

Sentiment Analysis Against Digital Payment “GoPay”, “OVO”, “DANA”, and “ShopeePay” Using Naïve Bayes Classifier Algorithm

Lorenza Julia Ningri, Masyhuri Hamidi*, Fajri Adrianto

Department of Economics, Faculty of Economics and Business, Andalas University, Padang, Indonesia

Research article

Received 23 March 2023; Accepted 30 March 2023

How to cite: Ningri, L.J., Hamidi, M., & Adrianto, F. (2023). Sentiment Analysis Against Digital Payment “GoPay”, “OVO”, “ShopeePay” and “DANA” Using Naïve Bayes Classifier Algorithm. *Indonesian Journal of Economics and Management*, 3(2), 322-336

***Corresponding author:** hamidi.masyhuri@gmail.com

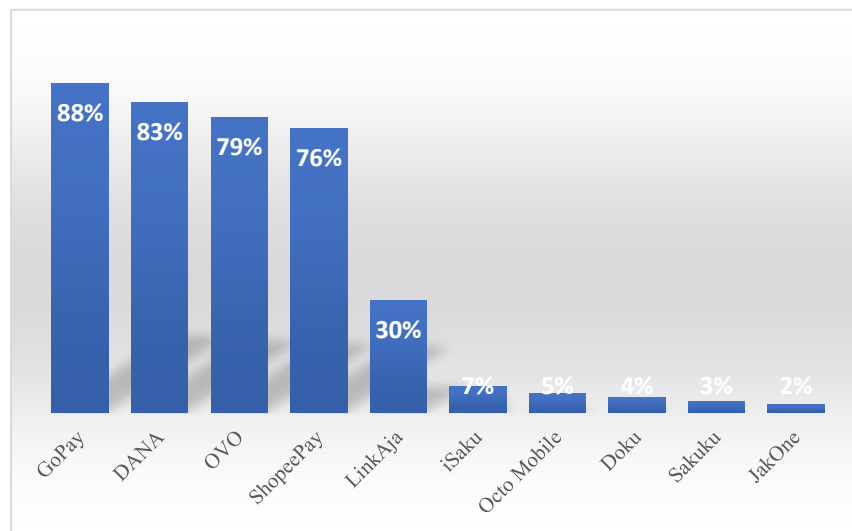
Abstract: Financial technology is a term used by companies that offer technological innovations in the financial sector. One of the products from Fintech is digital payments. The purpose of this study is to analyze the sentiment of digital payments services using the Twitter social media. The digital payments taken in this study are Gopay, Ovo, Dana, and ShopeePay. This research uses the Naïve Bayes Algorithm classification method. Comment data was taken from Twitter social media which were divided into two sentiment classes, namely positive sentiment and negative sentiment. The results of this study are the most widely accepted positive sentiment among the four digital payments is ShopeePay, the most widely received negative sentiment among the four digital payments is Dana. Customers who have skills in using digital payments can be grouped as Well Literate in financial literacy.

Keywords: financial technology; digital payments; sentiment analysis; twitter; naïve bayes algorithm.

1. Introduction

In the current modern era, technological developments continue to increase from time to time. Rapid advances in technological development also affect all important factors in human life. Various human jobs are now made easier with the help of technology. Currently, many financial products are given a touch of technology or often referred to as FinTech. One of the payment segment fintech products is a digital payment (e-wallet). A digital payment is a smartphone application that contains server-based digital money that can be used for economic transactions (Iqbal & Nastiti, 2022). The presence of digital payments also adds to digital financial transactions in Indonesia. Other data is also proven by research conducted by the Jakpat Institute, sourced at Katadata.id. Digital payment users make payments for various needs, most users use it for top up and purchase data (76 percent), online shopping (56 percent), product payments (41 percent), and food delivery purchases (36 percent). The following is a graph showing the Most Frequently Used Payment Method for E-Commerce in 2022 according to Katadata.co.id is E-wallet. According to the popularity of Ewallet, it can be seen in the graph below:

The popularity of E-wallet (Dewi, 2022) can be seen in graph 1 below:



Source: Idxchannel.com 2022

Figure 1. Most Popular E-Wallet in Indonesia

According to Idxchannel.com, users of digital payments with the most sequences are Ovo, Gopay, ShopeePay, Dana, Link AjA, PayTren, iSaku, Doku and Uangku. From the data on the popularity of digital payments and the number of users from the data above, it can be seen that the 4 digital payments, namely GoPay, OVO, DANA and ShopeePay, have high enthusiasm from the public.

There are several reasons people use digital payments. Apart from security reasons, one of the reasons is because of the promos in the form of discounts and cash-back, but over time they actually provide promos that are very detrimental to shareholders, one of which is Lippo releasing 2/3 of its shares or around 70% because it is not strong enough to burn money or often referred to as money-burning activities or activities that spend a lot of money. Apart from that, other digital payments such as gopay, funds and shopeepay also have a strategy of leaving money behind. Another reason people choose a digital payment is to see the security of the digital payment because the increase in digital payment users is used as an opportunity by various elements to commit cybercrime. Based on data from the Directorate of Cybercrimes, the Criminal Research Agency of the Republic of Indonesia, online fraud is not a crime that has been widely reported. Total cyber crimes reached 28.7 percent. To minimize losses, the gopay digital payment service provider launched a Back balance guarantee protection program. One of the digital payments that makes the program safe with gopay which is presented to provide extra security protection while increasing the comfort of gojek and gopay users. With this feature, GoPay will restore the GoPay balance, including GoPaylater, which is lost due to misuse of the Gojek account beyond the user's control. This abuse includes brute force attacks, which are losing balances due to unauthorized login attempts which lead to takeover of gojek or gopay accounts so that transactions are out of control. Apart from gopay, Shopeepay also claims to have embedded a high standard security system, besides that Dana has also implemented various efforts to improve the security system with a security score card to measure domain security posture from independent assessors. And Ovo also ensures the security of user data but there are still many problems that occur that make people have to choose again digital wallets that are safe to use. This phenomenon creates pros and cons for consumers who want to use a digital payment to choose which digital payment is good and safe to use. Perceptions from consumers can also be used to see which digital payments are good and safe to use, which have good service, these perceptions can be negative or positive.

This perception can be seen by analyzing consumer sentiment. One of them is through social media from a digital payment. In choosing a digital payment, one can also look at sentiment analysis through social media as well as by looking at the opinions of consumers or users who have used digital payments, the high level of public awareness of fintech platforms licensed digital payments (e-wallets). With more and more digital payment service providers in Indonesia from year to year, transactions using digital payments are increasing, and there are regulations governing digital payments. It can be interpreted that more and more people are interested in using digital payments in everyday life. Along with this, there will be more public opinion towards digital payments. Opinions regarding the use of digital payments can be channeled by the public through criticism and suggestions provided by digital payment service providers, or through social media. Sentiment analysis is a method of collecting other people's comments and reviews on a matter such as an issue on a web-based social network. Not infrequently consumer reviews on social media are used as evaluation material for companies to provide better service to consumers (Putra et al., 2020).

Social media generates a large amount of information in terms of perceptions, emotions and sentiments (Loureiro et al., 2022). Researchers from various fields make use of almost unlimited data (Žitnik et al., 2022). In this study using social media Twitter. Twitter social media which is the first platform to find the latest information or news. This is supported by the large amount of news or information circulating on online news portals, often sourced from social media Twitter (Hardina & Irwansyah, 2021). Indonesian Twitter users are among those who are active in discussing finance. Twitter Indonesia said that people come to the Twitter platform to discuss many things, from what's going on to talk about their likes or passions (Pratnyawan, 2021). The topic discusses finance from various spectrums, starting from discussions about saving, products, investments, to insights about digital payments.

Several previous studies related to this research. one of them is research Putra et al. (2020) regarding the Analysis of Electronic Wallet Sentiment on Social Media Twitter Using the Naïve Bayes Classifier. This research provides empirical evidence and recommends to the public regarding the selection of available electronic wallets based on the trial results as well as being used as material for analysis before making a choice on one of these electronic wallets.

In addition, Prasaja (2021) conducted research on Twitter Sentiment Analysis for OVO Services Using the Naïve Bayes Method. This study uses the Naïve Bayes Classifier classification method. Comment data was taken from user comments on the Twitter application using Twitter's API (Application Programming Interface) as many as 2500 comment data from users, which were divided into 2 sentiment classes, namely positive and negative classes. The test results have the highest accuracy ratio value on the 80:20% test with a fairly good accuracy value of 73.24%.

Sentiment analysis is seen as a desirable business intelligence tool because it has the ability to extract public opinion on product or service topics contained in unstructured text (Legiawati et al., 2022). With sentiment analysis of tweet data on the opinions of Twitter social media users, it can help research in analyzing data. In this study, opinions were taken on social media. Given the large amount of data the opinions entered, a data analysis process was needed that was able to handle this. One alternative currently available is using big data analysis (Nomleni et al., 2014). The data is processed using text mining. The data analysis process can be carried out using machine learning. And this research uses a classification method using the naïve Bayes algorithm. Based on the description above, the purpose of this study is to determine the sentiment analysis of Twitter social media users for Go-Pay, Ovo, Dana, and ShopeePay digital payment services using the Naïve Bayes algorithm. To find out the comparison of Go-Pay, Ovo, Dana, and ShopeePay digital payments using the Naïve Bayes algorithm. Based on the written research objectives, the researcher hopes that it will provide

the following benefits:

1) Theoretical Benefits

This research is expected to be useful for adding knowledge and insight related to Financial Technology, especially Digital payments which have something to do with sentiment analysis which can be used as a reference for researchers who want to research the same research.

2) Practical Benefits

a) For companies

The results of the research are expected to be used to find out how digital payment services are and to find out sentiment analysis provided by users which can be taken into consideration in decision making and evaluation material for digital payment service providers to improve services based on digital payment user comments so they can survive in competition with other digital payment service providers.

b) For Society

For users, it is hoped that this research will be useful as additional information in considering which digital payment has the service to use.

2. Literature Review

2.1. Financial Technology

Fintech is defined as “innovative and disruptive financial services by non-financial companies, where IT is the key factor” (Fang et al., 2021). FinTech, Financial Technologies, is an emerging topic in the business world and several definitions of Fintech exist in the literature. defines Fintech as an emerging process that results from combining financial services and IT. It covers the entire spectrum of financial services and products traditionally provided by financial institutions defining Fintech as the technical processes resulting from the development and establishment of new financial software that can affect the traditional system as a whole. Fintech can thus improve the performance of financial services by extending them to the mobile environment. Fintech is defined as “innovative and disruptive financial services by non-financial companies, where IT is the key factor” (Fang et al., 2021).

2.2. Digital Payments

Non-cash payments (digital payments) are a set of electronic (non-cash) transaction mechanisms related to the transfer of an amount of money from one party to another, to fulfill obligations arising from an economic activity (Agrani & Rikumahu, 2020). Digital payment Gopay, Ovo, Dana and ShopeePay.

2.3. Twitter

Twitter is an online social networking and microblogging service that allows its users to send and read text-based messages (Prasaja, 2021). In this study, the authors use Twitter social media to retrieve sentiment data related to services from digital payment that will be analyzed.

2.4. Signaling Theory

Signaling theory is a signaling theory based on the assumption that the information received by each party is different. In other words, signal theory is concerned with information asymmetry. Signaling Theory states that there is an information asymmetry between company management and other parties. complete, relevant, accurate and timely information as an

analytical tool in making decisions. The basis of asymmetric information is the inability to distinguish good from bad (Prasetya, 2012).

In this study, the sentiment of digital payment users becomes an assessment of the services of digital payment. Sentiments taken through digital payment user comments from Twitter social media are used as signals that will be seen by digital payment service providers which are used as evaluation material for digital payment service providers. In this study sentiment is used as a variable in making decisions by digital payment service providers in the future. In this study, sentiment becomes a large amount of information and tools that help decision makers to access, compare, and evaluate alternatives (Hariningsih & Harsono, 2019).

2.5. Financial Literacy

The Financial Services Authority defines that financial literacy is a series of processes or activities aimed at increasing the knowledge, skills and confidence of consumers and the general public so that they are able to manage their personal finances better and gain an understanding of the benefits and risks of products. and financial services. When people can recognize and improve their personal financial condition, it means that the level of financial literacy increases. The existence of financial literacy can help increase understanding of financial problems so that they can make the right financial decisions (Kristanti & Rinofah, 2021).

2.6. Preprocessing

In this pre-processing, the process of data processing will be explained for processing in the next process because the data from scraping Twitter data will definitely have noise or the form of the data is not neat (Putri, 2021). At the preprocessing stage, tweet data for digital payment Gopay, Dana, Ovo, and ShopeePay consist of several stages, namely Tokenize (RegExp), Tokenize, Transform Cases, Token Filters (by legh), Stopwords Filters and Stemming.

2.7. Sentiment Analysis

Sentiment analysis is a process that aims to analyze the contents of datasets in the form of text that are positive, negative or neutral. Sentiment analysis is a method used to process comments given by customers or customers through various media, regarding a product, service or agency. Sentiment analysis is carried out to see opinions or opinion tendencies towards a problem or object by someone, whether they tend to have negative or positive views or opinions (Agrani & Rikumahu, 2020).

2.8. Naive Bayes Classifier

The Naïve Bayes algorithm is one of the algorithms included in the classification. This method is the best method of classification proposed by Thomas Bayes by predicting future opportunities based on past data (Sari & Hayuningtyas, 2019).

3. Research Methods

This study aims to find out in depth, in more detail and precisely regarding the problem, namely to find out the Comparison of GoPay, Ovo, Dana and ShopeePay Digital Payment Services as seen from application user reviews. The data used is user comment data from applications from January to October 2022 on Twitter. The research method used in this research is Machine Learning using Text Mining using Rapidminer. The population used in this study is Twitter data where 4000 application user review data are from January to October

2022. The sampling technique used in this study is purposive sampling. Sample The sample criteria in this study were Tweets containing the keywords “@gopayindonesia” “@ovo_id”, @danawallet and @ShopeePay_id and Tweets uploaded from January to October 2022. In this study, secondary data sources were used. Secondary data is data obtained indirectly from related sources. The research used is text data, a collection of comments from users of the "Twitter" application. The data is taken on the application page on Twitter. The data was obtained using the data scraping technique using Tweepy on Twitter user comments. The tool used for scraping data is with the help of the Tweepy application to access the Twitter API to get data from Twitter based on the keywords used. The next process is data labeling. Data labeling is the process of labeling clean data, with the aim of forming a classifier model. Data labeling is done manually by the author, the writer reads the data and determines whether the data is positive or negative.

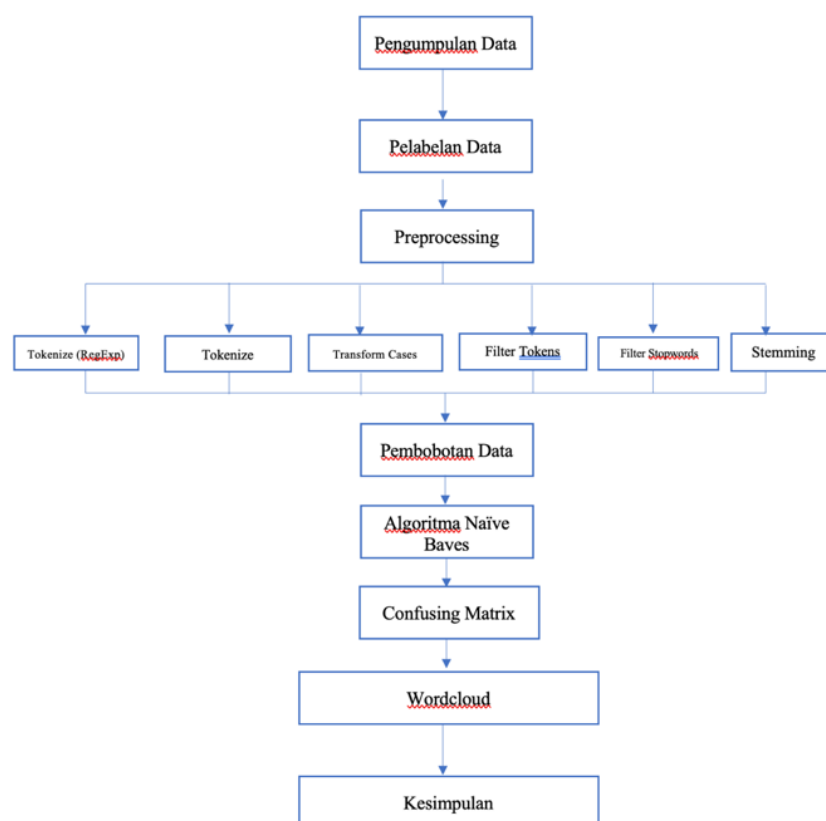


Figure 1. Design Research

4. Results and Discussion

4.1. Labelling

Table 1. Gopay Tweet Labeling Results

Tweet	Sentiment
Gopay plus @gopayindonesia knp ya, susah banget di upgrade. Dah coba 10x pun tetep gagal, ganti hp juga udh padahal.	Negative
CASHBACK @gopayindonesia Datang Lagi! Kali ini cashback @gopayindonesia hadir lebih gedeEEEyaitu https://t.co/D5SAzHD6Is	Positive

4.2. Data Processing Process

After labeling then perform data processing on the Rapidminer application. Below is a picture of the data processing in this study using the Rapidminer application:

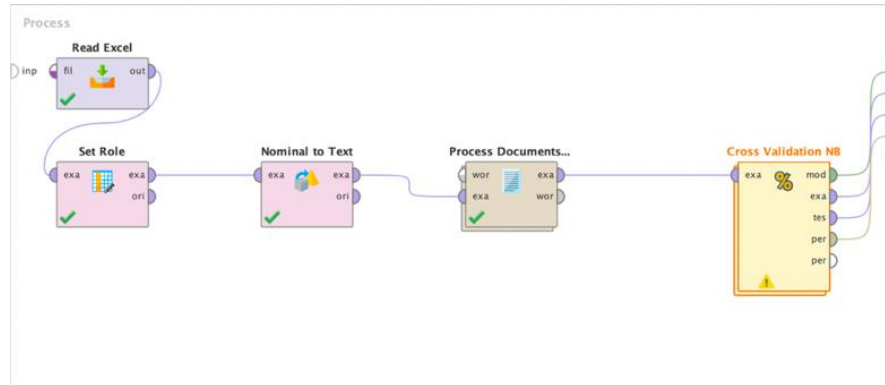


Figure 2. Data Processing Process

4.2.1. Read Excel

The next stage is Read Excel which functions to enter data files that have been labeled into Rapidminer.

4.2.2. Set Roles

The next stage is the Set Role function to distinguish the line naming attribute coordinates and position predictions that will be entered into the 'label' category.

4.2.3. Nominal To Text

This process aims to change and map all nominal attributes to the appropriate string attributes.

4.2.4. Preprocessing

This stage is the first step after carrying out the data analysis process. At the preprocessing stage, tweet data for digital payments Gopay, Dana, Ovo, and ShopeePay consist of several stages, namely Tokenize (RegExp), Tokenize, Transform Cases, Token Filters (by length), Stopwords Filters and Stemming. The following is a picture of the steps in the pre-processing process:

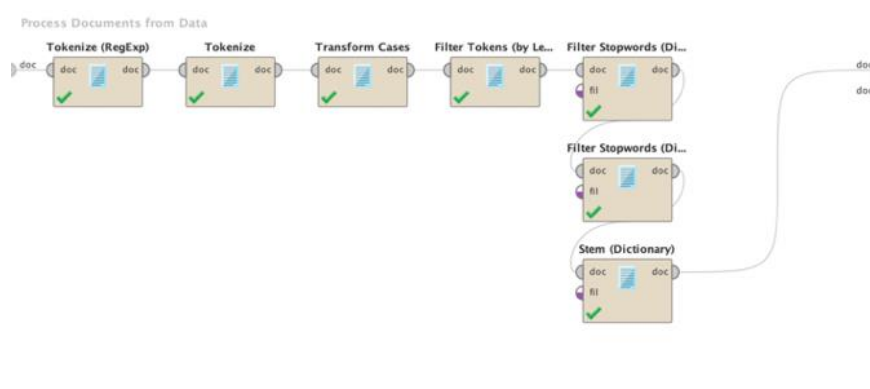


Figure 3. Preprocessing

Figure 3 shows the preprocessing of the document process where there are 7 display processes, namely the tokenize process (RegExp), the Tokenize process, the Transform Cases process, the Tokens Filter process (by leght), the Stopwords Filter process, and Stem.

1) Tokenize

In this study, two parameters were used, namely the regular expression mode and the non-letter mode.

2) Transform case

The operator used in this stage is to change the capital letters in the text to all lowercase.

3) Filter Tokens

In this study, the minimum and maximum length of the characters used are 4 characters and the maximum length is 25 characters.

4) Stopword filter

Stopwords filter is a process of removing unnecessary words from the previous tokenizing process. The word will be stopped by using the KBBI V online dictionary database.

5) Stemming

Stemming is doing the process of finding the root word of each word the results of the previous filtering process.

4.2.5. Weighting Process

Furthermore, the word weighting process is the process of converting words into numbers or vectors, while the TF (frequency term) is for determining the frequency value of a word in a document and assigning weights to each word in each document to find and count how many times the word appears.

4.2.6. Testing the Naïve Bayes Classification Model

At the classification stage using the Naive Bayes Algorithm, it is divided into two processes, namely the training process and the testing process using k-Fold Cross Validation with a value of $k = 10$. Evaluation is done by using the accuracy value in the confusion matrix table. The resulting data is presented with a confusing matrix table.

accuracy: 66.20% +/- 3.43% (micro average: 66.20%)

	true negative	true positive	class precision
pred. negative	356	194	64.73%
pred. positive	144	306	68.00%
class recall	71.20%	61.20%	

Figure 4. Naïve Bayes GoPay results

In sentiment analysis, the 'GoPay' dataset obtains a model accuracy of 66.20%. The number of tweets that are considered positive is 500 Tweets. However, machine learning concluded that 306 tweets were actually positive and 194 tweets were considered negative. With a Recall presentation of 61.20% and a precision of 68%. Meanwhile, the number of tweets that are considered negative is 500 tweets. However, machine learning concluded that 356 tweets were truly negative and 144 tweets were considered positive. With a Recall presentation of 71.2% and a precision of 64.73%.

Figure 5 is the result of sentiment analysis conducted by the author of 1000 tweets about GoPay. The tweets were taken with the keyword @Gopayindonesia.id:

accuracy: 60.40% +/- 6.02% (micro average: 60.40%)

	true negative	true positive	class precision
pred. negative	354	250	58.61%
pred. positive	146	250	63.13%
class recall	70.80%	50.00%	

Figure 5. Naïve Bayes GoPay results

In sentiment analysis, the 'OVO' dataset obtains a model accuracy of 60.40%. The number of tweets that are considered positive is 500 Tweets. However, machine learning concluded that 250 tweets were actually positive and 250 tweets were considered negative. With a Recall presentation of 50% and a precision of 63.13%. Meanwhile, the number of tweets that are considered negative is 500 tweets. However, machine learning concluded that 354 tweets were truly negative and 146 tweets were considered positive. With a Recall presentation of 70.80% and a precision of 58.61%.

Figure 6. is the result of sentiment analysis conducted by the author of 1000 tweets about ShopeePay. The tweets were taken with the keyword '@Danawallet.id':

accuracy: 56.10% +/- 4.91% (micro average: 56.10%)

	true negative	true positive	class precision
pred. negative	351	290	54.76%
pred. positive	149	210	58.50%
class recall	70.20%	42.00%	

Figure 6. Naïve Bayes ShopeePay Test Results

In sentiment analysis, the 'Dana' dataset obtains a model accuracy of 56.10%. The number of tweets that are considered positive is 500 Tweets. However, machine learning concluded that 210 tweets were actually positive and 290 tweets were considered negative. With a Recall presentation of 42% and a precision of 58.50%. Meanwhile, the number of tweets that are considered negative is 500 tweets. However, machine learning concluded that 351 tweets were truly negative and 149 tweets were considered positive. With a Recall presentation of 70.20% and a precision of 54.76%.

Figure 7. is the result of sentiment analysis conducted by the author on 1000 tweets about GoPay. The tweets were taken with the keyword '@Shopeepay.id'.

accuracy: 62.90% +/- 4.36% (micro average: 62.90%)

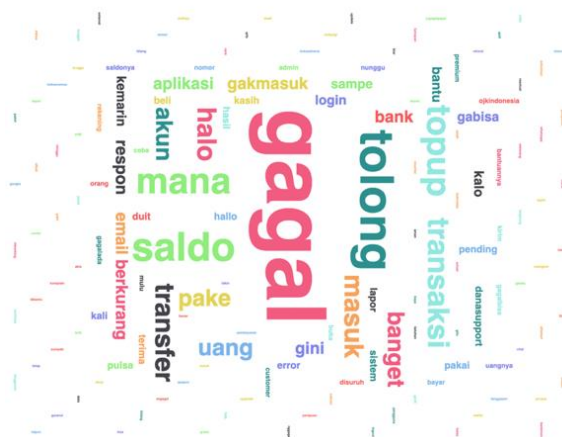
	true positive	true negative	class precision
pred. positive	356	227	61.06%
pred. negative	144	273	65.47%
class recall	71.20%	54.60%	

Figure 7. Naïve Bayes ShopeePay Test Results

In sentiment analysis, the 'Shopeepay' dataset obtains a model accuracy of 62.90%. The number of tweets that are considered positive is 500 Tweets. However, machine learning concluded that 356 tweets were actually positive and 144 tweets were considered negative.

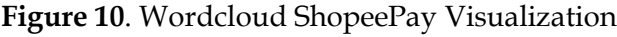
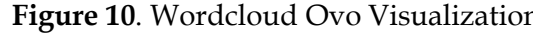
4.3. Wordcloud

As can be seen in the picture above, the words that appear most often are “pakai” which are words with positive sentiments. This word relates to the services provided by the Gopay digital payment. In the dataset, when people write Gopay tweets, the word that often appears with positive sentiment is "pakai" which indicates that the person feels satisfied with the service from Gopay's digital payment. Where the word "pakai" contains positive sentiment meaning that digital payment users use Gopay to make payments, one of the tweets on Twitter This means that digital payment users use the gopay digital payment and get discounts, meaning that users get the benefits of using the gopay digital payment and are satisfied with the gopay digital payment service.



For the words “gagal” are the words most often discussed which are related to the services of digital payment Dana. The word "gagal" is dominant and has a negative sentiment.

gengovoaja email pendirian berkurang mudah keberkurang



4.4. Discussion of Results and Comparison of Sentiment Analysis on Digital payments

In this study, we conducted a comparison of sentiment analysis on Gopay, Dana, Ovo, and ShopeePay digital payments. Here is a comparison of Sentiment Analysis on digital payments:

Table 8. Discussion of Sentiment Analysis Results

No	Digital Payment	Sentiment Count		Sentiment Percentage (Manual)	
		Positive	Negative	Positive	Negative
1	Gopay	306	356	46%	54%
2	Dana	210	351	37%	63%
3	Ovo	250	354	41%	59%
4	ShopeePay	356	273	57%	43%

Based on the table above it can be seen that in each digital payment, where in each digital payment you can see the percentage of positive sentiment and negative sentiment. The Gopay digital payment generates 46% positive sentiment and 54% negative sentiment. on the Dana digital payment generates 37% positive sentiment and 63% negative sentiment on the OVO digital payment generates 41% positive sentiment and 59% negative sentiment And on the fourth digital payment, Shopeepay generates 57% positive sentiment and 43% negative sentiment. After getting the sentiment results from each digital payment, it can be seen that the digital payment that has the most positive sentiment is on the ShopeePay digital payment, then in second place, GoPay, in third place, Ovo, and in fourth position, Dana, means that the digital payment has the best service. Among other digital payments when viewed from the positive sentiment among the four digital payments in this study is the ShopeePay digital payment. This result is supported by research (Fadiyah Basar et al., 2022) which states that the positive sentiment from the ShopeePay digital payment outweighs the negative sentiment from the ShopeePay digital payment. but it is different from the results of the study (Deviani et al., 2022) which concluded that the sentiment most owned by shopeePay is negative sentiment. Then the most negative sentiment among digital payments is Dana, then Ovo, the third is Gopay, and the fourth is ShopeePay which means that the digital payment that has the worst service among other digital payments when viewed from the negative sentiment in this study is Funds. This result is supported by research (Deviani et al., 2022) but different from research (Habibah et al., 2023) which concludes that the sentiment that most funds have is positive sentiment.

4.5. Discussion of Digital payment Service Sentiment Analysis Results

In assessing the results of sentiment analysis on digital payments in this study, it can be seen. In the Gopay digital payment, the accuracy value is 66.22%, which results in positive sentiment of 306 and negative sentiment of 354. The negative sentiment in the digital payment is closely related to the problems experienced by customers with the Gopay digital payment service. If these problems continue, it will reduce the customer's sense of trust, security and comfort in Gopay. This problem is very influential in reducing the intensity of Gopay digital payment users and will indirectly affect the financial decline of the company and the shift of customers to other digital payment service providers.

In the Ovo digital payment, the accuracy value is 60.40%, which results in a positive sentiment of 250 and a negative sentiment of 354. The negative sentiment in the digital payment is closely related to the problems experienced by customers with the Ovo digital payment service. If these problems are allowed to continue, it will reduce the customer's sense of trust, security and comfort in Ovo. This problem is very influential in reducing the intensity of Ovo digital payment users and will indirectly affect the financial decline of the company and the shift of customers to other digital payment service providers.

In the Dana digital payment, the accuracy value is 56.10%, which results in a positive

sentiment of 210 and a negative sentiment of 351. The negative sentiment in the digital payment is closely related to the problems experienced by customers with the Dana digital payment service. If these problems are allowed to continue, it will reduce the customer's sense of trust, security and comfort in Dana. This problem is very influential in reducing the intensity of Dana digital payment users and will indirectly affect the financial decline of the company and the shift of customers to other digital payment service providers.

In the ShopeePay digital payment, the accuracy value is 62.90%, which results in a positive sentiment of 356 and a negative sentiment of 273. The negative sentiment in the digital payment is closely related to the problems experienced by customers with the ShopeePay digital payment service. If these problems are allowed to continue, it will reduce the customer's sense of trust, security and comfort in ShopeePay. This problem is very influential in reducing the intensity of ShopeePay digital payment users and will indirectly affect the financial decline of the company and the shift of customers to other digital payment service providers.

From the results of thorough testing on digital payments, the highest accuracy values are Gopay, ShopeePay, Ovo and lastly Dana, while the highest positive sentiment is ShopeePay, then for negative sentiment the highest is Funds. Overall digital payments in Indonesia have more negative sentiment than positive sentiment. The average negative sentiment on the four digital payments in this study was 54.75% while the average positive sentiment on the four digital payments in this study was 45.25%, which means that there are still many negative comments given to digital payments in Indonesia. This indicates that digital payment services in Indonesia still have many problems that reduce users' sense of trust in digital payments and feel insecure and still have to be repaired and must be re-evaluated.

5. Conclusion

The conclusion of this study is based on a comparison of four digital payments consisting of ShopeePay, Gopay, Ovo and Dana and the digital payments that have the most negative sentiment if sorted are Dana, Ovo, Gopay and ShopeePay. The highest number of positive sentiments from the four digital payments is ShopeePay and the highest negative sentiment is Funds. This means that of the four digital payments that have the best digital payment services when viewed from sentiment analysis on Twitter social media using the Naïve Bayes Classifier Algorithm, the first is ShopeePay where among the four digital payments in this study which has the most positive sentiment and which has the most negative sentiment. few of the four digital payments, meaning that of the four digital payments in this study, ShopeePay has the best digital payment service and customers are more satisfied with the ShopeePay digital payment service. Overall, the average negative sentiment on the four digital payments in this study is 54.75%, while the average positive sentiment on the four digital payments in this study is 45.25%, which means that there are still many negative comments given to the wallets. digital in Indonesia. This indicates that digital payment services in Indonesia still have many problems that reduce users' sense of trust in digital payments and feel insecure and still have to be repaired and must be re-evaluated. Judging from the tweets posted by digital payment customers Gopay, Dana, Ovo and ShopeePay, customers from the four digital payments have skills in using digital payments so that they can be grouped into weel literate in financial literacy.

The several things that need to be developed in sentiment analysis on the four digital payments using the Naive Bayes method, and visualization using the word cloud are as follows:

- 1) In future research, it is expected to use other classification algorithms such as Support Vector Machine, Artificial Neural Network, or Maximum Entropy. In future research, you can use other digital payment objects such as LinkAja, Jenius and others. Preprocessing Data must always keep up with the times. Because remembering sentences taken from Twitter is slang. Based on the negative sentiment from the four digital payments, companies must continue to strive to improve service quality, both products and features. The problems experienced by customers are not necessarily the fault of the digital payment service provider, so the four digital payments should provide explanations and guidelines for using digital payments that are easier and clearer for customers who are still having problems.
- 2) Theoretically, this study provides input for future research that examines Sentiment Analysis through social media Twitter using the Naïve Bayes Algorithm in digital payment services.

References

- Agrani, Anan, and Brady Rikumahu. 2020. "Perbandingan Analisis Sentimen Terhadap Digital Payment 'Go-Pay' Dan 'Ovo' Di Media Sosial Twitter Menggunakan Algoritma Naïve Bayes Dan Word Cloud Comparison of Sentiment Analysis Against Digital Payment 'Go-Pay' and 'Ovo' in Social Media Twitter Using N." *Agustus* 7(2):2534.
- DANA. 2022. "Semua Transaksi Bisa Di Satu Dompot Digital Logo Dana." Retrieved (<https://www.dana.id>).
- Deviani, Winda Aulia, Krishna Kusumahadi, and Eva Nurhazizah. 2022. "Service Quality For Digital payment In Indonesia Using Sentiment Analysis And Topic Modelling." *International Journal of Business and Technology Management* 4(1):46–58. doi: 10.55057/ijbtm.2022.4.1.6.
- Dewi, Intan Rachmawati. 2022. "Peta Kompetisi Dompot Digital Indonesia, Siapa Lebih Unggul?" *CNBC Indonesia*. Retrieved (<https://www.cnbcindonesia.com/tech/20220628115548-37-350996/peta-kompetisi-dompot-digital-indonesia-siapa-lebih-unggul>).
- Fadiyah Basar, Thifal, Dian Eka Ratnawati, and Issa Arwani. 2022. "Analisis Sentimen Pengguna Twitter Terhadap Pembayaran Cashless Menggunakan Shopeepay Dengan Algoritma Random Forest." 6(3):1426–33.
- Fang, Hao, Chien Ping Chung, Yang Cheng Lu, Yen Hsien Lee, and Wen Hao Wang. 2021. "The Impacts of Investors' Sentiments on Stock Returns Using Fintech Approaches." *International Review of Financial Analysis* 77(January):101858. doi: 10.1016/j.irfa.2021.101858.
- Habibah, Nurul, Elvia Budianita, Muhammad Fikry, and Iwan Iskandar. 2023. "Analisis Sentimen Mengenai Penggunaan E-Wallet Pada Google Play Menggunakan Lexicon Based Dan K-Nearest Neighbor." 10(1):192–200. doi: 10.30865/jurikom.v10i1.5429.
- Hardina, Andhika Febi, and Irwansyah Irwansyah. 2021. "Uses and Gratifications : Twitter Tetap Menjadi Primadona." *Jurnal Lensa Mutiara Komunikasi*.
- Iqbal, Muhammaq, and Heni Nastiti. 2022. "Jurnal Akuntansi Dan Pajak." *Jurnal Akuntansi Dan Pajak* 22(22):1–13.
- Kristanti, Elisabet Yuli, and Risal Rinofah. 2021. "Karakteristik Literasi Keuangan (Studi Kasus Mahasiswa Fakultas Ekonomi Universitas Sarjanawiyata Tamansiswa)." *Jurnal Manajemen STIE Muhammadiyah Palopo* 7(1):1. doi: 10.35906/jm001.v7i1.672.
- Legiawati, Nenden, Teguh Iman Hermanto, and Yudhi Raymond Ramadhan. 2022. "Analisis Sentimen Opini Pengguna Twitter Terhadap Perusahaan Jasa Ekspedisi Menggunakan

- Algoritma Naïve Bayes Berbasis PSO." 9(4):930–37. doi: 10.30865/jurikom.v9i4.4629.
- Loureiro, Maria L., Maria Alló, and Pablo Coello. 2022. "Hot in Twitter: Assessing the Emotional Impacts of Wildfires with Sentiment Analysis." *Ecological Economics* 200:107502. doi: <https://doi.org/10.1016/j.ecolecon.2022.107502>.
- Mahendrajaya, Rachmad, Ghulam Asrofi Buntoro, and Moh Bhanu Setyawan. 2019. "Analisis Sentimen Pengguna Gopay Menggunakan Metode Lexicon Based Dan Support Vector Machine." *Komputek* 3(2):52. doi: 10.24269/jkt.v3i2.270.
- Mubarok, Agus Triana, Cici Suparti, and Citra Ryzki Damayanti. 2022. "Analisis Tingkat Transaksi Menggunakan Aplikasi Dompot Digital Dana Ovo ShopeePay Dan GoPay."
- Nomleni, Petrix, Mochamad Hariadi, and I. Ketut Eddy Purnama. 2014. "Sentiment Analysis Berbasis Big Data." *Seminar Nasional Rekayasa Teknologi Industri Dan Informasi* 9:142–49.
- Phan, Huyen Trang, Ngoc Thanh Nguyen, and Dosam Hwang. 2022. "Aspect-Level Sentiment Analysis: A Survey of Graph Convolutional Network Methods." *Information Fusion*. doi: <https://doi.org/10.1016/j.inffus.2022.10.004>.
- Prasaja, Harish Ridha. 2021. "Aanalisis Sentimen Twitter Terhadap Layanan OVO Menggunakan Merode Naïve Bayes Classifier."
- Prasetya, Ferry. 2012. "Modul Ekonomi Publik Bagian III: Teori Informasi Asimetris." *Modul Dosen* 53(9):1689–99.
- Sari, Retno, and Ratih Yulia Hayuningtyas. 2019. "Penerapan Algoritma Naive Bayes Untuk Analisis Sentimen Pada Wisata TMII Berbasis Website." *Indonesian Journal on Software Engineering, Vol.*
- SPay. 2021. "Selamat Datang Di ShopeePay!" *SPay* 23–25.
- Wildan, Rizky Ainul, Rian Adam Rajagede, and Ridho Rahmadi. 2021. "Analisis Sentimen Politik Berdasarkan Big Data Dari Media Sosial Youtube : Sebuah Tinjauan Literatur." *Automata* 2.
- Žitnik, Slavko, Neli Blagus, and Marko Bajec. 2022. "Target-Level Sentiment Analysis for News Articles." *Knowledge-Based Systems* 249:108939. doi: <https://doi.org/10.1016/j.knosys.2022.108939>.