



## Cashless Society: Cluster Analysis of Electronic Payment Users in E-Commerce

Shiddiq Sugiono<sup>1✉</sup>, Reninta Dewi Nugraheni<sup>2</sup>

<sup>1</sup>Center for Data and Information, National Research And Innovation Agency (BRIN), Jakarta

<sup>2</sup>Research Center for Economics of Industry, Services, and Trade, National Research and Innovation Agency (BRIN), Jakarta

Permalink/DOI: <https://doi.org/10.15294/jejak.v16i2.42451>

Received: May 2023; Accepted: July 2023; Published: September 2023

### Abstract

*Due to its ability to allow multiple electronic transactions, e-commerce is one of the ecosystems that helps to create a cashless society. In order to have a general understanding of the development of the cashless society, it is necessary to investigate the characteristics of behavior that underpin cashless transactions in e-commerce in Indonesia. The goal of this study is to examine the characteristics of cashless payment method consumers in Indonesian e-commerce. K-Medoids analysis was used to classify the survey's 519 participants into various groups. The research shows that it is most appropriate to divide users of cashless payments in e-commerce into three groups. Generation Z who are employed are the primary features of the first group. The second is older Millennial Generation cluster characterized by older males in supervisory roles and higher expenses than other groups. The findings also indicate that Generation Z Early Adopters, third cluster, has begun adopting electronic transactions for security purposes. Additionally, each group agreed to adopt electronic transactions for easy of use reasons.*

**Key words :** Cashless Society, Cashless Transaction, E-Commerce, Cluster Analysis, K-Medoids

**How to Cite:** Sugiono, S., & Nugraheni, R. (2023). Cashless Society: Cluster Analysis of Electronic Payment Users in E-Commerce. *JEJAK: Jurnal Ekonomi dan Kebijakan*, 16(2). doi:<https://doi.org/10.15294/jejak.v16i2.42451>

✉ Corresponding author : Shiddiq Sugiono  
Address: Gedung B.J. Habibie Jl. M.H. Thamrin No. 8 Jakarta  
E-mail: [shidoo2@brin.go.id](mailto:shidoo2@brin.go.id)

p-ISSN 1979-715X  
e-ISSN 2460-5123

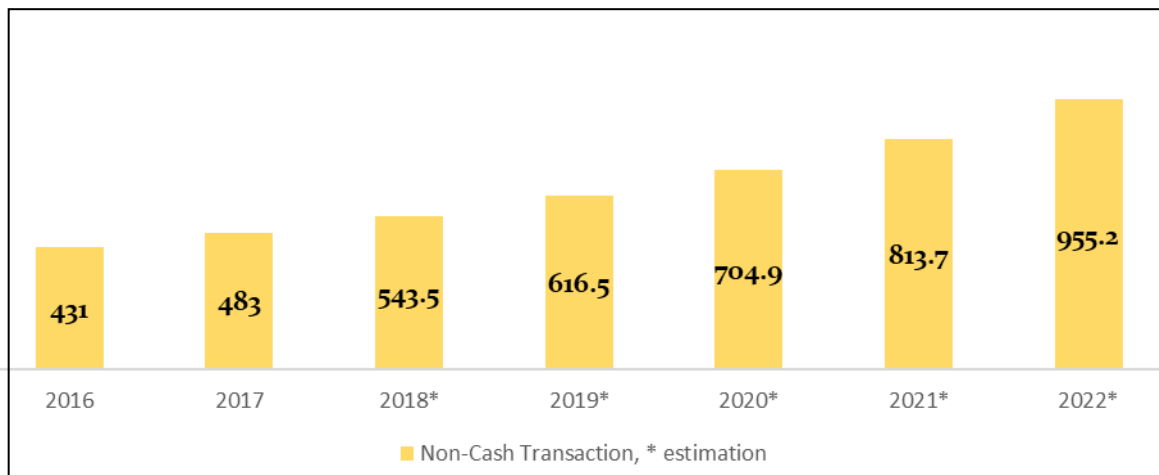
### INTRODUCTION

The idea of a cashless society emerged from the effects of widespread use of electronic/ cashless transactions. The term cashless society refers to a society that completely eliminates the use of cash and uses digital payment methods such as debit/ credit card payments, online payments, mobile payments to pay various bills (Zhao, 2019; Abdullah, Redzuan & Daud, 2020). According to Supra-

mono, Soegiono and Franksiska (2021), a cashless society has evolved into a lifestyle where people conduct their daily financial transactions using non-cash methods. A cashless society, according to Afaha (2019), is one that uses computer technology for payment transactions. To understand how people's economic behavior is affected by the changes in the current digital financial system, we need to recognize what advantages a cashless society can offer.

The transformation to a cashless society offers numerous advantages to all stakeholders. According to Fabris (2019), there are six advantages to the transition to a cashless society. First, since all cashless transactions would be tracked by the system, a cashless society reduces the likelihood of criminal cases developing that can only be handled with cash. Second, new payment options are continually emerging as a result of technological advancements. Third, increase tax reven-

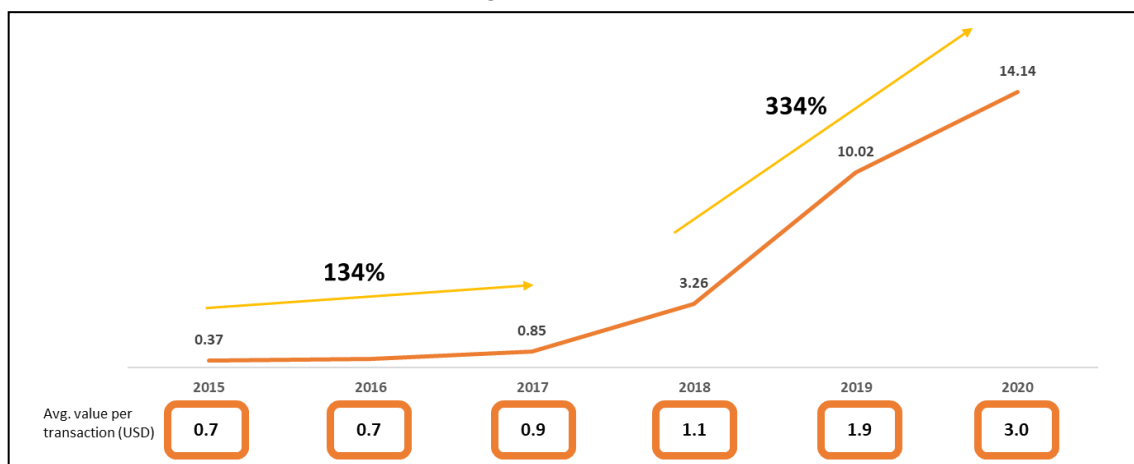
ue because it reduces unrecorded transactions or shadow economy. Fourth, the quick advancement of IT technology also promotes payment convenience. Fifth, increase personal security because user does not need to hold a lot of cash. Sixth, reduce transaction costs where financial institutions can reduce their staff. It's important to identify how far the world has evolved into a cashless society through the different benefits provided.



**Figure 1.** Number of Non-cash Transactions Globally in 2016-2022 (Capgemini, 2019)

Nowdays, the number of electronic transactions users and volume worldwide has increased, including the Asian region. According to Capgemini (2019), there will be \$955 billion of non-cash transactions in 2022, increasing 121% from 2016. Even with a proportion of 36.9%, Asia is expected to have the highest

volume of cash transactions in 2022. This forecast is interesting since Asia has a chance to take over as the center of the global economy in the future. The evolution of a cashless society in that region can be better understood with more in-depth study of the behavior patterns in a specific Asian nation.



**Figure 2.** Momentum Works Analysis of E-Money Transaction (Momentum Works, 2021)

As its residents increasingly utilize electronic transactions in everyday activities, Indonesia is gradually becoming a cashless society. The study report from Momentum Works (2021) shows that between 2018 and 2020, the value of electronic money/e-money transactions in Indonesia increased by 334% from 3.26 to 14.14 billion USD. Comparing this rise to the 0.48 billion USD growth between 2015 and 2017 indicates that it is relatively significant. In addition, the average electronic money transaction per person increased from 1.1 USD in 2015 to 3.0 USD in 2020 (Momentum Works, 2021). Datareportal (2022) study findings also revealed a 22.17% increase in the number of people who making cashless payments, from 129.9 in 2021 to 158.7 in 2022. The Indonesian population is gradually adopting the use of cashless transactions as a lifestyle.

People in Indonesia presently use a variety of electronic payment methods offered by a number of financial institutions. According to Momentum Works (2021) analysis, there were 20.8 million OVO users, 13.5 million DANA users, and 7.2 million LinkAja! users in May of that year. Additionally, 10 million of Shopee's 51.5 million active consumers use ShopeePay. Meanwhile, some Indonesian people have used the Quick Response Code Indonesian Standard/QRIS, where the nominal amount of transactions is at 27.6 trillion in 2021. Credit cards are still the choice of cashless means of payment for some people in Indonesia where there are 16.89 million credit cards circulating in Indonesia in September 2022 (Bank Indonesia, 2022). The availability of various types of payment needs to be understood as well as the buying and selling system that supports them.

In Indonesia, the development of a cashless society is also supported by the electronic transaction in e-commerce. Currently, e-commerce in Indonesia offers a variety of options for carrying out cashless transactions, including bank transfers, credit cards, e-wall-

ets, and online loans (Momentum Works, 2021). According to Hardianti, Permatasari and Wahyuni (2022) study, the growth of e-commerce in Indonesia is gradually forming a commercialism culture that can be leveraged as a catalyst for users to acquire a habit of using cashless transactions. The COVID-19 pandemic's effects are also thought to have accelerated Indonesia's transition to a cashless society because people are forced to transact remotely (Firmandani et al., 2021). Understanding the demographics of Indonesian population as consumers would help to further explore the potential of e-commerce in moving Indonesia toward a cashless society.

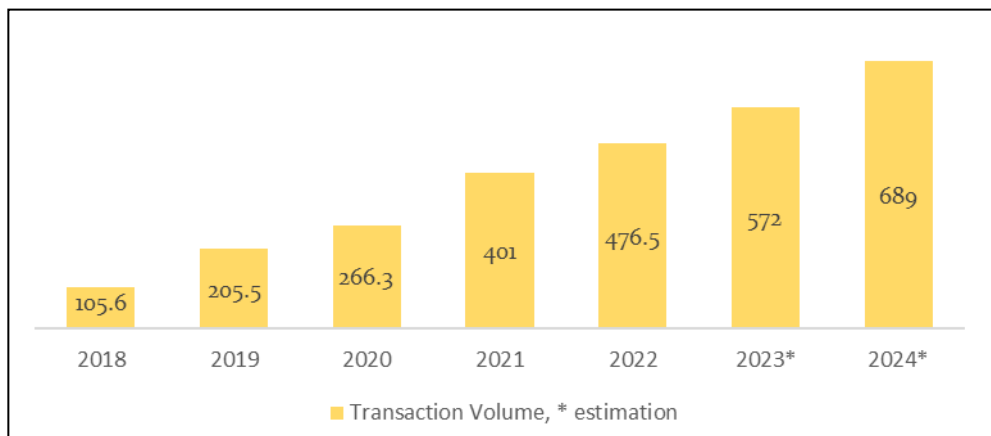
In general, Indonesia's demographics are considered to support the cashless transaction ecosystem in e-commerce. According to the study APJII (2022), 210,026,769 individuals, or 77.02% of Indonesia's population, are expected to have internet connection by 2022. Meanwhile, 79% of respondents in the APJII study used the internet to make transactions online. It is necessary to broaden society's form in order to comprehend these macro data.

A future shift toward a cashless society could be facilitated by the huge populations of Generation Y/ Millennials and Z in Indonesia, often known as digital native. Jayani (2021) said that based on the results of the 2020 Indonesian Population Census, 53.81% of Indonesians belong to Generation Z and Millennial Generation. According to Ayuni (2019), generation Z frequently makes purchases online since they are familiar utilizing applications because they are digital natives. These characteristics provide good hope for transforming into a cashless society.

Several studies have discussed various factors that motivated Indonesia's generations Z and Y to start using cashless transactions for e-commerce. According to a study by Utami (2022) on 100 members of generation Z between the ages of 18 and 25 who participated, they adopt e-wallets for the convenience and

security of their transactions. According to Ninggar and Anggraini (2022), which involved students in the Malang who were between the ages of 18 and 25, the adoption of utilizing e-wallets is a result of convenience, promotions, and lifestyle. In the context of the millennial age, variables that are thought to support their interest in using cashless payments in e-com-

merce include being simple to use (Nurdin & Basalamah, 2022), perceived benefits (Paramitha & Mahyuni, 2022), and even consumptive behavior (Rosita, 2020). It is envisaged that e-commerce transactions will increase as more Indonesians accept cashless payments when purchasing goods and services.



**Figure 3.** Trend of Indonesian E-Commerce Transaction (Bank Indonesia, 2022)

The development of e-commerce in Indonesia can also be seen in the trend of increasing transaction volume. E-commerce transactions rose during Semester I 2022, with nominal growth of 22.1% (yoy) to IDR 227.8 trillion and volume growth of 39.9% (yoy) to 1.74 million transactions. After the Covid-19 outbreak, the current economy in the e-commerce ecosystem is gradually getting better. Indonesia's gross merchandise value (GMV) will be IDR 95 trillion in 2025, an increase of 61% from 2022, when it was IDR 59 trillion, also inspire optimism for a favorable growth in the e-commerce sector. With Indonesia's well-developed e-commerce market, it is possible to see how typical consumers that conduct cashless payment.

Several previous studies have grouped consumers who use cashless transactions in certain countries or region. According to the findings of the Umuhzo et al. (2020) study using K-Means clustering, there are four groups of people who use credit cards to make purchases in Africa. These are the groups

of people who use credit cards to pay for their daily needs, the groups of people who use cards to make fashion purchases, the groups of people who use cards as their primary method of payment so their credit card spending is high, and the groups of people who use cards to make small furniture purchases. Liao and Ho (2021) grouped 1108 mobile payment users in Taiwan using K-means clustering. There are three groups of mobile payment users where the first group is an early adopter, the second group is a group that uses mobile payments for their daily needs, and the last group is a group that focuses on purchasing electronic devices. By using the ward method cluster analysis (Kaczmarek, 2022) divides 650 Polish people who shop at retail stores into four groups. The millennial generation frequently favors using mobile payment methods, according to Kaczmarek (2022) and Sutarso et al. (2022) conducted a K-Means clustering analysis to determine which groups of 270 Surabaya e-wallet users formed according to perceived risk variables. According to Sutarso there are three categories of e-wallet users: those who

perceive high, medium, and low risk. In each category, the most sensitive element is financial risk. Chawla and Joshi (2020) conducted a cluster analysis of 744 mobile wallet users who are from the Z and Y generations within the setting of the Indian community. Technology Enthusiasts, Technology Skeptics, and Technology Pragmatists are the three user segments for mobile wallets identified by Chawla and Joshi (2020) research. It is important to recognize first which features are relevant to the use of e-payments in e-commerce before classifying attributes.

Earlier research has outlined a number of variables that enable an individual to use electronic transactions. The findings of Fachrudin and Silalahi (2022) study demonstrate that a person's tendency for adopting cashless payments is influenced by their income level and it's herding behavior. The results of Kraiwanit, Panpon and Thimthong (2019) research on 934 Thai citizens show that access to cashless payments is influenced by age, education, income and internet use. According to Lai and Liew (2021) study of 388 Malaysians, the security factor mediates the convenience factor's considerable indirect influence on people's intentions to utilize mobile payments. The way someone uses electronic money to make purchases is also influenced by their gender (Yang et al., 2021). Some people use e-wallets because they may take advantage of discounts and the option to pay in installments (Ong and Chong, 2022). Panda, Reddy and Vaithianathan (2022) stated that apart from providing convenience and benefits, cashless transactions are also a necessity. Liao and Ho (2021) found that e-wallet users in Taiwan find it easy to use and can be used universally. According to Hadi et al. (2022), consumer knowledge, convenience of use, and comprehensive service features are the primary factors driving people to utilize cashless payments in e-commerce. In order

to categorize users of cashless payment methods in Indonesian e-commerce, these numerous factors will be employed as characteristics.

This research will classify Indonesian society through its demography, the type of cashless payment preferred and the reasons why they prefer. In general, this study is similar to Liao and Ho (2021) which grouped Taiwanese residents through demographic variables, mobile applications that are often used, types of payments that are often used, reasons for using them and main reasons for buying goods. Similar to the research done by Panda, Reddy and Vaithianathan (2022), the purpose of implementing cashless payments is also a consideration that would be involved in categorizing consumers. However, this research will use other methods that are considered more suitable in processing categorical data because basically categorical data is not suitable if it is estimated using the average or the k-means clustering method.

This research goal is to map the characteristics of Indonesia citizen groups that prefer to use electronic payment methods in e-commerce in order to understand how Indonesia is evolving toward a cashless society. Understanding the evolution of cashless in Indonesia can help determine the direction of future development. According to earlier research by Abbas (2017), Indonesia has not made significant progress toward a cashless society. Considering these conditions, it is important to take another look at the existing characteristics of Indonesians who prefer to use cashless payments. The research question to be answered is: What are the characteristics of groups of Indonesian who prefer to use cashless payment methods in e-commerce?

## METHOD

The data obtained in this study used a structured questionnaire which was distributed to 820 respondents. The sampling areas are all provinces in Indonesia, which are dominated by respondents from West Java, East Java and DKI Jakarta. According to the survey results, 519

respondents acknowledged their preference for a cashless payment method and provided their reasons. Other respondents stated that they preferred the cash on delivery/COD payment method. This study will concentrate on participants who said that cashless transactions are their preferred way of payment.

The data analysis technique used is K-Medoids. According to Horbach (2013) and Díaz et al. (2020) this analysis method can handle datasets that are categorical, numerical, or a combination of the two and can manage enormous volumes of data. It is also not sensitive to outlier data. Medoids in this

technique are data points that, like the average in K-Means analysis results, indicate characteristics of a group (Ambadkar & Akarte, 2016). This method finds a set of  $K$  groups that, mathematically speaking, minimizes the function of  $F_k$  as follows:

$$F_k = \sum_{i=1}^N \min_{t=1, \dots, K} d(S_i, m_t) \quad (1)$$

$F_k$  in the equation above represents the total distances between all  $S_i$  objects and the nearest medoids. In this instance, K-Medoids searches for medoids or data points that minimize the equation's total. The K-Medoids algorithm can be summarized as follows:

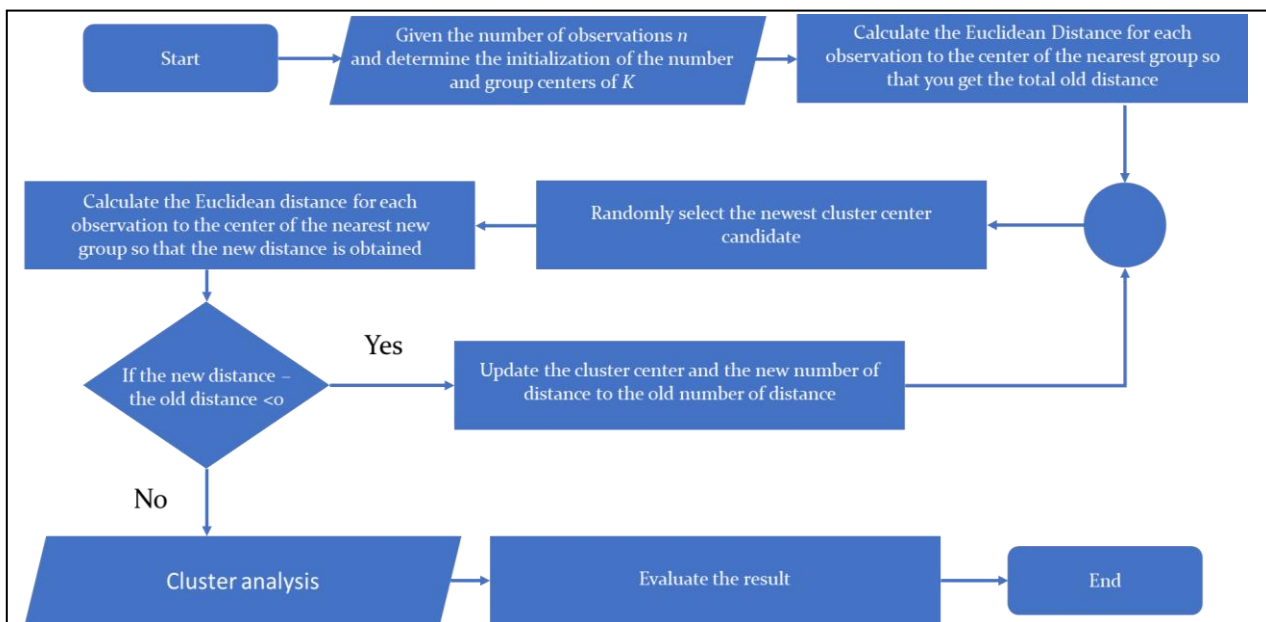


Figure 4. K-Medoids Algorithm (Marlina et al., 2018)

This study uses several variables that describe the characteristics of each respondent who uses electronic transactions. The dataset consist of 11 categorical variables and 1 continuous variable. Table 2 lists the variable names that were used in this study.

This study uses Rstudio and several packages in it as a software application to analyze data. The elbow approach will be used to

calculate the ideal number of clusters while taking the WSS graph into consideration. According to the elbow approach, the ideal number of clusters can be seen on the graph of the WSS calculation results as a point that resembles an elbow (Sari, Franz & Sugiartawan, 2022). Based on a sharp decline in WSS value followed by a gradual decline in WSS, the elbow point is determined.

**Table 1.** List of variable

Code	Variable Name	Type	Value
X1	Gender	Categorical	1=Male, 2=Female
X2	Age	Numeric	Numeric
X3	Education	Categorical	1=Elementary, 2=Junior High, 3=High School, 4=Diploma 1 Year, 5=Diploma 2 Year, 6=Diploma 3 Year, 7=Bachelor, 8=Master, 9=Doctoral, 10=Other
X4	Job Position	Categorical	1=No Job, 2=Staff, 3=Supervisor, 4=Manager, 5=Senior Manager, 6=Vice Manager, 6=Vice President, 7=Director, 8=Business Owner
X5	Monthly Spending	Categorical	1=<USD 100, 2=USD 101-200, 3=USD 201-300, 4=USD 301-500, USD 501-750, 6=>USD 750
X6	Socioeconomic Status/SES	Categorical	1=Upper 1, 2=Upper 2, 3=Middle 1, 4=Middle 2, 5=Lower 1, 6=Lower 2
X7	Shopping Frequency	Categorical	1=once a week, 2=2-3 times a week, 3=once a month, 4= Once every 2-6 months, 5=once a year, 6=never
X8	Payment Method	Categorical	1=Cash on Delivery, 2=Bank Transfer/Debit, 3=E-Wallet, 4=Credit Card, 5=convenience store, 6=Fintech Credit, 7=other
X9	Perceived Security	Categorical	1=yes, 2=no
X10	Perceived Easy Use	Categorical	1=yes, 2=no
X11	Promotions availability	Categorical	1=yes, 2=no
X12	Apply for Loan	Categorical	1=yes, 2=no

Source: Author's calculation

## RESULTS AND DISCUSSION

The fulfilment of the requirements for a representative sample is one of the assumptions for conducting a good cluster analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy test is used to get a good cluster analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy test, as shown in Table 2.

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy results show that the KMO statistic is 0.63. A statistical value of  $KMO > 0.5$  is

considered to be indicative of data that satisfies the requirements of a representative sample (Ls et al., 2021). The assumption of a representative sample is met by the data, according to the KMO statistic of 0.63.

This study was conducted to determine the distribution of the studied data and to set the cluster analysis's findings in context. The outcomes of the descriptive analysis of each dataset variable are listed (table 3).

**Table 2.** Kaiser-Meyer-Olkin Measure of Sampling Adequacy test

Items	Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO – MSA)
Gender	0.46
Age	0.65
Education	0.69
Position	0.72
Spending	0.68
Social Economy Status	0.65
Frequency	0.7
Payment Method	0.52
Security	0.39
Practical	0.31
Promo	0.67
Easy Payment	0.63
Overall MSA	0.63

Source: Author’s calculation

**Table 3.** Frequency Table For Categorical Table

Code	Variable Name	Value
X1	Gender	1=301 (57.99%), 2=218 (42.00%)
X2	Age	18-20=53 (10.21%), 21-23=86 (16.57%), 24-25=80 *15.41%, 26-28=94 (18.11%), 29-31=80 (15.41%), 32-33=39 (7.51%), 34-36=46 (8.86%), 37-38=20 (3.85%), 39-41=10 (1.93%), 42-44=8 (1.54%), 44-47=3 (0.58%)
X3	Education	1=6 (1.16%), 2=23 (4.43%), 3=235(45.28%), 4=6(1.16%), 6=35(6.74%), 7=204(39.31%), 8=8(1.54%), 10=2(0.39%)
X4	Job Position	1=199(38.34%), 2=180(34.68%), 3=46(8.86%), 4=19(3.66%), 5=7(1.35%), 7=7(1.35%), 8=61(11.75%)
X5	Monthly Spending	1=92(17.73%), 2=186(35.84%), 3=128(24.66%), 4=84(16.18%), 5=17(3.28%), 6=12(2.31%)
X6	Socioeconomic Status/SES	1= 81(15.60%), 2=142(27.36%), 3=180(34.61%), 4=77(14.83%), 5=39(7.5%)
X7	Shopping Frequency	1=129(24.85%), 2=139(26.78%), 3=151(29.09%), 4=92(17.72%), 5=8(1.5%)
X8	Payment Method	2=292(56.26%), 3=173(33.33%), 4=39(7.51%), 6=12(2.31%), 7=3(0.58%)
X9	Perceived Security	1=318(61.27%), 2=201(38.73%)
X10	Perceived Easy Use	1=436(84.01%), 2=83(15.99%)
X11	Promotions availability	1= 236(45.47%), 2=283(54.53%)
X12	Apply for Loan	1=78(15.03%), 2=441(84.97%)

Source: Author’s calculation

The majority of respondent are male. In general, the education level of respondents was centered on high school and bachelor degree. When compared to other reasons, perceived convenience accounts for the high-

est percentage (84.01%) of those using cashless payment methods, followed by perceived security. Bank transfers are the most often used method, followed by the use of e-wallets.



Finding the ideal number of cluster to establish is the first procedure to be carried out. The ideal number of cluster is determi-

ned in this study using a within sum of square (WSS) chart. The ideal group size for the K-Medoids approach is shown in Figure 4.

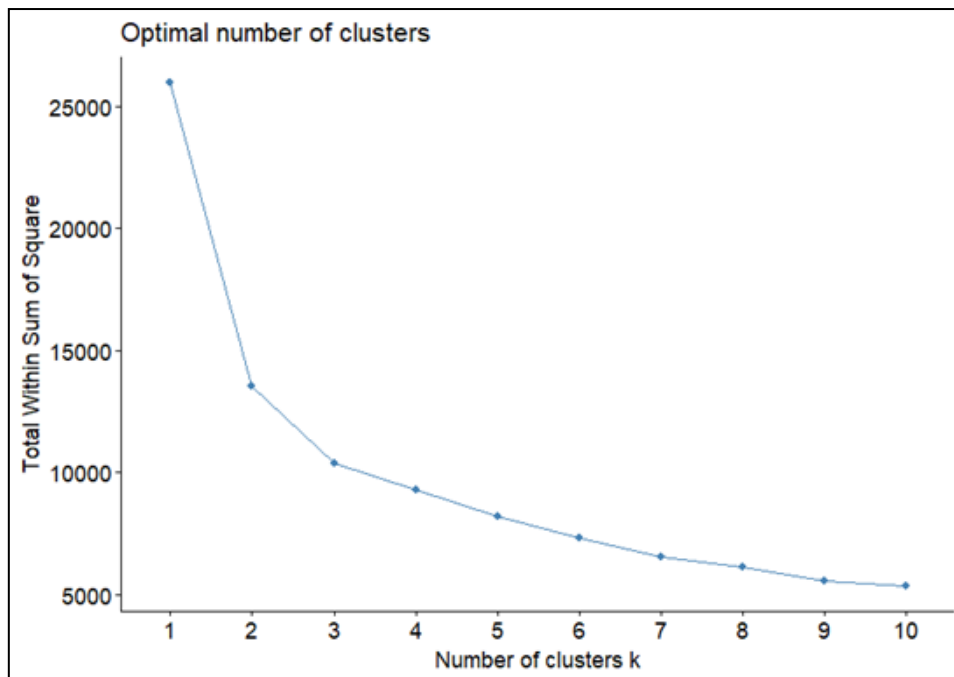


Figure 5. Within sum of square (WSS) chart

Based on the within sum of square graph, it can be said that the optimal number of groups is three groups. When compared to

the difference in WSS before to the three clusters (k=3) , it can be noted that the change in WSS value after point three is steady.

Table 4. Cluster Medoids

Cluster	Size (n)	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
1	246	2	26	6	3	2	3	2	2	2	1	2	2
2	142	1	35	6	2	4	2	2	3	2	1	1	2
3	131	2	21	3	1	2	3	3	2	1	1	2	2

Source: Data Analysis Results

The medoids or center of each cluster are described in Table 4. The medoids will be a characteristic of a specific cluster in general. According to the analysis's findings, cluster 1 has more members than the other clusters.

One member will only be included in one group in a hard clustering K-Medoids methods. The characteristics of each cluster are described as follows:

Table 5. Cluster Characteristics

Variable	Cluster 1 (n=246)	Cluster 2 (n=142)	Cluster 3 (n=131)
Gender	Female	Male	Female
Age	26 (Z Generation)	35 (Millennial Generation)	21 (Z Generation)
Education	D3/Diploma 3 Year	D3/Diploma 3 Year	High School
Job Position	Supervisor	Staf	No job level
Monthly Spending	USD 101-200	USD 301-500	USD 101-200
Socioeconomic	Middle 1	Upper 2	Middle 1

Variable	Cluster 1 (n=246)	Cluster 2 (n=142)	Cluster 3 (n=131)
Status/SES			
Shopping Frequency	2-3 times per week	2-3 times per week	once per month
Payment Method	Bank Transfer/Debit	E-Wallet	Bank Transfer/Debit
Perceived Security	No	No	Yes
Perceived Easy Use	Yes	Yes	Yes
Promotions availability	No	Yes	No
Apply for Loan	No	No	No

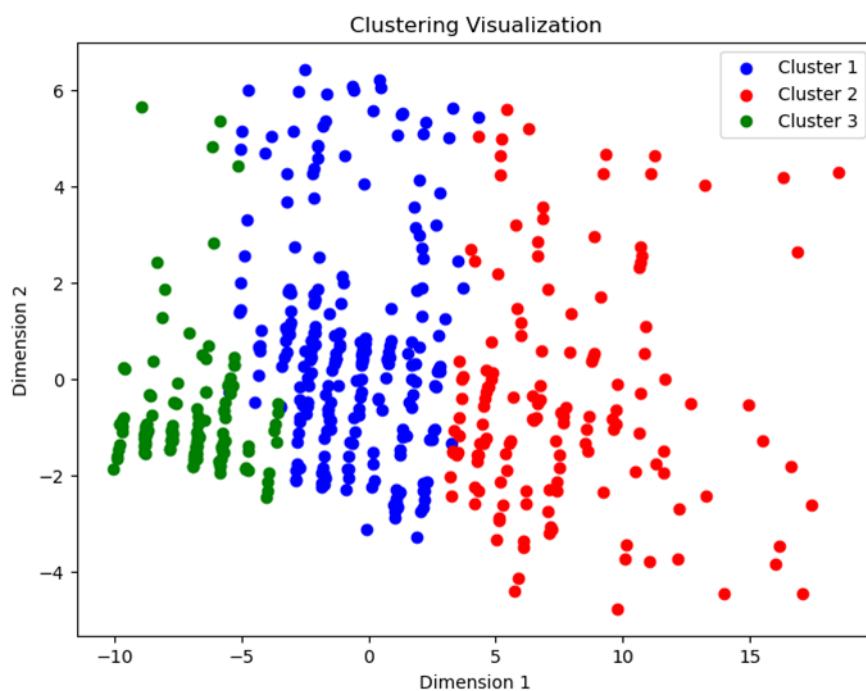
Source: Author's calculation

The typical characteristics of first cluster are people with female sex who are around 26 years old and already hold positions in their professions. In other words, this generation represents the last of the Z generation. This demographic shops online as frequently as twice or three times per week. Bank transfers are the favored mode of payment for the first group. This group mostly experiences the convenience of using this payment option in transactions. The monthly spending of this cluster is not as high as that of group 2, this could be possible if the members of this group are not yet married. This group tends not to seek promotions or use cashless payment loans. Generation Z who are employed is the name given to this first cluster.

Males with the oldest ages among members of the other categories are those who represent the second group. This group consists of 142 people, or 27.36% of all respondents. Due to discounts or promotion on purchases, cluster members frequently use e-wallet payment options. Similar to group 1, this group shops online between two and three times every week. The second cluster continues to adopt the cashless payment method due to the convenience of transactions reason. The older Millennial Generation is the name given to this second cluster.

The third cluster is early adopter of Generation Z. When compared to the previous groups, this third cluster contains persons who are relatively young in age. There are 131 members of this category, which represents 25.24% of all respondents. The majority of this group's members are either still students or unemployed. In other words, this group is a subset of generation Z that has begun utilizing cashless transactions. The method that its members favor the most is the bank transfer/ debit. They use bank transfers because they believe they are secure and easy to use. This group typically shops once a month, which is less frequently than other group.

Figure 6 illustrates how datasets are grouped in two dimensions/ factor. There are 12 dimensions in the dataset that is being examined, the Rstudio application uses factor analysis to reduce it to 2 dimensions. When compared to the other groups, group 3 has the characteristics of the youngest age member on the far left, while group 2 has older members and is comparatively on the far right. Age is the differentiator of the clusters produced. In comparison to clusters 1 and 3, group 3 is relatively at the top when measured by monthly spending. The findings from these three clusters will be elaborated upon in the discussion that follows along with findings from related literature.



**Figure 6.** Clustering Mapping Results in 2 Dimensions

Compared to the third cluster, the first and second clusters have higher levels of shopping frequency. This might be as a result of the first and second clusters already having occupations or income to support their needs. According to study by Ramadani (2016), the convenience of using debit cards and e-wallets is regarded as a factor in fostering a consumptive lifestyle. This might be the trigger for these two groups' comparatively high spending frequencies. According to Lee et al. (2017), a person's frequency of online buying is influenced by their level of income. The first and second clusters are considered to be more capable of frequent online shopping because they are clusters of workers.

According to the study's findings, generation Z prefers using debit cards or bank transfers as a form of payment. The use of debit cards makes it simple for users, according to Ramadani (2016) research on students in 2014. Funds for a digital wallet can be obtained through bank transfers. This might be considered the usage of payment methods to begin implementing additional cashless payment methods (Bagla & Sancheti, 2018). Electronic

wallet/ e-wallet or mobile wallet is an application created by a bank with the appropriate authorization (Singh & Sinha, 2020). Payments via digital wallets are typically made through smart phone applications that offer services such as money transfers, shopping, tickets, topups, and bill payments. The growing number of people using digital wallets, particularly in Indonesia, demonstrates the level of effectiveness and efficiency. Bank Indonesia has also issued a policy requiring the use of digital wallets for payment services (Rahadi, Nainggolan & Afgani, 2022). Through these findings, it is considered that banking institutions can become institutions that support the thrive of a cashless generation in Indonesia.

Apart from bank transfers or debit cards, E-wallets have become one of the preferred payment options in e-commerce by the people of Indonesia. This research offers empirical proof that there are cluster who favor e-wallets over other cashless payment options, which is consistent with the findings of a study from Momentum Works (2021) and (Rizaldi & Faruqi, 2020) where e-wallet is one of the payment methods that many people are starting to use. According

to the analysis's findings, the millennial generation prefers using an e-wallet as a method of payment because its convenience and promotion availability. This result is consistent with study from Nurdin and Basalamah (2022), which found that ease of use is one of the reasons why the millennial generation uses cashless payments. The promotions offered by e-wallets are considered more acceptable if they can support the everyday needs of the millennial generation, especially for those who have family needs, when considering the age of the millennial generation.

All clusters stated that the ease of use of cashless payments was the reason why they liked this payment method. These results are relevant to the framework for adopting cashless transactions by users presented by Panda, Reddy and Vaithianathan (2022), Do, Ninh and Do (2020) and Liu (2021) where cashless transaction devices compatibility with perceived ease of use, perceived trust, social impact, and perceived usefulness so that they can continue to increase the number of users. Similar findings are shown in Liao and Ho's research findings from 2021, which demonstrate that 2 of the 3 clusters formed in Taiwan's people accept that the convenience of adopting an e-wallet is its primary motivation. The capabilities of the millennial generation and generation Z, who are digital natives and accustomed to using mobile applications, are another factor supporting this (Ayuni, 2019). Fabris (2019) has stated that developments in digital technology will keep enhancing the convenience of cashless payments.

Differs for reasons of convenience, reasons related to the ease of applying for credit/installments were not found in each cluster as a reason why people use cashless payments. The descriptive analysis alone reveals that 84.97% of respondents who preferred cashless payments did not mention the ease of making installment payments as their preference. The second cluster does not use conv-

enient installment payments as a justification for embracing cashless payments, despite having a stronger economic capability than the other clusters. According to research by Eviana and Saputra (2022), a person's use of pay later payments is not influenced by their income level. Some individuals choose to pay by installments as a last option or due to an urgent issue (Hardhika & Huda, 2021). These results suggest that some Indonesians do not utilize installment payments as a justification for cashless transactions, therefore the effectiveness of this lending facility for the Indonesian people needs to be reevaluated.

Early adopters are one of the groups that have appeared in several previous studies regarding cashless payment users. The results of research from Liao and Ho (2021) show that clusters of early adopter groups that have the characteristics of female students also formed among mobile payment users in Taiwan. The emergence of early adopter clusters indirectly conveys that cashless payment users will continue to grow in the future. Members of third cluster also feel the need for transaction security. Because the younger generation in Indonesia has already experienced the security and ease of this method of payment, these qualities give reason for optimism that in the future cashless payments will become more acceptable.

## CONCLUSION

According to the findings of this survey, Indonesians who utilize non-cash payment methods for online transactions can be categorized into three groups: Generation Z employees who are now employed, older Millennials, and Generation Z Early Adopters. All clusters share the same attribute, namely their reliance on cashless payments due to their convenience. Thus, if consumers find cashless payments beneficial and handy for day-to-day activities such as paying for utilities or cashless shopping, they are more inclined to employ them. In addition, ba-

nk transfers and e-wallets are the main payment methods for the cluster.

This finding also suggests a willingness to adopt e-wallet services not only by system providers or banks, but also by Indonesians of various socioeconomic backgrounds and generations. As a result, not only must useful technological features be improved, but each generation's suitable personality must also be improved in order to express high compatibility with users. Additionally, because an early adopter cluster has already established, Indonesia is seen as having good prospects for becoming a cashless society in the future.

Participants in this study include Millennials and Generation Z, two technologically proficient generations born into the digital age. The consumption features of this target emphasize the predominance of convenience and lead to confidence. This research requires additional investigation in the future. Future research should investigate and compare the generational distinctions between millennials and generation Z. In addition, the results of clustering can be compared to those of other methods or sampling strategies, as this study employs only one method and a non-probability sampling technique.

## REFERENCES

- Abbas, A. E. (2017). Literature Review of a Cashless Society in Indonesia : Evaluating the Progress. *International Journal of Innovation, Management and Technology*, 8(3), 193-196. Doi: <https://doi.org/10.18178/ijimt.2017.8.3.727>.
- Abdullah, N., Redzuan, F., & Daud, N. A. (2020). E-wallet: Factors influencing user acceptance towards cashless society in Malaysia among public universities. *Indonesian Journal of Electrical Engineering and Computer Science*, 20(1), 67-74. Doi: <https://doi.org/10.11591/ijeecs.v20.i1.pp67-74>.
- Afaha, S. J. (2019). Electronic Payment Systems (E-payments) and Nigeria Economic Growth', *European Business & Management*, 5(6), 77. Doi: <https://doi.org/10.11648/j.ebm.20190506.11>.
- Ambadkar, S. V & Akarte, S. P. (2016). Clustering Categorical Data for Internet Security Applications. *International Journal of Scientific and Technical Advancements*, 2(1), 115-118.
- APJII. (2022). *Profil Internet Indonesia 2022*. Available at: [apji.or.id](http://apji.or.id).
- Ayuni, R. F. (2019). The Online Shopping Habits and E-Loyalty of Gen Z As Natives in The Digital Era. *Journal of Indonesian Economy and Business*, 34(2), 168-184. Doi: <https://doi.org/http://dx.doi.org/10.22146/jieb.39848>.
- Bagla, R. K., & Sancheti, V. (2018). Gaps in customer satisfaction with digital wallets: challenge for sustainability. *Journal of Management Development*, 37(6), 442-451. Doi: <https://doi.org/10.1108/JMD-04-2017-0144>.
- Bank Indonesia. (2022). *Sinergi dan Inovasi Kebijakan Untuk Menjaga Stabilitas Sistem Keuangan dan Mendukung Pertumbuhan Ekonomi*. Available at: [https://www.bi.go.id/id/publikasi/laporan/Documents/KS\\_K\\_3922.pdf](https://www.bi.go.id/id/publikasi/laporan/Documents/KS_K_3922.pdf) (Accessed: 30 January 2023).
- Bank Indonesia. (2022). *Statistik Sistem Pembayaran dan Infrastruktur Pasar Keuangan (SPIP) Oktober 2022*.
- Capgemini (2019) *World Payments Report*. Available at: <https://www.europeanpaymentscouncil.eu/sites/default/files/inline-files/World-Payments-Report-2019.pdf> (Accessed: 30 January 2023).
- Chawla, D. & Joshi, H. (2020). Segmenting and Profiling Mobile Wallet Users in India Segmenting and Profiling Mobile Wallet Users in India. 0-9. Available at: [https://aisel.aisnet.org/icis2020/implement\\_adopt/implement\\_adopt/2](https://aisel.aisnet.org/icis2020/implement_adopt/implement_adopt/2) (Accessed: 30 January 2023).

- Datareportal. (2022). *Digital 2022: Indonesia*. Available at: <https://datareportal.com/reports/digital-2022-indonesia?rq=indonesia>.
- Díaz, A. et al. (2020). Manufacturing cost prediction through data mining. *Linear and Multilinear Algebra*, 101–102. Doi: <https://doi.org/10.1080/03081088208817433>.
- Do, N. B., Ninh, H. & Do, T. (2020). An investigation of Generation Z's Intention to use Electronic Wallet in. *Journal of Distribution Science*, 10(18–10), 89–99.
- Eviana, V. & Saputra, A. J. (2022). *Analisis Faktor-Faktor yang Memengaruhi Minat Penggunaan Sistem Pembayaran Pay Later*. *Jurnal Pendidikan Tambusai*, 6(1), 1968–1977. Available at: <https://jptam.org/index.php/jptam/article/view/3242> (Accessed: 30 January 2023).
- Fabris, N. (2019). Cashless Society - The Future of Money or a Utopia?. *Journal of Central Banking Theory and Practice*, 8(1), 53–66. Doi: <https://doi.org/10.2478/jcbtp-2019-0003>.
- Fachrudin, K. A. & Silalahi, A. S. (2022). A Study of the Use of Cashless Payments in Relation to Income, Financial Behavior, and Almsgiving Behavior in Sumatera, Indonesia. *Proceedings of the Second International Conference on Public Policy, Social Computing and Development (ICOPOSDEV 2021)*, 642 (Icoposdev 2021), 128–132. Doi: <https://doi.org/10.2991/assehr.k.220204.021>.
- Firmandani, W. et al. (2021). Analysis of Indonesian Consumer Online Shopping Behavior During the Covid-19 Pandemic: A Shopee Case Study. *The International Journal of Business Review (The Jobs Review)*, 4(2), 191–202. Doi: <https://doi.org/10.17509/tjr.v4i2.4052>.
- Hadi, T. S. et al. (2022). *Faktor-Faktor yang Mempengaruhi Pembayaran Non Tunai Pada E-Commerce*. *Jurnal Ilmu Keuangan dan Perbankan*, 11(2), 138–154. Doi: <https://doi.org/10.34010/JIKA.V11I2.6036>.
- Hardhika, R. E. B., & Huda, A. M. (2021). *Pengalaman Pengguna Paylater Mahasiswa di Surabaya*. Available at: <https://ejournal.unesa.ac.id/index.php/Commercium/article/view/41291>
- Hardianti, R. A., Permatasari, I., & Wahyuni, R. N. (2022). *Paradigma Cashless Society aan E-Commerce Di Indonesia, Keberhasilan Pemulihan Ekonomi Atau Euforia?*. *Jurnalku*, 2(1), 44–53. Doi: <https://doi.org/10.54957/jurnalku.v2i1.13>.
- Horbach, S. (2013). Advances in Sustainable and Competitive Manufacturing Systems. *23<sup>rd</sup> International Conference on Flexible Automation & Intelligent Manufacturing*, 379–387. Doi: <https://doi.org/10.1007/978-3-319-00557-7>.
- Jayani, D. H. (2021). *Persentase Penduduk Indonesia Menurut Generasi, 2020*. Available at: <https://databoks.katadata.co.id/datapublish/2021/05/24/proporsi-populasi-generasi-z-dan-milenial-terbesar-di-indonesia>.
- Kaczmarek, M. (2022). Cash and Non-cash Payments for In-Store Purchases During the COVID-19 Pandemic – Similarities and Differences Between Generation X and Generation Y Consumers. Case of Poland BT - Modern Classification and Data Analysis', in K. Jajuga, G. Dehnel, and M. Walesiak (eds) *Conference of the Section on Classification and Data Analysis of the Polish Statistical Association*. Cham: Springer International Publishing, 323–333. Available at: [https://doi.org/10.1007/978-3-031-10190-8\\_22](https://doi.org/10.1007/978-3-031-10190-8_22).
- Kraiwanit, T., Panpon, P., & Thimthong, S. (2019). Cashless society in Thailand. *Review of Integrative Business and Economics Research*, 8(4), 44–56. Available at: <https://ssrn.com/abstract=3398225> (Accessed: 30 January 2023).

- Lai, P. C. & Liew, E. J. Y. (2021). Towards a Cashless Society: The Effects of Perceived Convenience and Security on Gamified Mobile Payment Platform Adoption. *Australasian Journal of Information Systems*, 25, 1–25. Doi: <https://doi.org/10.3127/AJIS.V25I0.2809>.
- Lee, R. J. et al. (2017). Relationships between the online and in-store shopping frequency of Davis, California residents. *Transportation Research Part A: Policy and Practice*, 100, 40–52. Doi: <https://doi.org/10.1016/j.tra.2017.03.001>.
- Liao, S. -H. & Ho, C. -H. (2021). Mobile Payment and Mobile Application (App) Behavior for Online Recommendations. *Journal of Organizational and End User Computing*, 33(6), 1–26. Doi: <https://doi.org/10.4018/joeuc.20211101.0a2>.
- Liu, D. (2021). Exploring new factors effecting purchase intention of mobile commerce : trust and social benefit as mediators. *International Journal of Mobile Communications*, 17(1)(January 2019). Doi: <https://doi.org/10.1504/IJMC.2019.096519>.
- Ls, D. et al. (2021). Analisis Klaster untuk Pengelompokan Kabupaten/Kota di Provinsi Maluku Berdasarkan Indikator Pendidikan dengan Menggunakan Metode Ward. *Jurnal Statistika dan Aplikasinya*, 5(1), 51–60. Doi: <https://doi.org/10.21009/jsa.05105>.
- Marlina, D. et al. (2018). Implementasi Algoritma K-Medoids dan K-Means untuk Pengelompokan Wilayah Sebaran Cacat pada Anak. *Jurnal CoreIT: Jurnal Hasil Penelitian Ilmu Komputer dan Teknologi Informasi*, 4(2), 64. Doi: <https://doi.org/10.24014/coreit.v4i2.4498>.
- Momentum Works (2021) *Blooming e-commerce in Indonesia, Part 2.1: Ecosystem - Payment*. Available at: [https://thelowdown.momentum.asia/country\\_sector/blooming-ecommerce-in-indonesia-part-2-3/?option=2021-indonesia&code=12408#](https://thelowdown.momentum.asia/country_sector/blooming-ecommerce-in-indonesia-part-2-3/?option=2021-indonesia&code=12408#).
- Ninggar, A. D., & Anggraini, I. K. (2022). Analisis Faktor-Faktor Yang Mempengaruhi Generasi Z Dalam Konsumsi E-Wallet Saat Pandemi Covid-19 (Studi Pada Mahasiswa Aktif Program Sarjana Di Kota Malang). *Jurnal Ilmiah Fokus Ekonomi, Manajemen, Bisnis & Akuntansi (EMBA)*, 1(2), 131–141. Doi: <https://doi.org/10.34152/emba.v1i2.498>.
- Nuridin, N., & Basalamah, R. (2022). Pengaruh Persepsi Kemudahan dan Risiko Terhadap Minat Menggunakan Financial Technology (Fintech) Gopay Pada Generasi Milenial Di Kota Palu. *Jurnal Ilmu Ekonomi dan Bisnis Islam*, 4(1), 57–71. Doi: <https://doi.org/10.24239/jiebi.v4i1.93-57-71>.
- Ong, H. B., & Chong, L. L. (2022). The effect of cashless payments on the internet and mobile banking. *Journal of Financial Services Marketing*, (0123456789), 2011–2020. Doi: <https://doi.org/10.1057/s41264-022-00145-0>.
- Panda, D. K., Reddy, S., & Vaithianathan, S. (2022). Does the cashless transaction work? An analysis of policy challenges in an emerging economy. *Digital Policy, Regulation and Governance*, 24(2), 179–198. Doi: <https://doi.org/10.1108/DPRG-01-2021-0007>.
- Paramitha, N. M. A. M., & Mahyuni, L. P. (2022). Preferensi Generasi Milenial Dalam Menggunakan E-Wallet Di Kota Denpasar. *E-Jurnal Ekonomi dan Bisnis Universitas Udayana*, (May), 583. Doi: <https://doi.org/10.24843/eeb.2022.v11.i05.p07>.
- Rahadi, R. A., Nainggolan, Y., & Afgani, K. F. (2022). Towards a cashless society : Use of electronic payment devices among generation Z. *International Journal of Data and Network Science*, (January), 137–146.

- Doi: <https://doi.org/10.5267/j.ijdns.2021.9.014>.
- Ramadani, L. (2016.) *Pengaruh Penggunaan Kartu Debit dan Uang Elektronik (E-Money) Terhadap Pengeluaran Konsumsi Mahasiswa*. *JESP*, 8(1).
- Rizaldi, A., & Faruqi, F. A. (2020). Digital Wallet as a Transaction Media in The Community', in *IOP Conference Series: Materials Science and Engineering Paper*. IOP Publishing. Doi: <https://doi.org/10.1088/1757-899X/879/1/012001>.
- Rosita, R. (2020). *Faktor Yang Mempengaruhi Perilaku Generasi Milenial Terhadap Keputusan Menggunakan Aplikasi Grabfood*. *Jurnal Lentera Bisnis*, 9(1), 95. Doi: <https://doi.org/10.34127/jrlab.v9i1.348>.
- Sari, W. E., Franz, A., & Sugiartawan, P. (2022). *Deteksi Tingkat Kematangan Tandan Buah Segar Kelapa Sawit Dengan*. *Sintech Journal*, 5(2), 154-164. Doi: <https://doi.org/https://doi.org/10.31598>.
- Singh, N., & Sinha, N. (2020). Journal of Retailing and Consumer Services How perceived trust mediates merchant 's intention to use a mobile wallet technology. *Journal of Retailing and Consumer Services*, 52(March 2019), 101894. Doi: <https://doi.org/10.1016/j.jretconser.2019.101894>.
- Supramono, Soegiono, L., & Franksiska, R. (2021). Study on Perception and Demographic Factors of Digital Financial Services (DFS). in *The 1st International Conference on Family Business and Entrepreneurship*, 12-21.
- Sutarso, Y. et al. (2022). Understanding the attributes of digital wallet customers: Segmentation based on perceived risk during the Covid-19 pandemic. *Jurnal Ekonomi dan Bisnis*, 25(2), 381-400. Doi: <https://doi.org/10.24914/jeb.v25i2.5676>.
- Umuhzoza, E. et al. (2020). Using unsupervised machine learning techniques for behavioral-based credit card users segmentation in Africa. *SAIEE Africa Research Journal*, 11(3), 95-101. Doi: <https://doi.org/10.23919/saiee.2020.9142602>.
- Utami, A. R. (2022). *Persepsi Penggunaan E-wallet OVO pada Generasi Z di Masa Pandemi Covid-19*. *MAMEN: Jurnal Manajemen*, 1(3), 409-415. Doi: <https://doi.org/10.55123/mamen.v1i3.828>.
- Yang, M. et al. (2021). Cashless transactions: A study on intention and adoption of e-wallets. *Sustainability (Switzerland)*, 13(2), 1-18. Doi: <https://doi.org/10.3390/su13020831>.
- Zhao, Z. (2019). *Cashless Society: Consumer Perceived Value Propositions of Mobile Payment*. Tampere University. Available at: <https://trepo.tuni.fi/bitstream/handle/10024/115548/ZhaoZheng.pdf?sequence=2&isAllowed=y>.