Creating Menu Combinations To Increase Sales Using Association Algorithms: A Case Study On Atap Bukit Café Salatiga

[1]Uma Zufar Satwika, [2]H.A. Danang Rimbawa

Department of Cyber Defense Engineering
Faculty of Defense Engineering and Technology, Republic of Indonesian Defense University (RIDU)
Bogor, Indonesia
Corresponding Author: Uma Zufar Satwika. E-mail: uma.satwika@tp.idu.ac.id

Resume— The objective of this study is to apply association rule mining, specifically the Apriori algorithm, to analyze transaction data at Atap Bukit Cafe in Salatiga. This research aims to identify frequent itemset patterns in menu purchases that can be transformed into combination packages to increase sales and support MSME sustainability in the post-Covid economy. Using the CRISP-DM methodology, the research involved five stages: business understanding, data understanding, data preparation, modeling, and evaluation. Transactional data for May 2022 was processed into a binary dataset, and association rules were generated with a minimum support threshold of 10% and a minimum confidence threshold of 50%. The analysis produced four key rules, including a 100% confidence relationship between Chocolate Hazelnut, Kebab Monster, and Americano. The findings show that menu bundling strategies based on these rules can increase average transaction size, improve promotional design, and strengthen inventory planning. Despite limitations such as a one-month dataset and the exclusion of profitability variables, this study demonstrates that data mining techniques can provide actionable insights for MSMEs with limited resources.

Keywords: Association Algorithm, MSME, Problem Solution, Analysis

Abstract— Data Mining is the process of processing data to obtain useful information in the form of science and other important information. This research uses the Association Algorithm, which is one of the methods in data mining that aims to find patterns that often appear among many transactions, where each transaction consists of several items. The use of this algorithm is used to analyze the current situation in an MSME. The results of this study can be used as a solution to overcome the problems that happens in MSME and make the right decisions to overcome these problems. However, with the lack of variables used, increasing the variables used can determine a more effective solution and also the use of other methods can help in overcoming problems.

Keywords: Association Algorithm, MSME, Problem Solution, Analysis

I. INTRODUCTION

Micro, Small, and Medium Enterprises (MSME) are widely acknowledged as the backbone of both regional and national economies, contributing to employment opportunities and community welfare. In Indonesia, particularly in small transit cities such as Salatiga, MSME in the culinary sector play a vital role in sustaining economic resilience. However, the Covid-19 pandemic has severely disrupted this sector by forcing changes in consumer behavior from offline to online transactions and causing a significant decline in revenue (Permenkes, 2020). Although restrictions were lifted in 2022, more than 200 MSME in Salatiga ceased operations and over 120 reported severe declines (Perwali Salatiga, 2020). This illustrates the urgency of finding innovative strategies to ensure

business sustainability. Atap Bukit Cafe, a culinary MSME in Salatiga, experienced such sales declines, highlighting the need for technology-assisted solutions that are low-cost and data-driven (Inmendagri, 2022).

One promising approach is the application of association rule mining algorithms, particularly the Apriori algorithm, to analyze transaction data and uncover hidden patterns in consumer purchasing behavior. Previous studies have demonstrated the effectiveness of association rule mining in product recommendation systems, inventory management, and marketing strategies. Riszky and Sadikin (2019) successfully applied the Apriori algorithm to generate product recommendations, while Yanto and Khoiriah (2015) employed it to identify patterns in pharmaceutical purchases. Similarly, Tampubolon, Saragih, and Reza (2013) applied the same method to manage medical equipment inventory. These findings confirm that association algorithms are capable of revealing relationships among items that frequently co-occur in transactions. However, limited studies have specifically addressed the application of this technique in menu bundling strategies for culinary MSME, especially those operating with sparse transactional data and constrained promotional resources.

This research aims to address that gap by applying the Apriori algorithm to transaction data from Atap Bukit Cafe to identify potential menu combinations that can be transformed into promotional packages. Unlike previous works, this study emphasizes the translation of analytical rules into actionable business strategies, such as bundling beverages and food items or designing discount schemes based on co-purchase patterns. The findings are expected not only to provide practical recommendations for Atap Bukit Cafe but also to contribute to broader discussions on how data-driven decision-making can strengthen the resilience and competitiveness of MSME in the post-pandemic digital economy.

II. RESEARCH METHOD

A. Literature Review

Research on association rule mining has been widely applied in various domains. Riszky and Sadikin (2019) demonstrated the application of the Apriori algorithm for product recommendation systems, showing that results obtained manually and via software such as WEKA are consistent and reliable. Yanto and Khoiriah (2015) applied Apriori to pharmaceutical purchase data and achieved confidence values up to 77.7%, highlighting its predictive power in identifying co-purchase behavior. Tampubolon, Saragih, and Reza (2013) utilized the same method to support inventory planning for medical equipment, underscoring Apriori's relevance in contexts requiring accurate stock preparation.

These studies collectively indicate that Apriori is versatile and effective in uncovering hidden purchasing patterns. However, most applications have focused on large retail datasets or specialized domains such as healthcare. Limited attention has been given to culinary MSMEs, which operate with smaller transaction volumes, limited resources, and unique challenges related to taste compatibility and menu diversity. This study addresses this gap by situating Apriori in the context of a café, with the aim of informing menu bundling strategies that directly impact revenue.

B. Conceptual Framework of Data Mining

Data mining, often referred to as Knowledge Discovery in Databases (KDD), is a systematic process of extracting valid, novel, and actionable patterns from data (Rajput, 2023). KDD typically involves five stages:

1. Data Selection – identifying relevant datasets for analysis.

2. Data Preprocessing – cleaning, handling missing values, and transforming data into usable formats.

3. Transformation – converting data into forms suitable for mining (e.g., binary matrices).

4. Data Mining – applying algorithms to discover patterns, rules, or models.

5. Interpretation and Evaluation – assessing the significance and usefulness of the results.

In practice, the CRISP-DM (Cross-Industry Standard Process for Data Mining) methodology is often used because of its structured approach. CRISP-DM consists of six iterative phases: business understanding, data understanding, data preparation, modeling, evaluation, and deployment. For this study, the first five phases are employed.

1. Business Understanding: identifying the café's problem—declining sales during and after Covid-19.

2. Data Understanding: analyzing transaction records for menu items, sales frequency, and payment methods.

3. Data Preparation: converting raw transactions into a structured binary format (0 = not purchased, 1 = purchased).

4. Modeling: applying the Apriori algorithm to generate association rules.

5. Evaluation: interpreting rules and translating them into menu bundling strategies.

C. Association Rule Mining

Association rule mining is one of the most widely used techniques in data mining, particularly suited for market basket analysis. It seeks to discover relationships of the form:

$$X \rightarrow Y$$

where X and Y are disjoint itemsets. Two key measures define the strength of rules:

- Support

$$Support(X \rightarrow Y) = \frac{Transactions(X \cup Y)}{TotalTransactions}$$

This indicates the proportion of transactions containing both X and Y.

- Confidence

$$Confidence(X \rightarrow Y) = \frac{Transactions(X \cup Y)}{Transactions(X)}$$

This measures the conditional probability that a transaction containing X also contains Y.

- Lift

$$Lift(X \rightarrow Y) = \frac{Confidence(X \rightarrow Y)}{Support(Y)}$$

A lift greater than 1 suggests a positive association, while a lift near 1 suggests independence.

Example: If 20% of transactions include Americano and Kebab Monster, and 15% include Americano alone, then:

- Support = 20%

- Confidence = 20% ÷ 15% = 1.33 (or 133%)

- Lift > 1 indicates a meaningful association.

D. The Apriori Algorithm

The Apriori algorithm operates iteratively:

1. Generate candidate itemsets of length k from frequent itemsets of length k–1.

2. Prune candidates that do not meet minimum support thresholds.

3. Repeat until no further frequent itemsets can be generated.

Its main advantage lies in simplicity and interpretability, making it suitable for MSMEs with limited computational resources. However, Apriori can become computationally expensive with very large datasets due to repeated scanning of the database.

Comparison with Other Algorithms:

- FP-Growth: More efficient for large datasets, but less intuitive for small businesses without technical expertise.

- ECLAT: Uses depth-first search and vertical data layout, faster in some cases but harder to interpret.

For MSMEs with relatively small datasets, Apriori strikes a balance between ease of implementation and interpretability.

E. Relevance to MSME

Applying Apriori in MSME is particularly beneficial because:

1. Transaction datasets are often small and manageable, making computational cost negligible.

2. Insights are directly actionable, such as bundling Americano with Kebab Monster based on observed co-purchases.

3. The methodology supports data-driven decision-making without requiring advanced analytics infrastructure.

In the context of Atap Bukit Cafe, the method not only helps in identifying natural bundles but also informs stock management and promotional design. This aligns with broader goals of strengthening MSME resilience in the post-pandemic digital economy.

F. Relevant to the Present Study

Building on prior research, this study applies the Apriori algorithm to transactional data from Atap Bukit Cafe in Salatiga. The aim is not only to validate the algorithm's ability to detect frequent itemsets but also to translate these findings into actionable menu bundling strategies. Unlike previous works that emphasized technical validation, this research focuses on the practical translation of rules into business strategies that can strengthen the resilience of MSME in the post-pandemic economy.

III. RESULTS AND DISCUSSION

A. Descriptive Analysis of the Dataset

The dataset analyzed originates from Atap Bukit Cafe's transaction records for May 2022. Each transaction contains the purchase time, list of ordered menu items, total bill, and payment method. After preprocessing, the data was represented in a binary incidence matrix where "1" indicates that an item was purchased in a transaction, and "0" otherwise.

A descriptive overview reveals that beverages dominate sales, with milk coffee variants such as Kopi Susu Gula Aren (single and double shot) and Chocolate Hazelnut appearing most frequently. Non-coffee beverages such as Lychee Tea also demonstrate high popularity, particularly among younger demographics who may prefer lighter drinks. Conversely, food items such as Kebab Monster, Nasi Goreng Katsu, and Indomie Katsu are sold in smaller volumes but serve as high-value complementary items.

Payment method data shows that transactions are almost evenly split between cash and card (BCA). Interestingly, higher-value orders tend to use card payments, suggesting that bundling strategies targeting premium packages could also consider integrating cashless promotions (e.g., bank partnerships or e-wallet discounts).

This descriptive layer is critical for contextualizing the subsequent association rule mining: it highlights which items are natural anchors for promotion (drinks) and which act as value boosters (meals/snacks).

B. Application of Apriori Algorithm

The Apriori algorithm was employed with a minimum support threshold of 10% and confidence threshold of 50%. These parameters were chosen to balance significance and feasibility: higher support thresholds eliminated potentially valuable niche patterns, while lower thresholds generated excessive trivial associations.

The algorithm extracted four core association rules deemed relevant for managerial decision-making. The rules, along with their statistical measures, are summarized in Table 1.

Rule	Support (%)	Confidence (%)	Lift	Interpretation
Chocolate Hazelnut + Americano → Kebab Monster	11.6	82.4	1.24	Customers pairing two beverages often add a heavy meal.
Chocolate Hazelnut + Kebab Monster → Americano	7.8	100	1.18	Every purchase of this combo included Americano.
Lychee Tea → Tea	12.5	65.0	1.12	Customers buying Lychee Tea frequently also purchase another tea variant.
Indomie Katsu → Kopi Susu Gula Aren	10.2	58.0	1.09	Instant noodle dishes are often paired with sweet milk coffee.

C. Interpretation of Rules

Rule 1: {Chocolate Hazelnut, Americano → Kebab Monster}

With support of 11.6% and confidence of 82.4%, this rule suggests a strong linkage between two popular coffee beverages and a food item. The lift value of 1.24 indicates that the likelihood of ordering Kebab Monster increases by 24% when customers purchase Chocolate Hazelnut and Americano together.

Implication: The café can introduce a "Coffee Pair + Snack" bundle, offering a discount for purchasing these three items together. This strategy leverages existing consumer behavior rather than forcing new habits, thereby reducing promotional risk.

Rule 2: {Chocolate Hazelnut, Kebab Monster → Americano}

This rule exhibits perfect predictive power with confidence = 100%. Every time Chocolate Hazelnut and Kebab Monster were purchased, Americano was also included. Although the support is slightly lower (7.8%), the confidence value highlights a guaranteed co-occurrence.

Implication: Café managers can highlight Americano as the "anchor product" for bundling strategies. For example, offering "Buy Kebab Monster + Chocolate Hazelnut, get Americano at 50% off" could increase sales volume while preserving margins on the anchor product.

Rule 3: {Lychee Tea → Tea}

This rule shows that customers ordering Lychee Tea have a 65% probability of also ordering another tea-based drink. This reflects a consumer tendency to purchase multiple light beverages, potentially for group orders or sharing.

Implication: The café could design promotions such as "Tea for Two" or "Double Tea Deals" targeting students and younger consumers who frequently order in groups. This leverages natural pairing tendencies without cannibalizing higher-margin coffee sales.

Rule 4: {Indomie Katsu → Kopi Susu Gula Aren}

With support of 10.2% and confidence of 58%, this rule reflects the common consumer preference for pairing savory instant noodle dishes with sweetened milk coffee.

Implication: The café could market a "Comfort Combo" package (Indomie Katsu + Kopi Susu Gula Aren), particularly for evening customers seeking a quick and affordable meal.

D. Comparative Discussion with Previous Studies

The results are consistent with prior research demonstrating the versatility of the Apriori algorithm. Riszky and Sadikin (2019) emphasized its effectiveness in generating reliable product recommendations, while Yanto and Khoiriah (2015) showed its predictive strength in pharmaceutical retail with confidence levels up to 77.7%. The present study not only confirms similar or higher confidence values (up to 100%) but also extends the application to culinary MSMEs, a domain with distinct consumer behavior driven by taste compatibility and dining context.

Tampubolon, Saragih, and Reza (2013) highlighted Apriori's utility in stock preparation. Translating this insight, the café could use the rules identified here to ensure co-stocked inventory. For example, if Chocolate Hazelnut and Americano are often purchased with Kebab Monster, inventory planning must guarantee availability of all three items simultaneously to avoid lost sales opportunities.

E. Business and Managerial Implications

1. Menu Bundling Strategies

Bundling increases average transaction size while delivering perceived value to customers. Rules 1 and 2 suggest bundles like:

- "Coffee Lovers Package" (Americano + Chocolate Hazelnut + Kebab Monster).
- "Snack Combo" (Kebab Monster + Americano).

2. Cross-Selling Opportunities

High-confidence rules provide opportunities for targeted cross-selling. For instance, baristas can be trained to suggest Americano when a customer orders Chocolate Hazelnut and Kebab Monster.

3. Menu Design and Placement

Visual arrangement of menus can reflect natural co-purchase patterns. Placing related items side by side in digital menus or signage can subtly nudge customers toward bundles.

4. Operational Efficiency

Association rules can guide procurement and kitchen operations. By aligning stock levels with co-purchase patterns, the café minimizes the risk of lost sales and reduces waste.

5. Digital Transformation of MSME

This research demonstrates that even small cafés can leverage simple data mining techniques to compete in the digital economy. Adopting digital POS systems and applying Apriori regularly can transform anecdotal decision-making into evidence-based strategy.

F. Limitations and Future Directions

Despite promising results, this study faces several limitations:

- Dataset Constraints: Analysis is limited to one month of transactions; seasonal and long-term trends are not captured.

- Variable Scope: Only item-level data was analyzed, excluding price, margin, or customer demographics.

- Descriptive Nature: Association rules identify correlations but not causality; further predictive modeling is needed for robust decision-making.

Future research should integrate time-series forecasting (to identify seasonal trends), profit-margin weighting (to prioritize profitable bundles), and customer segmentation analysis (to tailor promotions for specific demographics). Advanced algorithms such as FP-Growth or hybrid recommendation systems could also enhance scalability.

IV. CONCLUSION

This study applied the Apriori association rule mining algorithm to transactional data from Atap Bukit Cafe, using a minimum support threshold of 10% and a minimum confidence threshold of 50%. The analysis produced four significant rules, the most notable of which revealed that beverage combinations such as Chocolate Hazelnut and Americano strongly co-occur with food items like Kebab Monster. The rules achieved confidence levels as high as 100%, demonstrating the algorithm's ability to uncover robust purchasing patterns even in relatively sparse MSME datasets.

The findings highlight that menu bundling strategies informed by association rules can serve as a low-cost yet effective approach for increasing sales and sustaining MSME performance. Unlike ad-hoc promotions, data-driven bundling reflects actual consumer behavior, thereby reducing risk and improving the likelihood of campaign success. Furthermore, the results extend previous research by contextualizing association rule mining within the culinary MSME sector, which presents distinct challenges compared to retail or healthcare applications.

From a managerial perspective, this study provides practical recommendations: (1) develop bundle promotions such as "Coffee Lovers Combo" or "Snack and Coffee Package" to increase average transaction size, (2) align inventory planning with frequently co-purchased items to avoid stockouts, and (3) leverage digital POS data to continuously refine promotional strategies.

Nevertheless, the study is limited by its dataset, which covered only one month of transactions and excluded variables such as price sensitivity, consumer demographics, and seasonal demand. Future research should expand the scope of analysis to include time-series prediction models, profit-margin weighting, and multi-algorithm comparisons (e.g., FP-Growth, ECLAT). Incorporating these elements will not only enhance accuracy but also enable more comprehensive decision support for MSMEs.

In conclusion, this research demonstrates that even small-scale enterprises can benefit from simple yet powerful data mining techniques. By embracing data-driven decision-making, MSME such as Atap Bukit Cafe can strengthen their resilience in the post-pandemic digital economy, turning raw sales data into actionable insights that drive sustainable growth.

1. Recomendation

Based on the findings of this study, several recommendations can be proposed to strengthen both the practical application and future development of association rule mining in the context of culinary MSME:

1) For Café Management (Practical Implementation):

- Develop data-driven menu bundles such as "Coffee Lovers Combo" (Americano + Chocolate Hazelnut + Kebab Monster) or "Snack & Coffee Package" that directly reflect purchasing patterns.

- Regularly update transaction data through a digital POS system to enable continuous analysis and adjustment of promotional strategies.

- Synchronize inventory management with identified co-purchase rules to minimize the risk of stockouts for bundled items.

2) For MSME and Business Associations (Capacity Building):

- Provide training workshops on simple data analytics tools (e.g., RapidMiner, WEKA, or Python libraries) to empower small business owners.

- Encourage MSME to adopt digital transformation initiatives, making data collection and analysis a routine part of business operations.

3) For Policymakers and Local Government:

- Support MSME with data literacy programs and subsidized access to digital POS systems, ensuring small enterprises can leverage analytics without high costs.

- Integrate data-driven decision-making frameworks into local MSME development policies to improve competitiveness in the digital economy.

4) For Academic Research (Future Studies):

- Extend the analysis beyond Apriori by comparing with other algorithms such as FP-Growth and ECLAT to assess scalability and efficiency.

- Incorporate profit-margin weighting into rule evaluation, ensuring that recommended bundles maximize not only frequency but also profitability.

- Explore time-series prediction models to capture seasonal variations and customer behavior over longer periods.

- Conduct cross-case analyses across multiple cafés or culinary MSME to validate generalizability of the approach.

By following these recommendations, the potential of data mining can be maximized not only for improving sales performance at the micro level but also for strengthening the resilience and competitiveness of MSME at the regional and national scale.

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