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Implementation of the Apriori Algorithm for Product Recommendation Analysis at Asyifa Serba 35.000 Retail Store in Kisaran

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Abstract

This study aims to implement the Apriori algorithm to analyze sales transaction data and generate product recommendations at Toko Asyifa Serba 35.000. The research addresses the problem of underutilized transaction data, where sales records are only used for administrative purposes without further analysis to support marketing strategies and decision-making. The significance of this study lies in its contribution to enhancing data-driven decision-making in retail businesses, particularly in improving product promotion strategies, inventory management, and customer satisfaction. The research adopts an applied quantitative approach with an experimental design. Data were collected through observations, interviews, and documentation of sales transactions, and analyzed using data mining techniques, specifically the Apriori algorithm, to identify frequent itemsets and association rules based on support and confidence values. The results indicate that the implementation of the Apriori algorithm successfully uncovers patterns of consumer purchasing behavior, revealing combinations of products frequently bought together. The generated recommendations provide practical benefits for retail management, including more effective product bundling strategies, optimized shelf arrangement, targeted promotional campaigns, and improved inventory planning. These improvements can contribute to increased sales opportunities and better customer shopping experiences. These findings enable the development of a recommendation system that provides accurate and relevant product suggestions. The study concludes that the application of Apriori-based recommendation systems improves sales effectiveness, optimizes product placement, and enhances customer satisfaction. It is recommended that retail businesses adopt data mining techniques to maximize the value of transaction data and further develop integrated recommendation systems for better decision support.

Keywords:
Data Mining; Apriori Algorithm; Product Recommendation; Sales Transaction; Retail Strategy.

1. INTRODUCTION

The rapid development of information technology has brought significant changes to the business world, including the retail sector. Digital transformation has made various business activities increasingly dependent on data, ranging from inventory management and promotions to customer behavior analysis (Wilyanto et al., 2023). In the modern era, business actors are not only required to provide high-quality products but also to understand customer behavior patterns, preferences, and needs in order to deliver appropriate services and increase sales. Intensifying business competition requires companies to make decisions that are fast, accurate, and data-driven (Rizmayanti et al., 2021). One effective way to understand

customer behavior and support decision-making is through the utilization of data mining techniques (Srirahayu & Pribadie, 2023).

The use of information and communication technology in business activities is highly important, particularly through the use of the internet as a business tool (Amory et al., 2025). The benefits of the internet are not limited to government institutions but have also expanded into the business sector, one of which is its application in companies, especially in the field of digital marketing (Putra & Muflih, 2024)

Asyifa Serba 35,000 Store is a retail business that sells various daily necessities at affordable prices. Every day, the store serves hundreds of transactions involving a wide variety of products, ranging from household supplies to personal necessities. Although the store generates a high volume of transaction data, the sales data has not been utilized optimally. (Srirahayu & Pribadie, 2023). So far, the data has only functioned as an administrative record without further analysis to support marketing strategies or sales improvement. As a result, the store faces difficulties in determining which products should be promoted, strategically arranging product placement, and designing product bundles that align with customer interests (Ana Hanapi, 2023).

In the retail business, inventory accumulation often occurs due to low product demand. Therefore, retailers need to establish appropriate sales strategies to reduce stock levels. The results of questionnaire analysis indicate that, in order to remain competitive, retail businesses must satisfy customers through excellent service and ease of product search (Safitri et al., 2021). Product arrangement should be based on purchasing intensity rather than solely on product type or brand. In addition, inventory availability must be maintained to prevent stockouts during periods of high demand (Rizky Mangunsong et al., 2024).

Data mining is the process of analyzing data to discover patterns, relationships, and valuable information from large datasets using various techniques and algorithms. This process includes preprocessing, modeling, evaluation, and interpretation stages and is widely utilized in fields such as business, science, healthcare, and finance to support better decision-making (Prasetyo et al., 2020).

A previous study entitled “Transaction Data Analysis of Consumer Purchasing Patterns Using the Apriori Algorithm Method” demonstrated that the implementation of the Apriori algorithm on consumer transaction data can reveal purchasing patterns that frequently occur together (Alma et al., 2020). Through the data mining process, several product combinations with high support and confidence values were identified. For example, customers who purchased coffee also tended to purchase sugar and milk. This information was then utilized to optimize promotional strategies and product placement within the store (Asmaul Husnah Nasrullah, 2021).

However, Asyifa Serba 35,000 Store currently does not have a system capable of effectively processing and analyzing sales transaction data to identify associations among products that are frequently purchased together by customers (Sudarsono et al., 2021). Product recommendation processes are still performed manually, making them less accurate and time-consuming. Furthermore, the available sales data has not been utilized optimally to support promotional strategies and product arrangement (Hidayat et al., 2022). Therefore, the implementation of the Apriori algorithm is required to develop a product recommendation system that can assist the store in improving sales efficiency and customer satisfaction (Mare et al., 2024).

2. RESEARCH METHOD

2.1. Research Design

This study employs a quantitative approach with an applied and experimental design. The quantitative method is used because the research focuses on analyzing numerical transaction data to identify purchasing patterns using the Apriori algorithm. The experimental aspect lies in the implementation of a product recommendation system based on the generated association rules. This design is aligned with the research objectives, which aim to transform raw transaction data into meaningful insights for decision-making in retail management.

2.2. Population and Sample

The population of this study consists of all sales transactions recorded at Toko Asyifa Serba 35.000 during the observation period. A total of 150 transaction records collected from November 2025 to February 2026 were used as the research sample. Purposive sampling was employed by selecting complete and valid transaction records containing detailed product purchase information. Transactions with incomplete, duplicated, or inconsistent data were excluded from the analysis.

2.3. Data Collection Methods

Data were collected using three main techniques: 1) Observation: Direct observation of sales processes, customer interactions, and inventory management, 2) Interviews: Conducted with the store owner and staff to identify operational challenges and system requirements, 3) Documentation: Collection of historical transaction data used as the primary dataset for analysis.

The main instrument in this research is the transaction dataset. Data validity is ensured through cross-checking records, while reliability is maintained through consistent formatting and preprocessing.

Interviews were conducted with one store owner and three store employees to obtain information regarding sales processes, inventory management, and product arrangement strategies. Documentation included transaction reports, sales records, product lists, and inventory reports collected during the research period.

2.4. Research Procedures

The research was conducted through several structured stages, beginning with problem identification and data collection through observation, interviews, and documentation. It then proceeded to system analysis and design using UML diagrams, followed by system development using PHP and MySQL. Afterward, system testing was carried out to ensure accuracy and functionality, and finally, the system was implemented in the operational environment. The study was conducted from November 2025 to March 2026 at the research location.

System testing was performed using black-box testing techniques to evaluate system functionality, accuracy of recommendation results, and user interface performance. The generated association rules were validated by comparing the system output with manual Apriori calculations to ensure consistency and reliability.

2.5. Data Analysis Techniques

Data analysis in this study was carried out using the Apriori algorithm through several systematic stages. The process began with data cleaning and preprocessing to ensure the accuracy and consistency of the transaction data. Next, the cleaned data were transformed into an itemset format suitable for analysis. The algorithm then calculated support and confidence values to measure the strength of relationships between items. Based on these calculations, frequent itemsets were generated, followed by the formation of association rules that represent purchasing patterns. The results of this analysis were subsequently used to develop a product recommendation system capable of suggesting items that are frequently purchased together.

2.6. Research Limitations

This study has several limitations. First, the dataset is limited to a single retail store, which may affect the generalizability of the findings. Second, the analysis depends on historical transaction data, which may not fully capture changing consumer behavior. However, these limitations were mitigated by ensuring data accuracy, applying systematic analysis procedures, and focusing on producing practical insights relevant to small and medium-sized retail businesses.

3. RESULTS AND DISCUSSION

3.1. Results

The data used comes from a list of products frequently purchased by customers. Based on the product table in the image, some products that often appear in transactions include.

Table 1. Itemset Results

No	Product Name	Category
1	Plain Syari Robe	Clothing
2	Pashmina Hijab	Clothing
3	Hijab Brooch	Clothing

The results of this study were obtained from the implementation of the Apriori algorithm on sales transaction data at Toko Asyifa Serba 35.000. The analysis process began with data preprocessing, followed by the determination of minimum support (30%) and minimum confidence (70%) thresholds. The results are presented in several stages, including frequent itemset generation and association rule formation.

Table 1. Itemset Results

Item	Number of Transactions	Support
Plain Syari Robe	5	50%
Pashmina Hijab	5	50%
Hijab Brooch	3	30%

Table 2 shows that Gamis Syari Polos and Jilbab Pashmina are the most frequently purchased items, each with a support value of 50%. This indicates that both products have high demand and often appear in transaction data.

Tabel 3. Itemset Results

Item Combination	Number of Transactions	Support
Plain Syari Dress, Pashmina Hijab	4	40%
Hijab Brooch, Plain Syari Robe	3	30%
Hijab Brooch, Pashmina Hijab	3	30%

Table 3 illustrates the combination of two items frequently purchased together. The combination of Plain Syari Dress and Pashmina Hijab has the highest support value (40%), indicating a strong relationship between these products.

Tabel 4. Itemset Results

Item Combination	Number of Transactions	Support
Hijab Brooch, Plain Shari'a Dress, Pashmina Hijab	3	30%

Table 4 shows that the combination of three items also meets the minimum support threshold, indicating that these products are often purchased together in a single transaction.

Tabel 5. Association Rules

No	Rule	Support	Confidence
1	Plain Shari'a Dress → Pashmina Hijab	40%	80%
2	Pashmina Hijab → Plain Syari Dress	40%	80%
3	Hijab Brooch → Plain Syari Robe	30%	100%
4	Hijab Brooch → Pashmina Hijab	30%	100%
5	Hijab Brooch → Plain Syari Robe, Pashmina Hijab	30%	100%
6	Hijab Bros, Plain Shari'a Dress → Pashmina Hijab	30%	100%
7	Brooch Hijab, Hijab Pashmina → Plain Syari Robe	30%	100%
8	Plain Syari Robe, Pashmina Hijab → Brooch Hijab	30%	75%

Table 5 presents the final association rules that meet the minimum support and confidence thresholds. The results indicate strong relationships between products, particularly for rules involving Bros Jilbab, which consistently show high confidence values (up to 100%).

These findings demonstrate that the Apriori algorithm successfully identifies purchasing patterns and product relationships. The generated association rules can be utilized to build a recommendation system that suggests products frequently purchased together, thereby supporting decision-making in marketing strategies and improving sales performance.

Support represents the frequency with which an item or item combination appears in the transaction dataset. Higher support values indicate products that are commonly purchased by customers and have greater business relevance. Confidence measures the probability that customers purchasing one product will also purchase another related product. High confidence values indicate stronger associations and more reliable recommendations.

For example, the rule "Hijab Brooch → Plain Syari Robe" achieved a confidence value of 100%, indicating that every transaction containing Hijab Brooch also included Gamis Syari Polos. This finding suggests a very strong purchasing relationship that can be utilized in cross-selling and promotional activities.

3.2. Discussion

The results show that the Apriori algorithm successfully identifies meaningful purchasing patterns from transaction data at Toko Asyifa Serba 35.000. Strong associations were found among products such as Plain Syari Robe, Pashmina Hijab, and Hijab Brooch, supporting the research objective of generating product recommendations. High confidence values, reaching up to 100%, indicate a strong likelihood of certain products being purchased together.

These findings have practical implications for retail management, particularly in implementing strategies such as cross-selling, product bundling, and optimizing product placement. Additionally, the results help improve inventory management by identifying products that should be stocked together.

However, this study is limited by the use of data from a single store and reliance on historical transactions, which may not fully represent changing consumer behavior. Despite this, the study demonstrates that the Apriori algorithm is effective in transforming transaction data into valuable insights, contributing to improved decision-making and business performance.

The identified purchasing patterns can be directly implemented in retail operations. For example, products frequently purchased together such as Plain Syari Dress and Pashmina Hijab can be displayed in adjacent shelves to encourage impulse purchases. Similarly, promotional bundles combining these products may increase transaction value. The recommendation results can also assist store managers in planning inventory replenishment and reducing stock shortages for highly associated products.

The Product Data page is a website interface that can be accessed by users to manage product data that will be used in the Apriori Method calculation process performed by the system.

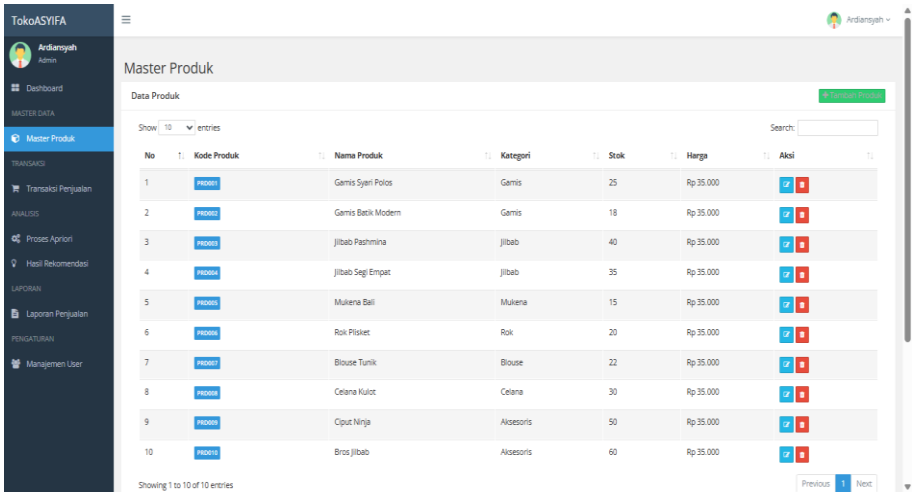

Figure 1. Product Data Management Table Page Display

The Sales Transaction page is a website interface that can be accessed by users to input product transaction data that will be used in the Apriori Method calculation process performed by the system.

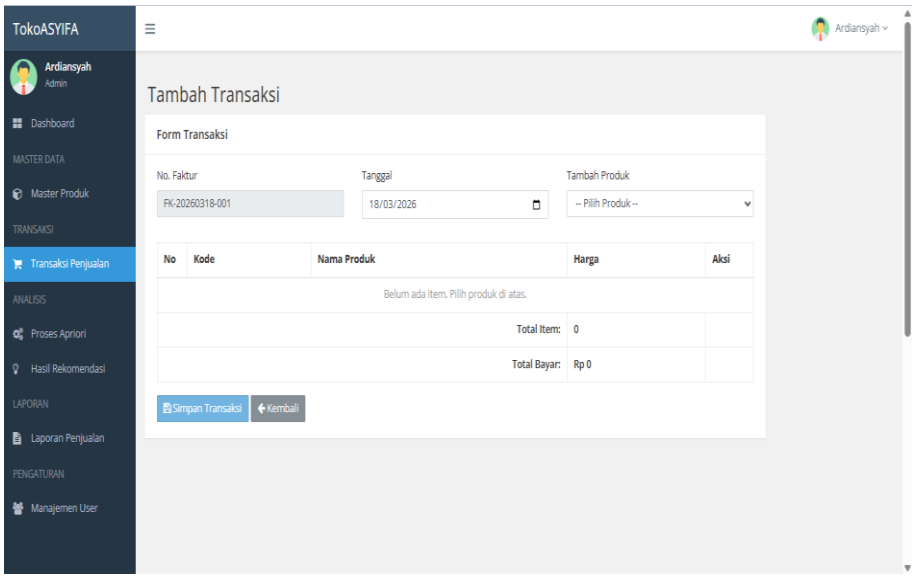

Figure 2. Add Sales Transaction Data Page Display

The Apriori Method Calculation page is a website interface that can be accessed by users to view the results of the Apriori Method calculations performed by the system.

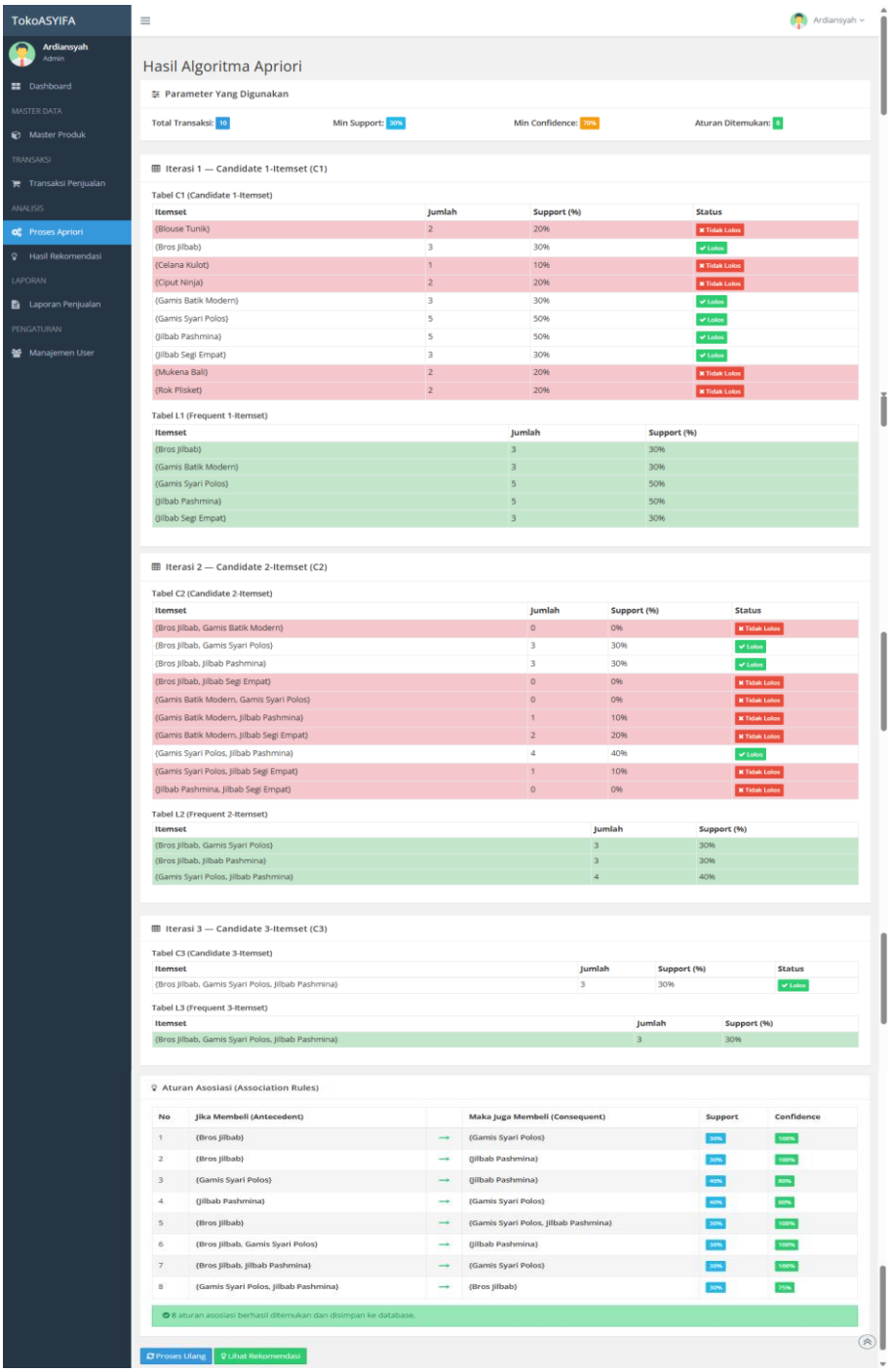

Figure 3 Apriori Method Calculation Details Page Display

4. CONCLUSION

Based on the entire series of research activities that have been carried out, starting from problem identification, data collection, system design, implementation, and application testing, it can be concluded that the application of the Apriori algorithm in the product recommendation system at Asyifa Serba 35,000 Store has successfully provided a more objective and data-driven solution for analyzing consumer purchasing patterns. The developed system is capable of processing sales transaction data into useful information through the generation of association rules among products that are frequently purchased together. The analysis results indicate that Plain Syari Robe, Pashmina Hijab, and Hijab Brooch have strong relationships, as evidenced by high support and confidence values, making them suitable as the basis for providing product recommendations to customers. In addition to effectively identifying purchasing patterns, the system also helps improve the efficiency of sales data management, accelerates the analysis process that was previously conducted manually, and provides better insights into consumer behavior. The testing results demonstrate

that all application features, including product data management, transaction processing, Apriori calculations, and product recommendation generation, function properly according to user requirements.

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