs, to ensure long-term financial sustainability.

### Empowering Bakeries with AI-Driven Financial Management:

- **Data-Driven Decision Making** - YeastAI helps bakery owners make informed decisions on pricing, promotions, and resource allocation by analyzing sales data. It suggests optimal pricing strategies, adjusting for high-demand periods to maximize revenue and align with customer trends.
- **Operational Efficiency** - YeastAI automates routine tasks like inventory management and order processing, boosting efficiency and reducing costs. It prevents overordering, ensures ingredient availability, and minimizes waste, allowing staff to focus on higher-value tasks.
- **Risk Mitigation**- YeastAI analyzes sales data to identify financial risks and helps bakeries mitigate them. For example, it forecasts seasonal fluctuations, enabling targeted marketing or discounts during slow periods to protect profitability.

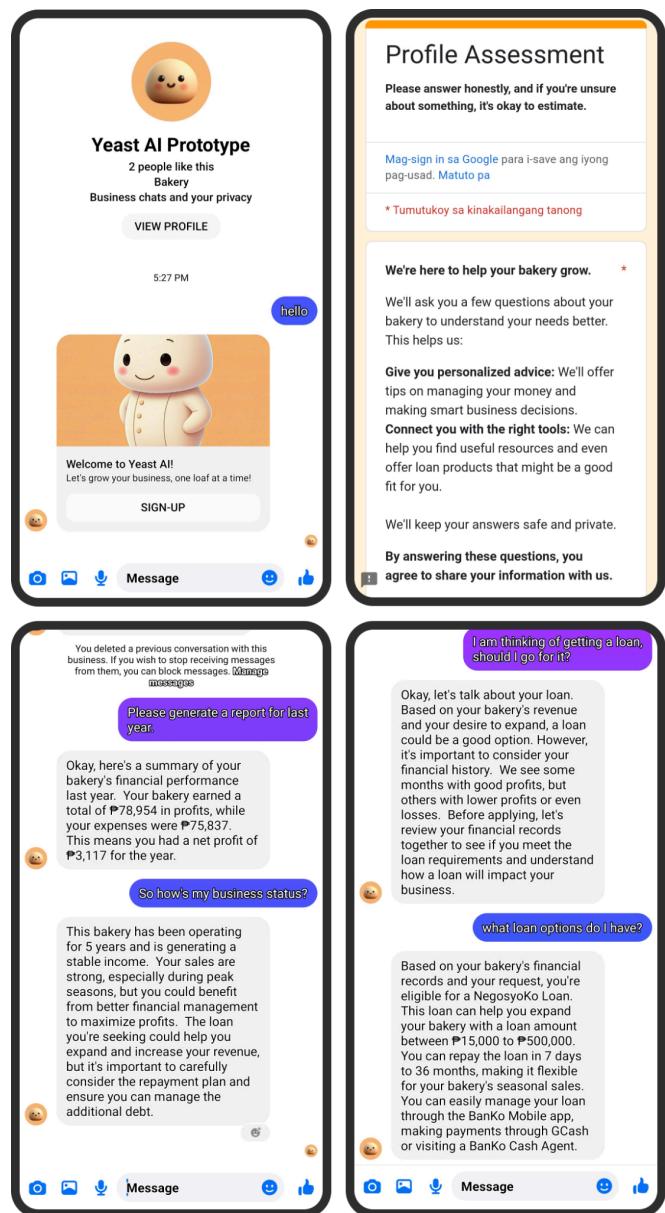
### Addressing Potential Challenges and Limitations:

While banking data offers significant advantages for bakery financial management, it is essential to acknowledge several potential challenges:

- **Data Quality and Relevance:** The usefulness of banking data depends on its quality and relevance. It may require cleaning or preprocessing to ensure accuracy, especially when integrating multiple sources. High-quality data is crucial for making accurate forecasts and decisions.
- **Generalizability:** Insights from banking data may not apply to all bakeries. Niche markets or unique business models may require customized analyses. Tailoring AI-driven insights to different bakery types is key to maximizing data utility.
- **Ethical Considerations:** AI and machine learning raise ethical concerns around data privacy, bias, and transparency. It's crucial to handle customer data responsibly, protect privacy, and ensure algorithms are transparent and unbiased to maintain trust and fairness.

By addressing these challenges and leveraging AI, YeastAI unlocks the potential of banking data for bakeries, driving innovation, streamlining operations, and ensuring long-term financial sustainability. With data-driven insights and better decision-making, YeastAI provides bakeries with a comprehensive solution for financial management and building a resilient business model.

### PROJECT PROTOTYPE



### REFERENCES

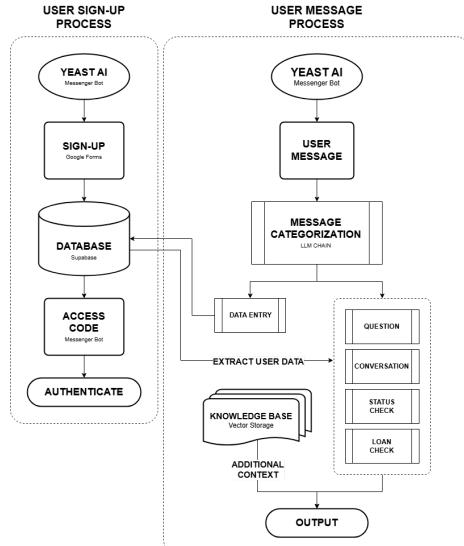
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## APPENDIX

### Appendix A: Data Pipeline



### Appendix B: Code Snippets

Figure 1: LLM Chain for Generating Business Overview

```

129 # Function: LLM Chain for Generating Business Overview
130 def generate_overview(lm, answers):
131     template = """
132         Generate a business overview of a bakery using these answers from a questionnaire:
133
134         1. How long has your bakery been open? (Years in business) - (q1)
135         2. Who owns the bakery? (Ownership) - (q2)
136         3. What is the total monthly revenue of your bakery? (Annual revenue) - (q3)
137         4. Are your bakery's sales steady throughout the year? (Sales consistency) - (q4)
138         5. Can you tell when your bakery has its busiest time? (Peak seasons) - (q5)
139         6. What is the total area of your bakery? (Physical records) - (q6)
140         7. Do you feel your bakery's profit margin is good? (Financial profits) - (q7)
141         8. Do you understand words like "sales," "income," "costs," and "profit"? (Financial terms) - (q8)
142
143         Note it short while maintaining the important details. Please answer directly.
144
145     """
146
147     prompt = PromptTemplate.from_template(template)
148     chain = prompt | lm
149     result = chain.invoke({"q1": answers["q1"], "q2": answers["q2"], "q3": answers["q3"]},
150                          {"q4": answers["q4"], "q5": answers["q5"], "q6": answers["q6"]},
151                          {"q7": answers["q7"], "q8": answers["q8"], "q9": answers["q9"]},
152                          {"q10": answers["q10"], "q11": answers["q11"], "q12": answers["q12"]})
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154     return result.content
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