

## WHAT DO INDONESIAN NETIZENS THINK ABOUT THE E-MONEY? : A SENTIMENT ANALYSIS WITH MACHINE LEARNING

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### ABSTRACT

This study aims to identify the most popular topics and words in conversations in cyberspace with the issue of E-Money. In addition, the research aims to find out how netizens feel about E-Money with the help of Machine Learning. This study uses a quantitative method with a sentiment analysis approach using the Machine Learning program, namely Orange Data Mining. The data used are tweets originating from Twitter that were crawled from April 5, 2023, to April 12, 2023. Researchers used the keywords E-Money, "Electronic Money," and "Electronic Money" to get a total of 800 tweets. The results showed that the words "Money," "Deposit," and "Tools" are the three words that appear most frequently in discussions of E-Money on Twitter, which is a registration procedure for using E-Money for the first time. In addition, E-Money is widely discussed in tweets in the form of Quizzes or giveaways, so in these tweets, E-money is used as a medium for transferring funds. Overall, the sentiment shown by netizens on Twitter is positive, with emotions dominated by feelings of joy and surprise towards E-Money. On the other hand, a tiny number still shows negatively, especially when experiencing technical problems when using E-Money, so concerns arise about the security of their money and personal data. Then the results of this study can be used by E-Money issuers as evaluation material to continue improving the security system so that E-Money users feel safe and satisfied and will continue to use E-Money for an extended period.

**Keyword:** E-Money, sentiment analysis, twitter, machine learning

### ABSTRAK

Penelitian ini bertujuan untuk mengidentifikasi topik dan kata yang paling populer dalam percakapan di dunia maya dengan topik E-Money. Selain itu, penelitian juga bertujuan untuk mencari tahu sentimen dan emosi netizen tentang E-Money dengan bantuan *Machine Learning*. Penelitian ini menggunakan metode kuantitatif dengan pendekatan sentiment analysis menggunakan program Machine Learning yaitu Orange data Mining. Data yang digunakan adalah tweet yang berasal dari Twitter yang diambil dari 5 April 2023 sampai dengan 12 April 2023. Peneliti menggunakan kata kunci E-Money, "Electronic Money," dan "Uang Elektronik untuk mendapatkan total 800 tweet. Hasil penelitian menunjukkan bahwa kata "Money," "Deposit," dan "Pulsa" adalah tiga kata yang paling sering muncul dalam pembahasan E-Money di Twitter. Ketiga kata tersebut merupakan tata cara registrasi untuk menggunakan sebuah E-Money pertama kalinya. E-Money banyak sekali dibahas di dalam tweet yang berbentuk Quiz atau giveaway sehingga dalam tweet tersebut, E-Money digunakan sebagai media transfer dana. Secara keseluruhan, sentimen yang ditunjukkan oleh netizen di Twitter positif dengan emosi yang didominasi oleh perasaan senang, dan surprise terhadap E-Money. Di sisi lain, masih ada sebagian kecil yang menunjukkan sentiment negatif terutama pada saat mengalami kendala teknis saat menggunakan E-Money sehingga muncul kekhawatiran terhadap keamanan uang dan data pribadi mereka. Maka, hasil penelitian ini dapat digunakan oleh penerbit E-Money sebagai bahan evaluasi untuk terus meningkatkan sistem keamanan sehingga pengguna E-Money merasa aman dan puas sehingga akan terus menggunakan E-Money dalam jangka waktu yang Panjang.

**Kata Kunci:** E-money, analisis sentimen, twitter, machine learning

### Introduction

Digital technology has developed very rapidly in the last two decades. Digital technology also encourages the development of trading systems through e-commerce activities. In addition, digital technology also offers various other

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advantages. For example, in the business sector, digital technology encourages manufacturers to create automation systems that can provide efficiency and increase competitiveness (Gu *et al.*, 2021; Shao *et al.*, 2022; Timur, 2022). From the consumer side, technology can offer advantages in terms of service, flexibility, and cheaper price options for consumers (Güney and Sangün, 2021; Mohammadyari and Singh, 2015).

Electronic Money or E-Money is an example of using digital-based financial technology widely applied in today's business world. Mansour (2022) said that the rapid spread of the COVID-19 virus in 2021-2022 made many countries synergize through their central banks to develop e-money-based financial infrastructure to reduce the volume of non-cash transactions. E-Money has a more optimal function of documenting transactions and traceability through digital banking (Alkhowaiter, 2020 and Patil *et al.*, 2020). In addition, the COVID-19 pandemic has also encouraged consumers to use e-money payment systems because consumers are required to comply with distance restrictions, so the only practical solution is to use digital payment services (Timur *et al.*, 2022 and Upadhyay *et al.*, 2022).

The increase in the use of the e-money system is in line with the growth of global non-cash transactions, especially in developing countries which have doubled in development (Mansour, 2022). In Indonesia, the product of E-Money is marked by the increasing number of operating E-Money issuers, namely as many as 61 issuers, of which 44 are non-bank institutions (Danareksa Research Institute, 2021). The government also encourages the public to use E-Money in daily transactions to reduce the use of non-cash payment instruments with the "National Non-Cash Movement" campaign (Hapsari *et al.*, 2021).

On the other hand, the use of technology in the E-Money system still has various challenges. The level of acceptance of new technology, such as E-Money, is strongly influenced by digital literacy. The digital literacy gap varies based on gender, place of residence, age, and profession, so it will make a difference in the level of technology acceptance (Kurnia and Astuti, 2017). As consumers and business actors, many still need to gain the interest, knowledge, and ability to adapt to E-Money (Collyn and Zalukhu, 2021 and Romadhon and Fitri, 2020). Consumers have concerns about security issues related to data security, privacy, and data governance and the risk of being misused for criminal purposes (Buldas *et al.*, 2022 and Subagiyo, 2019). Some public sentiment also considers that the direct costs incurred when making top-ups or transactions with e-money are too significant in value, so they are detrimental to consumers (Setiawati and Falah, 2019).

Several previous studies have confirmed the identification of customer behavior and sentiments in using e-money. Miliani *et al.* (2013) identified customer behavior using e-money with the in-depth interview approach. Meanwhile, Aji *et al.* (2020) tried to quantitatively measure how a person's intention to use e-money services in Indonesia with the variable subjective norm and knowledge about usury. New technology will have different user sentiments and responses (Al-Sabaawi *et al.*, 2021). Research by Alshamsi and Andras (2019) for example, says that Bitcoin, as a manifestation of blockchain technology in the financial industry, is perceived

negatively by some people from a security point of view. In contrast, Balzarova *et al.* (2022) found that blockchain technology has a relatively positive sentiment because it provides benefits from aspects of transparency. What about e-money? This research will offer a different approach because it uses many data derived from twitter metadata so that the results obtained can complement previous research. Twitter is the most important and influential medium for exploring public opinion on a topic (Li *et al.*, 2018). Understanding public opinion is very important in developing policy strategies that aim to shape and direct public behavior toward the goals to be achieved (Khanday *et al.*, 2021).

Policymakers and financial industry players need to understand public sentiment as direct users of e-money. As a new technology developed in the last ten years, e-money has higher dynamics than traditional money storage systems. By knowing how the public responds and sentiments about e-money, it can be measured later and identify the weaknesses and strengths that need to be improved in the practice of e-money in the community. In the end, this study aims to determine the public sentiment and emotions on social media twitter regarding using e-money to store money and payment systems in society. This research will be the first study to use primary data from metadata originating from twitter using the keyword e-money or electronic money. This study's results will enrich the body of knowledge, especially in understanding public responses and opinions regarding e-money. Researchers and academics can also use the results of this study as a reference for future research using e-money as a research focus. In addition, the results of this study can provide a practical contribution in the form of new insights for business actors and the government as policymakers to find out trends and public opinion so that they can identify and develop new strategies related to e-money.

## **Literature Review**

### **Digital Payment**

Digital payment is a system of payment of funds through electronic media using authority from banking institutions to carry out credit and debit activities for accounts included in the bank's management (Sivathanu, 2019). Meanwhile, Al-Sabaawi *et al.* (2021) define digital payment as a method of commercial payment that uses electronic network technology. Digital payments are growing with the mobility offered through mobile phones and telecommunication networks (Raharja *et al.*, 2020). Many people in developing countries choose to use digital payment services because they offer a variety of financial solutions and services such as electronic money or e-money, e-banking, mobile banking, insurance, micro-loans, and payment of various bills via mobile phones (Al-Sabaawi *et al.*, 2021 and Setor *et al.*, 2021). Digital payments offer better flexibility and security than conventional payment systems (Yusfiarto *et al.*, 2023). In addition, governments in developing countries also support cash reduction campaigns in their financial systems (Purba *et al.*, 2021). Al-Sabaawi *et al.* (2021) explained that the flow of payments with the digital payment system starts from an e-payment gateway where when a buyer makes a particular transaction, the buyer will send a message signal to the financial institution as the authority, which will continue to transfer the funds to the seller via encryption process.

On the other hand, new technologies, such as digital payments in developing countries, are only sometimes well-received by the public. Ghosh (2022) said that people in developing countries have habits and cultures that have developed long enough sometimes to have negative sentiments about the existence of digital payments, which have only developed in the last decade. The ease of use, image, and value provided by digital payments greatly influence public sentiment about digital payments as a new technology. Sentiment analysis in this study will prove the results of advertising campaigns and the quality of products and services provided by digital payment providers in influencing public sentiment on twitter social media (Trivedi and Singh, 2021).

### Definition and Development of E-Money in Indonesia

Electronic money or e-money is a means of payment stored electronically, issued based on the value of money by the issuer (Bank Indonesia, 2009). Meanwhile, Hapsari *et al.* (2021) define E-Money as an innovative digital money product that is an alternative to technology-based payment instruments whose value is stored in an electronic medium. In Indonesia, the practice of circulating e-money is regulated in Bank Indonesia law Number 20/6/PBI.2018 concerning Electronic Money or E-Money.

Some researchers, such as Jakhiya *et al.* (2020), Kiconco *et al.* (2020), and Koomson *et al.* (2021) use the term "Mobile Money" to describe electronic money that uses a chip inside a mobile phone to store the value of money held by customers. However, e-money in Indonesia differs from mobile money in terms of the technology used. E-Money in Indonesia is in the form of a card with a chip that stores money values (Aji *et al.*, 2020). The customer deposits the value of money to the e-money issuer (Arifin and Oktavilia, 2020). In Indonesia, issuers of chip-based cards are still dominated by banks such as Bank BCA (Flazz), Bank Mandiri (E-Money), Bank BRI (Brizzi), and Bank BNI (Tap Cash) (Aji *et al.*, 2020).

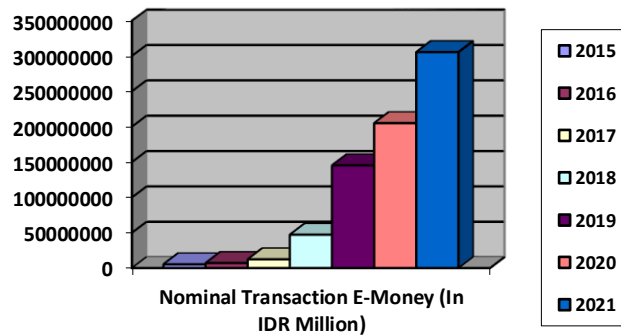


Figure 1. Data Nominal Transaction E-Money in Indonesia

Source : Bank Indonesia 2021

Bank Indonesia (2021) data in figure 1 shows that transaction turnover using E-Money in Indonesia continues to increase simultaneously yearly. It was recorded that in 2021, the transaction value using E-Money reached IDR 305,435,821 Million. This value increased by almost 50% compared to E-Money transactions in Indonesia in 2020. The high volume of money transactions using E-Money has contributed significantly to the circulation of money in Indonesia

(Rahmawati *et al.*, 2018). E-Money offers more advantages compared to conventional payment systems. For example, as cheaper transaction costs because there are no additional fees (Arifin and Oktavilia, 2020), security both from the physical side of money and from the transaction data (Tee and Ong, 2016), easy practical and time-saving (Miliani *et al.*, 2013).

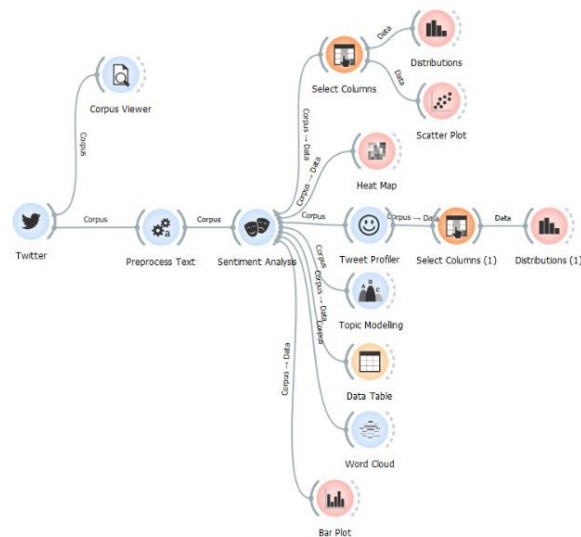
### **Pros and Cons of E-Money**

Electronic money or e-money is developing along with the growing use of cell phones and the internet worldwide (Alkhowaiter, 2020 and Chawla and Joshi, 2021). E-money is perceived as a payment method that can save time, has a method of use that is easy and efficient, and has a higher level of security than conventional payment methods (Miliani *et al.*, 2013). Many small and medium-scale entrepreneurs use e-money in their business activities, such as paying suppliers and taxes and as a payment medium for products sold (Bai *et al.*, 2021). E-money has at least three stakeholders in its workflow, namely customers (funders), regulatory agencies (banks), and sellers (recipients of funds). The length of the e-money workflow has created several negative issues that can affect the image and sentiment of the public regarding e-money. Mogaji and Nguyen (2022) found several aspects that can negatively influence public perception of e-money, such as the vulnerability to hacking, online fraud, issues of data leakage, and privacy of e-money users. Hacking and online fraud are prone to occur in financial systems that use digital systems due to weak supervision, especially on the part of banks and the government as regulators (Whisker and Lokanan, 2019). Information technology infrastructure that is quite complicated makes people worry about the ease of using e-money (Buldas *et al.*, 2022). User sentiment or response to new technology is significant to understand because it will affect a person's intensity in long-term use (Duffett, 2015).

### **Research Methods**

This study uses a qualitative method with a sentiment analysis approach using the Orange Data Mining program as a tool. The data used comes from twitter's social media tweets. Twitter can provide free and original data and information from tweets originating from its users (Mittal and Ahmed, 2021). Tweets are short messages in the form of words with a maximum of 280 words, which is characteristic of twitter (Antonakaki *et al.*, 2021). Several types of metadata obtained from the results of the Twitter data crawl process are tweets, retweets, comments, comment replies, number of likes, date tweet, author name, language, and author location.

Overall, this study has three stages, namely, the first stage is crawling data on social media twitter. The second stage is the pre-processing process, sentiment analysis, and visualization using the *multilingual sentiment* method with the help of the orange data mining program as shown in figure 2. The third is the identification and visualization results. Sentiment analysis is an analytical method based on text classification by processing language, processing linguistics, and data originating from text mining into an analysis of the author's opinions, sentiments, and emotions on a particular topic (Mailoa, 2021).



**Figure 2. Widget Structure in Orange Data Mining**

Source: Processed By Orange Data Mining

The crawling process uses the Twitter Application Programming Interface (API), carried out on April 12, 2023, to retrieve metadata sources originating from tweets on twitter from April 5, 2023 to April 12, 2023 in website <https://developer.twitter.com/>. The data crawling process uses the help of orange data mining tools. Orange data mining is an open-source machine learning with functions for data mining, identification, and analysis in visual form (Mir *et al.*, 2022). Orange data mining operates within python programming. Sentiment analysis in orange data mining can provide sentiment predictions for each document in the corpus or a group of previously crawled documents. Sentiment prediction uses sentiment modules from lexicon bases which have advantages in terms of flexibility (Trivedi and Singh, 2021).

This research focuses on netizens in Indonesia, where the language commonly used is Indonesian. Therefore, the three keywords used in this study are a combination of research objects that have an absorption language from English and also use Indonesian. The three keys used are "E-Money," "Electronic Money," and "Uang Elektronik". The total tweet data obtained and processed in this study are 800 tweets in Indonesian and originat.

In the pre-processing stage, researchers carried out three steps to eliminate parts of tweets that were irrelevant to the research so that the results of crawling data were cleaner. The first stage, namely the Transformation stage, where the researcher uses the "Lowercase" function to change all letters in the tweet sentence to lowercase, the "Remove Accents" function to remove accents or language that has no meaning relevant to this study, the "Purse HTML" function to delete tweets in the form of HTML or URL. The second stage is Tokenization, which is the stage for separating each word that composes tweets so machine learning can process them more quickly. The last is the filtering process using Stopwords to remove comments that have no meaning and are irrelevant to the targeted keywords.

At the sentiment analysis stage, researchers used the Multilingual Sentiment method. Multilingual Sentiment was chosen because it is the only Lexicon language method that can detect tweets or sentences in Indonesian. Data that has been recognized will be identified with three types of dictionary files consisting of words that describe a positive sentiment, netral and phrases that describe a negative sentiment. The results of sentiment weighting with multilingual sentiment will produce three types of descriptions : positive, netral and negative.

## Result

### Dialogue Data Text Mining Twitter

**Table 1. Tweets With Most Likes and Retweets**

Content (Original)	Content (In English)	Number of Likes	Number of Retweet
Lindungi Kalimantan Utara dari polusi udara. Bergabung bersama kami! Tandatangani petisi, unggah screenshot bukti, dan dapatkan kesempatan memenangkan e-money / flazz dengan muka bias kamu!	Protect North Kalimantan from air pollution. Join us! Sign the petition, upload proof screenshots, and get a chance to win e-money / flazz with your biased face!	469	96
Giveaway Saldo 10K Bebas E-money apa aja ya guys, Follow aku, RT twit ini + thread review dibawah	10K Balance Giveaway Free e-money, guys, follow me, RT this tweet + review thread below	205	205
Yuasa mau mengetes kalian nih, apa aja sih ciri-ciri aki mobil yuasa yang kalian tahu? Sebutkan minimal 3 yaa. Untuk kalian yang berhasil jawab dengan benar, kalian dapet kesempatan untuk memenangkan e-money total 300K untuk 3 orang pemenang!	Yuasa wants to test you. What are the characteristics of Yuasa's car battery that you know? Mention at least three, okay. For those of you who answer correctly, you get a chance to win e-money totaling 300K for three winners!	105	76
Bagi Bagi THR !dalam edisi ultahku yang berumur 2 dekade ini, saya berniat untuk bagi-bagi THR (e-money) untuk 10 orang!! hehe. Rulesnya cukup like/rt twit ini terus kasih wish/pantun di twit ku di bawah ini!InsyaAllah bsk sore lgsg diumumkan bagi yg beruntung	Share THR! In my two decade old birthday edition, I intend to share THR (e-money) with ten people!! Haha. The rules are enough to like/rt this tweet and than give a wish/rhyme on my tweet below! InsyaAllah, it will be announced tomorrow afternoon for the lucky ones	60	61
Pre-Order e-money Sticker / Card Skin - Going Seventeen Edition Bisa untuk kartu kredit / kartu debit / e-money / flazz / Brizzi, To Be Noted: Ini hanya sticker bukan kartu ya!	Pre-Order e-money Sticker / Card Skin - Going Seventeen Edition Available for credit cards / debit cards / e-money / flazz / Brizzi, To Be Note: This is just a sticker, not a card!	52	19

Source: Processed by Orange Data Mining

Table 1. shows five tweets from the crawling process metadata with the highest likes and retweets. Table 1 presents the original tweet content in Indonesian and the tweet content translated into English. Based on the five tweets with the highest number of likes and retweets above, there are similarities in the nature or characteristics of each tweet, namely the use of e-money as a noun that functions as a means of payment. For example, the first, second, third, and fourth tweets are quizzes and will distribute prizes to the winners as e-money. E-Money is used as a payment medium for products sold by the tweet's author in the fifth tweet.

### Word Cloud

In the word cloud widget section, the research results are presented in a visualization of a set of words with a high intensity used as topics in tweets that discuss E-Money as shown figure 3. The larger the word size on the Word Cloud, the more often the word is mentioned in the tweet.



**Figure 3. Word Cloud Visualisation**

Source : Processed by Orange Data Mining

The results of the Word Cloud process show that the word "Money" is the word most frequently mentioned in the tweets used in this study, namely 843 times. Furthermore, "Deposit" is the word that appears the second most often, with an intensity of 706 times. Next comes the word "Pulsa", "Dana", "Bonus", "Member", "Event", "Berhadiah", "Diawal", dan "Lucky" is the next word that appears most frequently in tweets discussing E-Money. Apart from the words above, there are also several words that are familiar as institutions or brands of card providers or issuers of E-Money services such as "Bank", "Mandiri", "Flazz", "Brizzi", "Livin", "Gopay", "Linkaja", "Ovo", "Bca" dan the others. The results of word cloud visualization are presented in table 2.



**Table 2. The Most Appearing Words in Tweets**

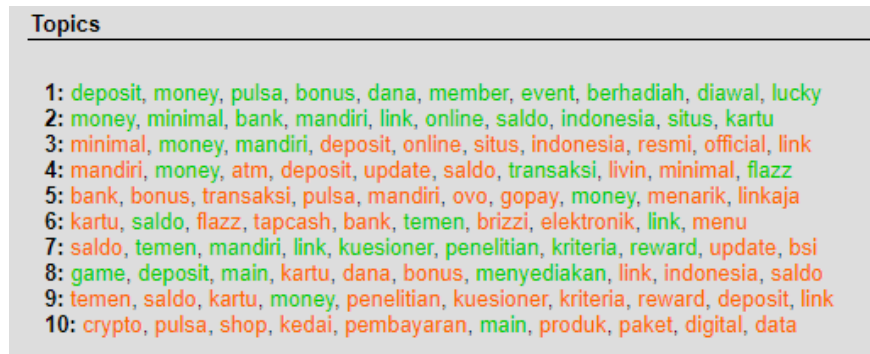
Word (Original)	Word (In English)	The word count appears in the tweet
Money	Money	843
Deposit	Deposits	706
Pulsa	Pulses	354
Dana	Fund	336
Bonus	Bonus	335
Member	Member	310
Event	Event	306
Berhadiah	Proze	305
Diawal	At The Beginning	304
Lucky	Lucky	304

Source: Processed by Orange Data Mining

### Topic Modelling Visualisation

In the topic modeling visualization section, the results of data processing using Orange Data Mining found 10 topics that became the most popular topics of discussion on Twitter social media as shown figure 4. This result also strengthens the results of the previous Word Cloud process which also obtained data in the form of "Word" which appears most frequently in e-money discussions.

Some of the topic words that appear most often are "Deposit", "Money", "Pulsa", "Bonus", "Dana", "Member", "Event", "Berhadiah", "Diawal", dan "Lucky". In addition, in the group of topics that often appear second are the words "Money", "Minimal", "Bank", "Mandiri", "Link", "Online", "Saldo", "Indonesia", "Situs", Kartu".



**Figure 4. Topic Modelling Visualisation**

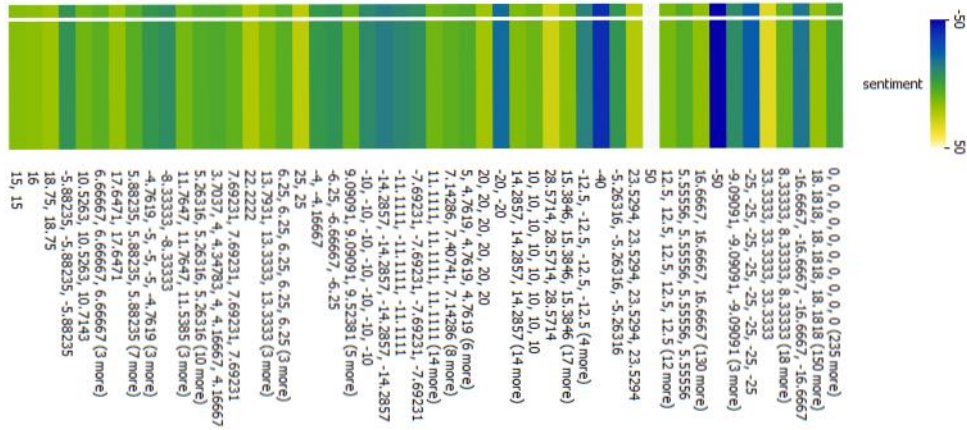
Source: Processed by Orange Data Mining

### Heat Map Visualisation

The heat map widget provides visible results derived from the two selected matrices in the form of numerical data. The value and color represent the strength of each attribute so that we can identify sentiment from the tweet data used. Based on the heat map numbers, the greater the number obtained or > 0.00, the more positive the sentiment of the tweet data group used. Vice versa, the smaller the heat map value or <0.00, the more negative the sentiment obtained.

The sentiment displayed by the heat map widget can also be judged based on the colors that appear on the Heat Map. The yellowish-green color reflects positive sentiment, while the bluish-green color represents negative sentiment. The

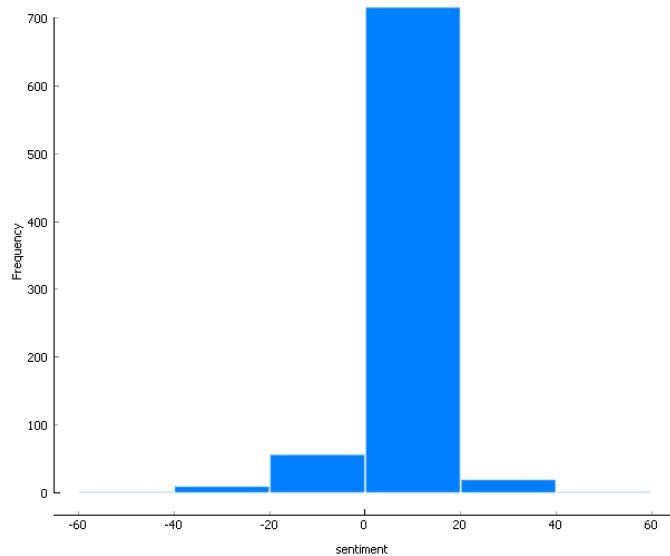
results of the heat map visualization are presented in figure 5 show that positive sentiment dominates the 800 tweets analyzed in this study. This can be seen on the heat map, which is dominated by yellowish-green color, which indicates that the sentiment value obtained on average has a value of  $> 0.00$ .



**Figure 5. Heat Map Visualisation**  
 Source: Processed by Orange Data Mining

**Sentiment Distribution Visualisation**

Sentiment visualization can also be described in a different form than the visualization results from the Heat Map widget, for example, in the Visualization of sentiment distribution which has a simple graphic display that is easier for readers to understand. If the sentiment value is  $> 0.00$ , the sentiment from the tweet data used is positive. Conversely, if sentiment has a value  $< 0.00$ , the tweet data has a negative sentiment. The result of sentiment distribution visualisation are presented in figure 6.



**Figure 6. Sentiment Distribution Visualisation**  
 Source: Processed By Orange Data Mining

The sentiment distribution visualization shows that the number of tweet sentiments with a value between 0 – 20 dominates with 716 or 89.28% of the total number of tweets. If the sentiment value is at 0, then sentiment can be considered neutral. In addition, tweet data has very positive sentiment, meaning that it has a sentiment value between 20-40, as much as 19 or 2.37%. At the same time, the tweet data with negative sentiment is 56 or 6.98%, with a sentiment value of 0 – minus 20. The research also found a small portion of tweet data showing very negative sentiment, with 9 or 1.12% of the total 800 tweet data processed. Table 3 show the sample tweet and the emoticon reaction of sentiment distribution data.

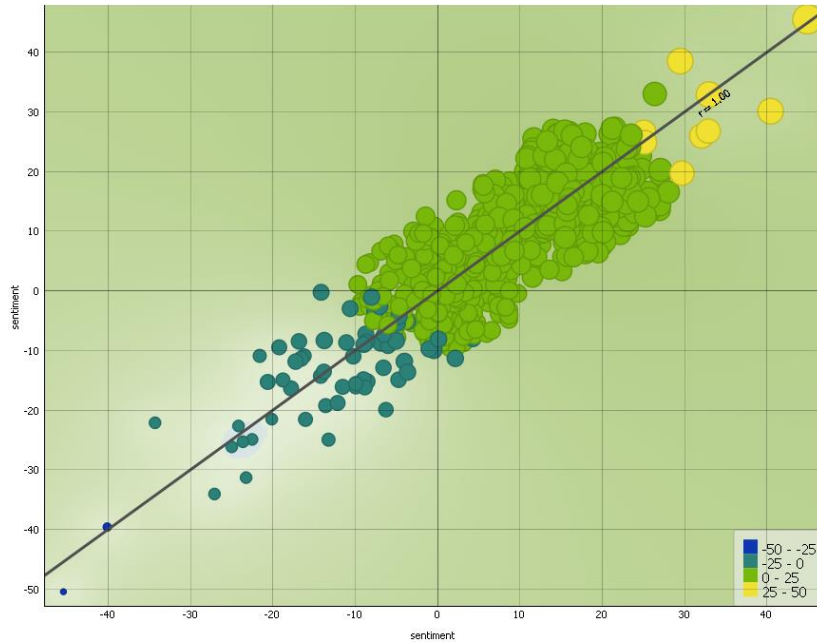
**Table 3. Sample Tweets and Emotions shown**

Content (Original)	Content (In English)	Emotions Type
lebih suka e-money mandiri, top up nya gampang	prefer Mandiri e-money, top up was easy	Very Positive
!UPI ada yang mau ngisi kuisisioner penelitian terkait Pengaruh User Generated Content di Instagram? Untuk 2 orang beruntung bakal dapet gift tunai/e-money senilai Rp.200.000. Link nya aku drop dibawah	!UPI anyone wants to fill out a research questionnaire related to the Influence of User Generated Content on Instagram? For 2 lucky people, they will get a cash/e-money gift worth IDR 200,000. I dropped the link below	Positive
Aku baru pulang dari Jepang, kartu e-money banyak yg ga bisa dipake.. tapi kemarin Alhamdulillah bisa dipakai lgi yang lama	I just got back from Japan, many e-money cards can't be used... but yesterday, Alhamdulillah, I can use the old one again	Netral
hallo min @ShopeeID saya ada masalah dengan top up e-money melalui aplikasi shopee. pd tgl 4 april saya top up 200.000, posisi di jalan tol menuju cikaran krn saldo kurangstlh lakukan top up, saldo berkurang, tetapi saldo di e-money tidak bertambah, meskipun sudah update	hello admin @ShopeeID I have a problem with e-money top up via the Shopee application. on April 4th I top up 200,000, the position is on the toll road heading to Cikaran because the balance is lacking, after I top up, the balance decreases, but the balance in e-money does not increase, even though it has been updated	Negative
ini livin mandiri kenapa error ya gak bisa topup e-money?udh berapa hari	The Livin Mandiri, why is there an error, can't top up e-money? How many days has it been	Very Negative

Source: Processed by Orange Data Mining

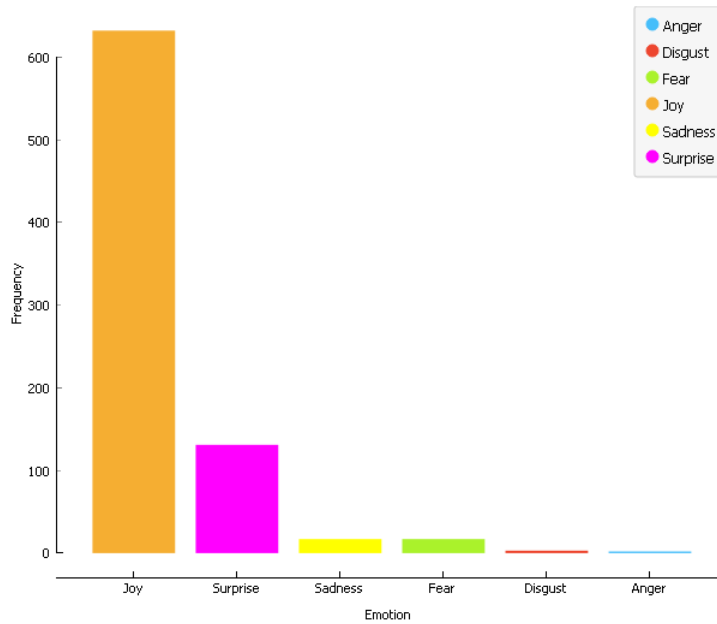
### Scatter Plot Visualisation

The widget scatter plot can visualize the results of metadata assistance from twitter in the form of scattered dots plotted in a specific pattern. Scatter plot data is used based on the attributes of the x-axis and y-axis with various color choices and graphics to make it easier for users to understand the results of data processing. In this study, researchers used sentiment attributes on both axes to determine the scatter plot distribution based on the sentiments obtained. The visualization results of the scatter plot widget show in figure 7 explain that most of the tweet data show a light green color with a sentiment value between 0 - 25. This means that the scatter plot results also complement the results of the previous visualization that public sentiment regarding e-money has a positive meaning in Indonesia.



**Figure 7. Scatter Plot Visualisation**  
 Source: Processed by Orange Data Mining

**Data Sentiment Based On Twitter Profiller**



**Figure 4. Data Sentiment Bsd On Twitter Profiller Visualisation**  
 Source: Processed By Orange Data Mining

Sentiment analysis can be measured through the twitter profiler from previously crawled document data. The twitter profiler widget will identify and measure the emotional probability of each document by classifying Ekman's, Plutchik's, and Profile of Mood States (POMS). The sentiment analysis results

using the twitter data profiler widget show in figure 8 explain that 632 data tweets show a joy response. This feeling of joy dominates with a percentage value of 78.80% of the total processed tweet data. Next, 131 data tweets, or 16.33%, are identified as tweets showing feelings of surprise. On the other hand, only a small number of tweets show negative sentiments. For example, on feelings of sadness, the results of sentiment data using the twitter profiler widget show 17 or 2.12% of the tweet data feeling feelings of sadness and fear. The smaller number was also obtained by sentiment analysis results, which showed feelings of disgust and anger where each of these sentiments only contained 3 or 0.37 and 2 or 0.25%.

## Discussion

This study processes 800 metadata in the form of tweets from twitter with the keywords "E-Money," "Electronic Money," and "Uang Elektronik. The results show that most e-money talks are in the corridor of their function as a means of transactions such as payments and transfers. In Table 1, for example, we can see that the tweet with the most likes and retweets discusses a quiz given by the tweet's author to other Twitter users with prizes that will be transferred using E-Money. We can see that other tweeters use e-money to provide prizes through giveaways and payment media for purchasing a product offered.

The results of this study prove that the use of a technology that can provide benefits and convenience that have never been felt before, then these two things will provide satisfaction so that users will use the technology repeatedly and even recommend the technology to others (Indriati and Agustina, 2018; Maillet *et al.*, 2015; Marinković *et al.*, 2020). The emotional and enjoyment factors that are felt when using e-money to pay or transfer greatly determine user satisfaction (Chao, 2019 and Ratnasari *et al.*, 2023). E-Money is proven practical in paying for a purchase or transferring funds because there is no need to carry physical money, and it is safe from crim (Güney and Sangün, 2021; Mohammadyari and Singh, 2015).

The exciting thing we can find in the results of the topic modeling widget where some words from topics that often appear are "deposit," "money," "pulsa," "bonus," "dana, (in English:fund)" "member," and "event," "berhadiah (in English:prize)," "diawal (in English:beginning)," lucky." These ten words are very closely related to the function of E-Money as a transfer tool for quizzes or giveaways held by the tweet's author. For example, the words "money," "pulsa," "bonus," "event," "prize" and "lucky" can describe several words that are often used to create a quiz or giveaway. There are also the words "deposit," "money," and "at the beginning" which explain that to use e-money, users must register and deposit a certain amount of money as an initial deposit. This also reinforces the previous discussion that e-money users on twitter focus on the functions and benefits that e-money has as a technology in the tweets they discuss.

The same result is seen in the sentiment visualization, where positive sentiment dominates with 89.28%. In the sentiment visualization based on the twitter profiler, we can see that feelings of joy and surprise dominate the emotions of Twitter users. A small part of the tweet writer feels sadness, fear, disgust, and anger, which on average, are due to a problem with the e-money card, which cannot

be used as it functions. This indicates that some e-money users still experience interference when using it, which causes users to feel afraid of the security of their money and privacy data (Buldas *et al.*, 2022). Understanding and paying attention to negative sentiment is also essential to reduce the possibility of switching brands in the future (Faza *et al.*, 2022).

### **Conclusion**

Sentiment analysis is critical in identifying the most discussed topics and words in cyberspace about a theme. On the topic of discussing e-money, e-money is widely discussed within its scope as a means of payment and transfer of funds. This proves that the technology carried by e-money provides an alternative method of saving money that is easy and efficient, so many netizens on twitter use e-money to carry out various transaction activities. Overall, the public's sentiment towards e-money is positive, shown by the emotion of joy. The results of this study can be a reference for E-Money issuers to continue to develop the quality of e-money services in terms of speed and accuracy of payments using e-money. Researchers found some negative sentiments in the technical sphere, such as top-up or transfer failures when doing e-money. Therefore, e-money issuers must pay more attention to the strategy for developing and maintaining the system infrastructure used by e-money to minimize technical incidents.

### **Limitation**

This study has limitations in the range of data used, namely tweet data from April 5, 2023, to April 12, 2023, as many as 800 tweets. In addition, crawled tweets only come from Indonesia and use the Indonesian language.

### **Suggestion**

In future research, researchers can use the crawling data method simultaneously and periodically every seven days to get more data. In addition to enriching and deepening research results, especially those discussing e-money, researchers can retrieve data from tweets worldwide, especially those using english, using the more flexible VADER (Valence Aware Dictionary and Sentiment Reasoner) method.

### **Implication**

Even though, as a whole, the use of E-Money in Indonesia has been responded to positively by netizens on Twitter. A small number of netizens still have negative sentiments when using e-money. For example, there are technical problems when using it, and there are concerns from e-money users about security in terms of the funds stored and the safety of personal data. The results of this research can be input for e-money issuers to continue improving the security system to avoid phishing, bugs, and other disturbances. Improving service quality is very important for e-money issuing companies because it can maintain user satisfaction so that users can be loyal and willing to use the same e-money brand for an extended period. e-money issuing companies can also form a team whose job is to handle social media, such as monitoring the suitability of the content, as well as comments and direct messages that enter social media. The team is also tasked with responding quickly to all complaints and suggestions submitted to e-money users through social media.

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