

Behavioral Pattern Discovery for Fintech Strategy: Naïve Bayes Analysis of Digital Payment Sentiments

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Abstract

The rising adoption of digital wallets in Indonesia has created an urgent need for fintech service providers to gain deeper insights into user perceptions and satisfaction. However, many providers continue to rely on conventional methods for evaluating consumer feedback, without leveraging the power of machine learning-based sentiment analysis. This study aims to identify user sentiment patterns toward five leading digital wallet platforms GoPay, OVO, DANA, LinkAja, and ShopeePay and to evaluate the effectiveness of the Naïve Bayes algorithm in classifying sentiments based on user reviews from the Google Play Store. A quantitative approach was employed, involving web scraping, text preprocessing, and sentiment classification using the Multinomial Naïve Bayes algorithm. The results indicate that Naïve Bayes can achieve classification accuracy exceeding 85% across all platforms, with the highest performance observed for LinkAja (95.10%) and GoPay (93.33%). These findings reveal variations in public perception across platforms and underscore the potential of machine learning in supporting user voice-based digital service strategies. The novelty of this research lies in the integration of organic review data with predictive approaches to inform strategic decision-making in the fintech service context.

Keywords: Sentiment Analysis, Machine Learning, Naïve Bayes, Digital Payment, Fintech Strategy.

Abstrak

Meningkatnya adopsi dompet digital di Indonesia menuntut penyedia layanan fintech untuk memperoleh pemahaman yang lebih mendalam mengenai persepsi dan tingkat kepuasan pengguna. Namun demikian, banyak penyedia layanan masih mengandalkan metode konvensional dalam mengevaluasi umpan balik konsumen tanpa memanfaatkan pendekatan analisis sentimen berbasis machine learning. Penelitian ini bertujuan untuk mengidentifikasi pola sentimen pengguna terhadap lima platform dompet digital utama di Indonesia, yaitu GoPay, OVO, DANA, LinkAja, dan ShopeePay, serta mengevaluasi efektivitas algoritma Naïve Bayes dalam mengklasifikasikan sentimen berdasarkan ulasan pengguna yang diperoleh dari Google Play Store. Penelitian ini menggunakan pendekatan kuantitatif yang melibatkan proses web scraping, prapemrosesan teks, serta klasifikasi sentimen menggunakan algoritma Multinomial Naïve Bayes. Hasil penelitian menunjukkan bahwa algoritma Naïve Bayes mampu mencapai tingkat akurasi klasifikasi lebih dari 85% pada seluruh platform yang dianalisis, dengan kinerja tertinggi pada LinkAja sebesar 95,10% dan GoPay sebesar 93,33%. Temuan ini mengungkap adanya variasi persepsi publik antarplatform serta menegaskan potensi pemanfaatan machine learning dalam mendukung pengembangan strategi layanan digital yang berbasis pada suara pengguna. Kebaruan penelitian ini terletak pada integrasi data ulasan organik dengan pendekatan prediktif untuk mendukung pengambilan keputusan strategis dalam konteks layanan fintech.

Kata kunci: Analisis Sentimen, Machine Learning, Naïve Bayes, Pembayaran Digital, Strategi Fintech

Introduction

The rapid expansion of the digital economy has become one of the most transformative developments in Indonesia's financial landscape. Over the past decade, the integration of digital technologies into financial services has accelerated the growth of financial technology (fintech), particularly in the digital payment sector (Kilay & Simamora, 2022; Novani et al., 2023; Aminullah et al., 2024). The total value of Indonesia's digital economic transactions reached approximately USD 77 billion in 2022 and is projected to increase to USD 130 billion by 2025, reflecting the growing penetration of digital financial services across multiple layers of society (Limanseto, 2023). This expansion is closely accompanied by the rapid development of digital payment systems within the banking sector. In 2024, digital payment transactions through banks reached IDR 15,881.5 trillion, representing an annual increase of 16.15% (Limanseto, 2023). Furthermore, innovations in the national payment infrastructure particularly the Quick Response Code Indonesian Standard (QRIS) initiated by Bank Indonesia have significantly strengthened the digital payment ecosystem. As of 2024, QRIS had recorded more than 50.5 million users with a transaction value of approximately IDR 42 trillion, reflecting a remarkable year-on-year growth of 226.5% (Indonesia, 2024).

Within this rapidly evolving ecosystem, digital wallet platforms have emerged as key intermediaries facilitating seamless financial transactions. Several major digital wallets including GoPay, OVO, DANA, LinkAja, and ShopeePay have established dominant positions in the Indonesian fintech market and collectively represent the majority of digital payment activity. These platforms compete intensely by offering integrated, efficient, and user-friendly financial services that are embedded within broader digital ecosystems such as ride-hailing, e-commerce, and retail networks. Collectively, these five applications accounted for more than 90% of the digital wallet market share in Indonesia in 2024, highlighting their central role in shaping the dynamics of digital financial services (Rosalia et al., 2024; Saputri & Pratama, 2021; Malika, 2024).

Despite operating within the same digital payment environment, each platform exhibits distinct strategic positioning and service characteristics. GoPay is strongly integrated with the Gojek ecosystem, enabling seamless transactions within ride-hailing and lifestyle services. ShopeePay benefits from the extensive infrastructure of the Shopee e-commerce platform, which drives high transaction frequency through online retail activities. OVO collaborates with various retail and transportation partners to expand its service reach, while DANA focuses on interoperability and flexible digital payment solutions. Meanwhile, LinkAja emphasizes financial inclusion through its integration with state-owned enterprise (SOE) networks. These differences in platform ecosystems and service features may generate diverse user experiences and perceptions, which are often reflected in public digital reviews.

User-generated reviews have increasingly become a valuable source of information for understanding consumer perceptions and behavioral patterns within digital platforms. Online reviews provide spontaneous feedback regarding service quality, transaction speed, security, usability, and reliability. In the context of fintech services, these reviews represent a rich dataset that captures users' real experiences and expectations toward digital payment systems.

Consequently, analyzing sentiment embedded in these reviews offers an important opportunity to uncover behavioral insights that can support strategic decision-making in fintech service development.

In recent years, sentiment analysis based on machine learning techniques has gained significant attention as an effective method for extracting insights from large volumes of unstructured textual data. Various algorithms have been widely applied to classify user sentiment across digital platforms, including Naïve Bayes, Support Vector Machines, and deep learning models. Among these approaches, the Naïve Bayes algorithm remains one of the most widely used techniques due to its simplicity, computational efficiency, and interpretability when processing large-scale text data (Alslaity & Orji, 2024; Brandão et al., 2025; Xu et al., 2020), for instance, proposed a continuous learning framework using the Naïve Bayes algorithm to classify sentiment in e-commerce product reviews, demonstrating that the approach can maintain efficiency while adapting to evolving domains.

In the financial domain, more advanced natural language processing models have also been developed to improve sentiment classification accuracy. Huang et al. (2022) introduced FinBERT, a domain-specific language model designed to analyze financial texts and ESG-related discourse. The study demonstrated that FinBERT can achieve higher classification accuracy compared to traditional algorithms such as Naïve Bayes by capturing complex linguistic contexts embedded in financial communication. Nevertheless, while deep learning models offer superior contextual understanding, they often require significant computational resources and present challenges in interpretability.

Previous studies have also highlighted several methodological challenges associated with Naïve Bayes-based sentiment analysis. One key limitation is the algorithm's independence assumption, which may be violated in real-world datasets where textual features are highly correlated. Subramanian & Prabha, (2022) addressed this issue by applying bagging-based homogeneous feature selection and ensemble variable selection techniques to improve classification performance. Similarly, Elgeldawi et al. (2021) demonstrated that hyperparameter tuning strategies such as Bayesian Optimization and Grid Search can significantly enhance predictive accuracy, particularly in large-scale textual datasets.

Further research has emphasized the importance of integrating preprocessing techniques and hybrid analytical approaches to strengthen the robustness of Naïve Bayes models. Balakrishnan et al., (2021), for example, combined Naïve Bayes with topic modeling techniques such as Latent Dirichlet Allocation (LDA) to detect sentiment and emotional patterns in digital payment application reviews. Their findings indicate that although Naïve Bayes is relatively simple compared with algorithms such as Random Forest or Support Vector Machines, its performance remains competitive when supported by appropriate preprocessing and feature extraction methods. In addition, Itoo et al. (2021) demonstrated that Naïve Bayes can also perform effectively in financial applications such as credit card fraud detection when supported by sampling techniques that address data imbalance.

Although numerous studies have explored sentiment classification using machine learning algorithms, most existing research primarily emphasizes technical model development rather than linking analytical results with strategic

implications for digital service providers. Studies by Xu et al., (2020) and Brandão et al. (2025), for instance, highlight the efficiency of Naïve Bayes in sentiment classification tasks but do not explicitly discuss how the extracted sentiment insights can inform strategic business decisions. In the fintech context, research examining user perceptions of digital wallet services in Indonesia also remains relatively fragmented and limited in scope (Anis et al., 2024; Widianoro et al., 2021; Simamora & Fathoni, 2024; Fattahila et al., 2021; Hantoro et al., 2022). Most studies tend to focus on specific platforms or technical modeling aspects without providing comparative cross-platform analysis based on large-scale user review data.

Moreover, despite the availability of extensive user-generated data on platforms such as the Google Play Store, relatively few studies have systematically utilized these datasets to extract behavioral insights capable of supporting fintech strategy development. Existing research often emphasizes algorithmic performance metrics, such as accuracy or precision, rather than exploring how sentiment patterns reflect underlying user behavior and expectations toward digital financial services. This gap highlights the need for analytical approaches that integrate sentiment classification with behavioral pattern discovery in order to generate actionable insights for fintech innovation.

Based on these considerations, this study aims to analyze sentiment patterns and dominant themes within user reviews of five major digital wallet platforms in Indonesia GoPay, OVO, DANA, LinkAja, and ShopeePay using a Naïve Bayes–based sentiment classification approach. Specifically, the research examines the distribution of positive and negative sentiments across platforms and evaluates the classification accuracy of the Naïve Bayes model applied to review data retrieved from the Google Play Store. The study also seeks to identify behavioral patterns embedded in user feedback that can serve as a basis for developing more adaptive and personalized fintech strategies.

Accordingly, this research addresses two primary research questions. First, what sentiment patterns and thematic issues characterize user reviews for each digital wallet platform? Second, how can these insights be translated into strategic recommendations to improve fintech service design and user experience? To answer these questions, this study formulates the hypothesis that significant differences exist in sentiment patterns across digital wallet platforms and that the Naïve Bayes algorithm can classify these sentiments with a minimum accuracy level of 85%.

By integrating machine learning–based sentiment analysis with strategic behavioral interpretation, this research contributes to both methodological and practical dimensions of fintech research. Methodologically, the study evaluates the effectiveness of Naïve Bayes as a scalable and interpretable sentiment classification tool in the context of digital payment services. Practically, the findings provide empirical insights that may assist fintech providers in improving service quality, optimizing feature development, and designing customer retention strategies grounded in real user experiences. In an increasingly competitive digital payment landscape, such behavior-driven strategies are essential for ensuring sustainable platform growth and enhancing user satisfaction within Indonesia’s rapidly expanding digital economy.

Literature Review

Digital Payment Ecosystem and Fintech Development

The rapid development of financial technology has significantly transformed the structure of financial services, particularly in the area of digital payments. Fintech innovations have enabled faster, more accessible, and more efficient financial transactions, thereby reshaping consumer behavior and expanding financial inclusion across both urban and rural communities. In emerging economies such as Indonesia, the growth of the digital economy has been strongly supported by the increasing penetration of smartphones, internet connectivity, and digital platforms that integrate financial services into everyday activities (Kilay & Simamora, 2022; Novani et al., 2023; Aminullah et al., 2024).

Digital wallet platforms have emerged as central actors in the fintech ecosystem, offering integrated financial services such as mobile payments, bill settlements, peer-to-peer transfers, and online shopping transactions. These platforms operate within complex digital ecosystems that connect multiple industries, including e-commerce, transportation, banking, and retail services. The integration of these services enables digital wallets to function not only as payment instruments but also as strategic platforms that shape digital consumer behavior.

Several studies have emphasized that the success of digital wallet platforms depends largely on user trust, service convenience, transaction speed, and perceived security. These factors influence the level of user adoption and long-term engagement with fintech services. Research examining digital payment services in Indonesia has shown that user perceptions of reliability, usability, and service integration strongly affect user satisfaction and continued usage behavior (Anis et al., 2024; Widiatoro et al., 2021; Simamora & Fathoni, 2024). In addition, the increasing competition among digital wallet providers encourages continuous innovation in service features, promotional strategies, and system interoperability in order to attract and retain users.

Within this competitive landscape, major platforms such as GoPay, OVO, DANA, LinkAja, and ShopeePay have adopted different strategic approaches to strengthen their market presence. These strategies range from ecosystem integration and retail partnerships to interoperability features and financial inclusion programs. As a result, users may experience different levels of service quality and usability across platforms, which are frequently expressed through online reviews and digital feedback mechanisms. Such user-generated feedback represents a valuable source of information for understanding user behavior and service performance within digital financial ecosystems.

Sentiment Analysis in Digital Platforms

Sentiment analysis has become an important analytical approach for extracting meaningful insights from large volumes of user-generated textual data. With the rapid growth of digital platforms and online communities, users increasingly express their opinions, experiences, and expectations through online reviews, social media posts, and discussion forums. These digital traces provide valuable information that can be analyzed to understand consumer perceptions and behavioral tendencies.

In recent years, sentiment analysis has been widely applied across multiple domains, including e-commerce, marketing analytics, and digital service

evaluation. The primary objective of sentiment analysis is to classify textual data according to emotional polarity, typically distinguishing between positive, negative, and neutral sentiments. Such classification enables researchers and organizations to evaluate public opinion, identify service weaknesses, and detect emerging behavioral trends among users.

In the context of digital services, sentiment analysis plays an important role in evaluating user satisfaction and identifying areas for service improvement. Online reviews often contain detailed descriptions of user experiences, including aspects such as service reliability, application usability, transaction security, and customer support quality. Consequently, the analysis of sentiment embedded in these reviews can provide valuable insights into how users perceive digital services and what factors influence their satisfaction or dissatisfaction.

A comprehensive systematic review conducted by Alslaity & Orji (2024) examined more than one hundred studies related to sentiment analysis and emotion detection. The review found that supervised machine learning algorithms remain the dominant approach in sentiment classification tasks due to their efficiency and relatively high predictive performance. Similarly, Brandão et al. (2025) reported that appropriate feature selection and model optimization techniques can significantly improve sentiment classification accuracy, particularly when dealing with large volumes of unstructured text data obtained from digital platforms.

In fintech-related applications, sentiment analysis has increasingly been used to analyze user feedback on digital financial services. Balakrishnan et al. (2021) explored the application of sentiment detection techniques in digital payment application reviews and found that user sentiment data can reveal important patterns related to usability issues, service satisfaction, and consumer trust. These insights can provide valuable guidance for fintech companies seeking to improve their digital services and strengthen user engagement.

Machine Learning Approaches for Sentiment Classification

Machine learning techniques have played a central role in the development of modern sentiment analysis. Unlike traditional rule-based approaches, machine learning models can learn patterns from large datasets and automatically classify textual information based on statistical relationships between words and sentiment categories. Several algorithms have been widely used in sentiment classification, including Naïve Bayes, Support Vector Machines (SVM), Random Forest, and more recently, deep learning architectures such as transformer-based language models.

Among these algorithms, Naïve Bayes remains one of the most widely applied techniques due to its computational efficiency and relatively simple implementation. The algorithm operates based on probabilistic classification principles derived from Bayes' theorem and assumes conditional independence among features. Despite this simplifying assumption, Naïve Bayes has demonstrated strong performance in many text classification tasks, particularly when processing large-scale datasets.

Xu et al. (2020) developed a sentiment classification framework based on the Naïve Bayes algorithm for analyzing e-commerce product reviews. Their study demonstrated that Naïve Bayes can maintain high computational efficiency while effectively classifying user sentiments across evolving datasets when

implemented within a continuous learning framework. This capability makes the algorithm particularly useful for analyzing dynamic data environments such as online review platforms.

However, several studies have highlighted limitations associated with Naïve Bayes. One major challenge relates to the algorithm's assumption of feature independence, which is often violated in real-world text data where words frequently appear in correlated contexts. Subramanian & Prabha (2022) addressed this limitation by introducing bagging-based homogeneous feature selection and ensemble variable selection techniques. Their findings indicate that such approaches can significantly improve the predictive performance of Naïve Bayes when dealing with datasets containing redundant or correlated features.

Another important factor affecting model performance is the optimization of algorithm parameters and preprocessing strategies. Elgeldawi et al. (2021) demonstrated that hyperparameter tuning methods such as Grid Search and Bayesian Optimization can significantly enhance classification accuracy. Similarly, Brandão et al. (2025) emphasized the importance of feature selection and cross-validation techniques in improving the robustness and generalization capability of sentiment classification models. Without proper optimization, machine learning models may suffer from issues such as overfitting or underfitting when applied to large and complex datasets (Hokijuliandy et al., 2023; Barik et al., 2023; Kusumaningrum et al., 2024).

Naïve Bayes remains one of the most widely used probabilistic classifiers in text mining due to its computational efficiency and relatively simple implementation. Various studies have proposed methodological improvements to enhance the robustness of this algorithm. For instance, Blanquero et al. (2021) explored variable selection techniques to improve the predictive capability of Naïve Bayes models, while Chen et al. (2020) introduced a selective Naïve Bayes algorithm designed to optimize feature relevance in classification tasks. In addition, Zhang et al. (2020) proposed class-specific attribute weighting to enhance the discriminative ability of Naïve Bayes classifiers in complex datasets. These methodological developments demonstrate the continuous evolution of Naïve Bayes to address the limitations of its traditional independence assumption.

A comprehensive review by (Wickramasinghe & Kalutarage, 2021) discusses various applications, methodological variations, and potential vulnerabilities of the Naïve Bayes classifier. Their study highlights that despite the emergence of more complex machine learning models, Naïve Bayes continues to be widely adopted in text classification tasks due to its interpretability and scalability.

Recent developments have also explored ensemble-based Naïve Bayes frameworks to improve classification precision and recall. Peretz et al. (2024) proposed an ensemble procedure that combines multiple Naïve Bayes classifiers to enrich recall and precision performance, demonstrating the potential of hybrid approaches in handling complex datasets.

Advanced Natural Language Processing in Financial Sentiment Analysis

Recent advances in natural language processing have introduced more sophisticated models capable of capturing contextual information within textual data. Transformer-based models such as BERT have significantly improved the

accuracy of sentiment classification by enabling deeper semantic understanding of language structures. These models are particularly effective when analyzing domain-specific textual data that requires contextual interpretation.

In the financial domain, Huang et al. (2022) introduced FinBERT, a domain-specific language model designed to analyze financial texts and sentiment within financial communications. The study demonstrated that FinBERT achieved superior classification performance compared with traditional machine learning algorithms, including Naïve Bayes. The model was particularly effective in identifying sentiment patterns embedded in financial narratives and ESG-related documents.

Nevertheless, although deep learning models offer superior contextual capabilities, they also present several practical challenges. These models require substantial computational resources, extensive training datasets, and complex model architectures, which may limit their applicability in certain research contexts. Additionally, transformer-based models often lack interpretability, making it difficult for researchers and practitioners to fully understand how classification decisions are generated.

Comparative research conducted by Subramanian & Prabha (2022) and Rahman & Maryani (2024) examined the performance of multiple machine learning algorithms, including Naïve Bayes and transformer-based models such as BERT. Their findings confirmed that while BERT-based models generally outperform traditional algorithms in handling complex linguistic contexts, Naïve Bayes remains a highly relevant method due to its efficiency, scalability, and transparency. These characteristics make it particularly suitable for studies involving large datasets where computational efficiency and interpretability are important considerations.

In addition to algorithmic improvements, several studies highlight the importance of feature selection and ensemble learning in improving classification performance. Ensemble-based methods such as bagging and boosting have been widely used to enhance model stability and predictive accuracy in machine learning applications (González et al., 2020). Furthermore, feature selection techniques combined with classifier ensembles can significantly improve the effectiveness of probabilistic classifiers such as Naïve Bayes (Kiziloz, 2021). These approaches help reduce redundant features and improve model generalization when analyzing large-scale textual datasets.

Research Methods

This study adopts a quantitative approach using an exploratory-predictive method based on machine learning technology. This approach is designed to identify emerging sentiment patterns among users toward digital wallet services and to evaluate the performance of the Naïve Bayes algorithm in classifying sentiment from textual data. The study utilizes secondary data in the form of user reviews obtained from the Google Play Store.

The objects of this study include five leading digital wallet platforms in Indonesia: GoPay, OVO, DANA, LinkAja, and ShopeePay. The unit of analysis comprises sentences or short paragraphs within user reviews that express opinions and emotions toward the services they used. The reviews analyzed were selectively chosen based on sentiment diversity and a minimum word count

requirement to ensure the quality and validity of the analysis. The stages of sentiment analysis are presented in figure 1 below:

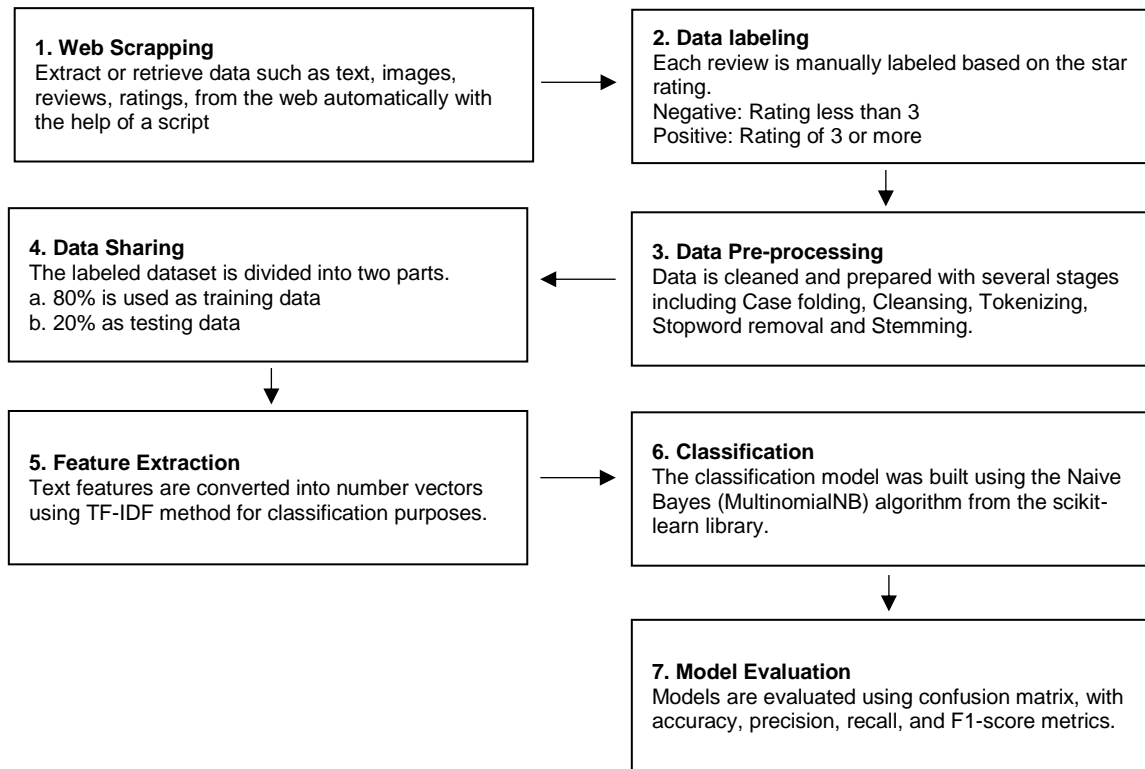


Figure 1. Stages in sentiment analysis

Data collection was conducted through a web scraping technique using Python scripts to access and extract user reviews from the Google Play Store for each application. For each platform, a minimum of 5,000 of the most recent reviews were collected to capture variation in time, ratings, and sentiment expression. The raw data were subsequently processed through a cleaning stage, which involved the removal of stopwords, non-alphabetic symbols, and word normalization procedures to prepare the dataset for machine learning modeling.

The data analysis began with manual labeling of the training dataset to classify sentiments as either positive or negative. Following the labeling process, the model was trained using the Multinomial Naïve Bayes algorithm with a train-test split approach and cross-validation to ensure model stability and generalizability. Model performance was evaluated using metrics such as accuracy, precision, recall, and F1-score, calculated based on True Positive (TP), True Negative (TN), False Negative (FN), and False Positive (FP) values, as defined by the following formulas:

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \tag{1}$$

$$Recall = \frac{TP}{TP + FN} \tag{2}$$

$$Precision = \frac{TP + TN}{TP + FP} \quad (3)$$

$$F1 - score = \frac{2 \times recall \times precision}{recall + precision} = \frac{2TP}{2TP + FN + FP} \quad (4)$$

In addition, a confusion matrix visualization was employed to evaluate the classification accuracy of the model. All analytical procedures were carried out using the Python programming language, along with supporting libraries such as scikit-learn, pandas, numpy, and matplotlib. The analysis results were visualized to enhance the interpretability of the constructed model and to enable both descriptive and quantitative comparisons of classification performance across the different digital wallet platforms.

Result and Discussions

Result

The sentiment classification results using the Multinomial Naïve Bayes algorithm, as presented in Table 1, indicate a notable variation in sentiment distribution and accuracy across the five digital wallet platforms. The model achieved an accuracy rate above 85% for all applications, with the highest scores observed for LinkAja (95.10%) and GoPay (93.33%), and the lowest for DANA (85.10%).

Table 1. Naïve Bayes Model Evaluation Results for Five Platforms.

Platform	Accuracy	Precision	Recall	F1-Score
GoPay	0.933	0.869	0.936	0.901
OVO	0.907	0.914	0.987	0.949
DANA	0.851	0.872	0.943	0.906
LinkAja	0.951	0.844	0.988	0.910
ShopeePay	0.891	0.766	0.936	0.843

Source: Phyton Output, 2026

The model demonstrated strong performance in detecting negative sentiment across all applications; however, it encountered difficulties in classifying positive sentiment for the OVO and DANA platforms, with positive recall rates of only 34% and 56%, respectively.

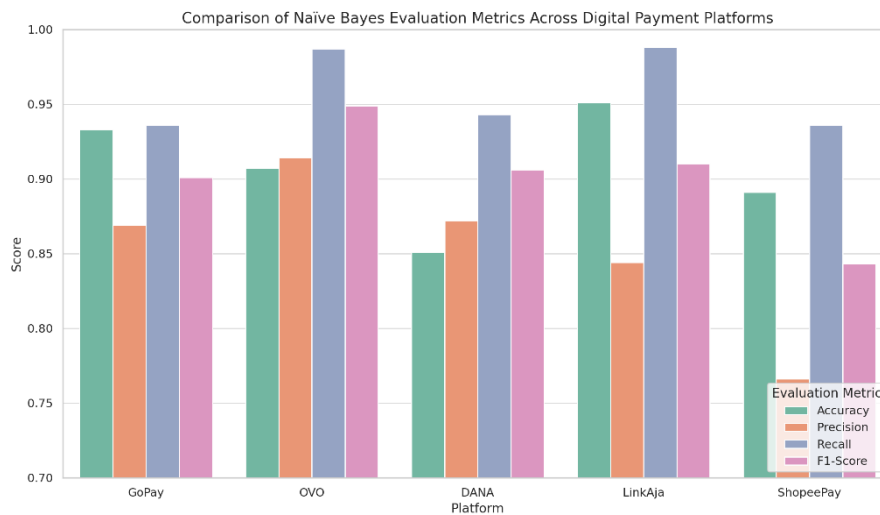


Figure 2. Comparison of four key evaluation metrics (Accuracy, Precision, Recall, and F1-Score)

Source: Phyton Output, 2026

The sentiment distribution presented in Table 2 also reflects differences in user perceptions across platforms. GoPay and LinkAja exhibit a dominance of positive sentiment, with high precision and recall rates (>90%) in both sentiment classes. In contrast, OVO and DANA display a sharp imbalance between the number of negative and positive reviews, resulting in relatively low F1-scores for positive sentiment (48% and 64%, respectively). ShopeePay falls in the middle, with an overall accuracy of 89.06% and a more balanced classification between negative and positive sentiments. DANA recorded the lowest overall accuracy at 85.10%.

Table 2. Differences in user perceptions across platforms

Platform	TN	FN	TP	FP	Total Data	Negative (%)	Positive (%)
GoPay	291	20	604	44	959	32,43%	67,57%
OVO	811	11	40	76	938	87,62%	12,38%
DANA	662	40	123	97	922	76,14%	23,86%
LinkAja	243	3	679	45	970	25,26%	74,74%
ShopeePay	279	19	568	85	951	31,33%	68,67%

Source: Phyton Output, 2026

Discussions

The findings indicate that GoPay and LinkAja maintain relatively stable positive user perceptions, primarily associated with transaction ease, integration with other application ecosystems, and fast payment processing. In contrast, OVO and DANA are characterized by predominantly negative sentiment, largely linked to complaints regarding technical issues, slow verification processes, or transaction disruptions. ShopeePay received generally positive perceptions due to its integration with the Shopee platform; however, users also expressed concerns about its limited usability outside the marketplace ecosystem.

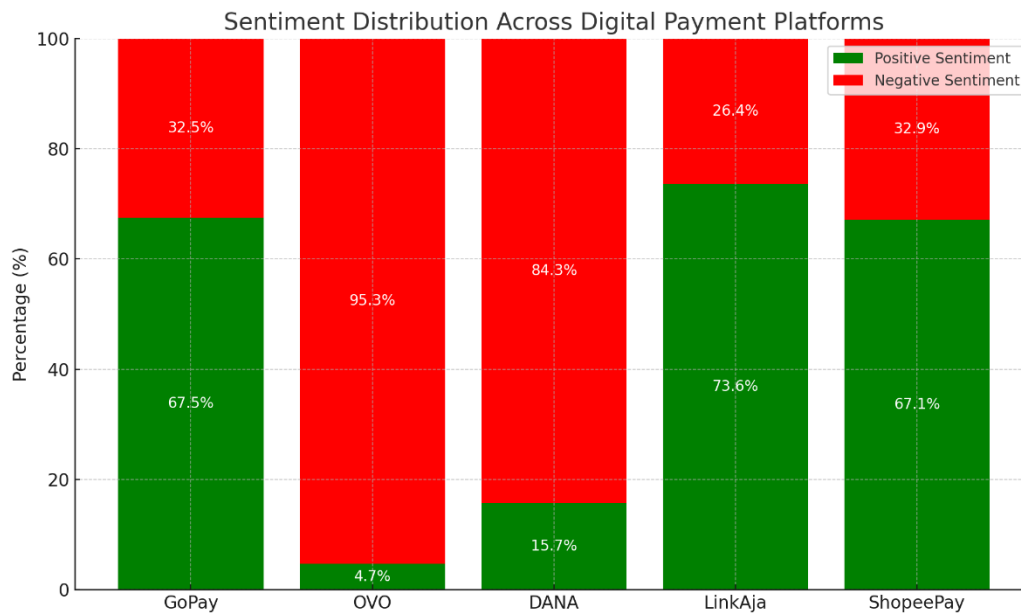


Figure 3. Distribution of positive and negative sentiments on each platform
Source: Python Output, 2026

These findings can serve as a foundation for developing customer insight-driven service strategies. Platforms with high levels of negative perception (e.g., OVO and DANA) should undertake a comprehensive evaluation of users' technical pain points and adopt predictive customer service approaches based on sentiment analysis. Conversely, platforms with a strong positive image (such as GoPay and LinkAja) may strengthen user loyalty through service personalization informed by usage patterns and established positive perceptions.

These findings can be linked to the Theory of Planned Behavior (Ajzen, 1991), which posits that user behavior is significantly influenced by attitude, subjective norms, and perceived behavioral control (Perri et al., 2020; Alsharida et al., 2025). In this context, user sentiment regarding service features and experiences reflects attitude, which may affect intention and loyalty toward specific e-wallet platforms (Rahardja et al., 2023; Ariffin et al., 2021; Al-Okaily, 2025). Leveraging review data as a proxy for users' actual attitudes provides a novel dimension in measuring perception, extending beyond traditional survey-based methods (Cai et al., 2022; Zhao et al., 2021; Natarajan & Periaiya, 2024).

Furthermore, Customer Experience Theory (Schmitt, 1999) underscores the importance of affective dimensions in customer interactions with digital services. The findings suggest that negative experiences recorded in user reviews are not limited to technical functionality but also encompass emotional perceptions such as frustration, discomfort, or satisfaction, which are then expressed through sentiment.

Unlike previous studies such as Xu et al. (2020) and Balakrishnan et al., (2021), which focused primarily on technical classification without linking the results to service strategies, this study fills a critical gap by integrating sentiment analysis based on actual user review texts with the development of adaptive fintech strategies. Moreover, most prior research has not conducted cross-platform comparisons using organic data (e.g., Google Play Store reviews), nor

has it established classification performance benchmarks in the context of digital financial applications.

The implications of these sentiment classification findings provide a strong foundation for developing more adaptive and personalized fintech strategies. GoPay demonstrates a relatively well-balanced performance between precision and recall, indicating that user perceptions of the platform are consistently stable. This suggests that GoPay has been successful in maintaining a consistent user experience, and future strategic priorities may include strengthening customer loyalty and enriching service features.

In contrast, OVO recorded a very high recall rate, but a significant imbalance was observed between negative and positive sentiments, particularly in the precision score for positive sentiment. This condition indicates that OVO should focus more on improving service aspects or features that frequently receive negative sentiment from a segment of its users.

In contrast, DANA tends to receive a higher proportion of negative sentiment compared to positive feedback. Although the model's accuracy is relatively strong, its brand perception could benefit from enhanced communication and public education strategies to foster more favorable user attitudes.

LinkAja demonstrated the best performance in terms of accuracy and recall, with a relatively high dominance of positive sentiment. This reflects a high level of user satisfaction with LinkAja's services, suggesting that strategic efforts should focus on expanding service coverage and strengthening customer retention initiatives.

ShopeePay, on the other hand, recorded the lowest precision among all platforms, despite achieving a relatively high recall. This finding suggests a potential gap between user perceptions and expectations, indicating the need for a more thorough evaluation of the platform's features and service processes.

Overall, the analysis reveals that consumer sentiment patterns vary considerably across platforms, implying that each provider requires a tailored strategic approach aligned with the specific characteristics of its user base. A data-driven personalization strategy is thus essential to support effective decision-making in the development of more responsive and targeted fintech services.

This study makes a significant theoretical contribution to the advancement of knowledge in digital consumer behavior and technology-based financial service strategies (fintech), particularly in the domain of sentiment classification using machine learning. Grounded in a research framework that explores thematic patterns and consumer sentiment toward five leading digital wallet platforms GoPay, OVO, DANA, LinkAja, and ShopeePay and their relevance to adaptive fintech strategy development, the study not only presents empirical findings but also proposes a state-of-the-art theoretical extension.

The primary theoretical contribution of this study lies in the development of an integrative approach that combines Behavioral Pattern Analysis with Algorithmic Sentiment Modeling within the context of digital business strategy. The finding that each platform exhibits heterogeneous sentiment structures with significant variation in accuracy, precision, recall, and F1-score demonstrates that consumer perceptions and reactions to fintech services are highly contextual and platform-dependent. This challenges the prevailing generalized assumptions

in the digital consumer behavior literature, which often overlook nuanced platform-specific response patterns.

As a form of theoretical advancement, this research introduces a novel concept termed 'Sentiment-Driven Strategic Alignment' (SDSA), a conceptual framework that integrates machine learning-based sentiment analysis with the formulation of adaptive strategies in digital services. SDSA emphasizes the importance of granular mapping of actual user sentiment configurations as a foundation for real-time adjustments in service strategies, communication, and product innovation. In essence, SDSA extends the customer-centric strategy paradigm into a more dynamic, predictive, and data-driven form.

Furthermore, the study contributes to strengthening the theoretical foundations of resource orchestration and personalization strategy within the digital ecosystem. The observed disparities in sentiment across digital wallet platforms underscore the need for fintech organizations to orchestrate data capabilities, analytical technologies, and consumer behavior insights in a coordinated manner. Accordingly, this research positions the Naïve Bayes model not merely as a technical classification tool, but as a strategic component for data-informed decision-making in digital service management.

Conclusion

This study successfully identified user sentiment patterns toward five major digital wallet platforms in Indonesia GoPay, OVO, DANA, LinkAja, and ShopeePay based on user review data obtained from the Google Play Store. Utilizing the Naïve Bayes algorithm, sentiment classification achieved high levels of accuracy, with all platforms exceeding 85%, and the best performance observed in LinkAja and GoPay. Thematic sentiment patterns revealed that positive perceptions were generally associated with ease of transaction, speed, and service integration, whereas negative sentiment was largely driven by technical issues, slow verification processes, and unmet user expectations. These findings support the hypothesis that significant differences exist in sentiment patterns across platforms and demonstrate that the Naïve Bayes algorithm is an effective tool for systematically capturing user perceptions.

Based on these results, it is recommended that digital wallet service providers develop machine learning-based customer feedback analytics systems to monitor and respond to user sentiment in real time. Platforms exhibiting a predominance of negative sentiment, such as OVO and DANA, should prioritize improvements in critical service areas such as application stability and verification procedures and strengthen communication channels with users. In contrast, platforms with consistently high positive sentiment, such as GoPay and LinkAja, are advised to maintain their competitive edge through ongoing feature innovation and personalized service development. More broadly, the integration of user review data as a source of strategic insight should be embedded in product development policies and digital service quality management, enabling fintech providers to evolve in a more adaptive and consumer-driven manner.

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