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The Indonesia Digital Payment Puzzle: Unraveling User Segmentation via Transaction Behaviors

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ABSTRACT: This research discusses the rapid development of technology and how it can affect the dynamics of life, especially in the economic sector and digital payments in Indonesia. Increasing internet usage and adoption of digital payments are the main focuses here. Digital wallets are one of the technological developments, namely digital payments. This digital wallet has relatively many users and continues to increase over time. There are several well-known digital wallets, namely Shopeepay, OVO, Dana, GoPay, etc. All digital wallet services strive to provide the best service to consumers. Where consumer satisfaction affects consumer behavior of a product or service. The study also highlights the importance of financial literacy in influencing a person's financial behavior. This study aims to see how transaction patterns affect the segment of digital payment usage in Indonesia, which is to help digital payment service providers improve their services.

KEYWORDS: Digital Payment, Digital wallet, consumer satisfaction, consumer behavior, transaction pattern, consumer segmentation.

I. INTRODUCTION

Technology continues to evolve at all times. Because the development of technology is so fast, the dynamics of life in society must also move quickly. This is because technological developments affect many factors in the lives of the wider community. In addition, Indonesia is one of the countries with increased internet usage. This is evidenced by the increase in internet usage from 2021 to 2022, from 62.10% to 66.48% (BPS, 2022).

Technological developments influence the Indonesian economy, especially in the economic sector. It has developed into a simpler online system, starting from buying and selling activities carried out directly. In addition to growing buying and selling activities, payment instruments have become easier for all groups to use as digital payments have begun. In Indonesia, many have begun to adopt digital payments. According to Bank Indonesia's annual report last year, the use of digital payments in Indonesia has increased compared to the previous year, supported by BI policy in the context of economic recovery (Bank Indonesia, 2022).

With various types of digital payments, in Indonesia, digital wallets are more widely used than virtual accounts, bank transfers, Qris, or cash. From the results of research conducted by KIC (Katadata Insight Center) in 2022, it was said that of the respondents obtained, digital wallets were more widely used than other payment methods, with a percentage of 81%. This happens because of the convenience digital wallets offer compared to other services. There are several digital wallet services in Indonesia, including Shopee, OVO, DANA, Gopay, and many more. Because there are several digital wallet services, the platform must provide satisfactory service to consumers. Providing satisfactory service to consumers will have a positive impact, such as creating loyalty to the company and will use services or buy the company's products again (Gounaris et al., 2010).

Consumer satisfaction will affect consumer behavior in using a company's product or service (Darmawan, 2019). Therefore, it is necessary to create a good customer experience; where there are several ways to increase customer loyalty, including service quality, unit price, and connection speed (Kumar & Reinartz, 2018).

Transaction patterns are created due to exchange/buying and selling activities between buyers and sellers. This transaction pattern does not appear suddenly, but several factors encourage the emergence of this transaction pattern. With the times that continue to advance, the Indonesian people can also increase their financial literacy, from 38.03% in 2019 to 49.68% in 2022,

with vulnerable ages ranging from 15 to 79 years (OJK, 2022). The increase in financial literacy every year shows that people are starting to be aware of their financial behavior. This will also affect people's financial behavior and transaction patterns carried out by the community.

This research is a continuation of the previous study entitled "The Gen Z's Digital Payment Loyalty In Indonesia" by Raharjo (2023) with topics related to the influence of cultural factors on consumer loyalty, analyzing cultural factors in Gen Z related to consumer loyalty, and the influence of customer loyalty and its implications. This research was conducted to deepen knowledge related to information on each digital payment segmentation in Indonesia, where research like this still needs to be carried out. Usually, research like this is carried out by internal digital payment companies, and information related to research is closed to the public. Therefore, we want to analyze more deeply related to this. Therefore, we raise research with the topic "Digital Payment Consumption Patterns in Generation Z." This research will dig deeper into the influence of literacy levels on consumer behavior in forming user segmentation.

II. LITERATURE REVIEW

A. Digital Payment

Digital payment is an electronic payment that uses electronics as a medium and is only used through certain software, electronic money, and payment cards (Noviana & Darma, 2020). In Indonesia, this digital payment has been widely used, be it by Generation Y, Z, or X. From the results of a survey conducted by KIC using 2,209 respondents stated that the highest percentage of digital payment usage is in Generation Y. Digital payments have a positive impact on Indonesia by providing convenience in transactions (Deloitte, 2020). According to Bank Indonesia (2020), the use of digital payments in Indonesia has increased monthly, both from the volume of transactions and the value of transactions made. In addition to Indonesia, several other developing countries have also experienced an increase in the use of digital payments. This is because of the convenience provided to the public by digital payment services. According to Bank Negara Malaysia (2021, 2023), the use of digital payments in Malaysia has increased from 2018 to 2022.

B. Financial Literacy Affects The Formation of Consumer Behavior

Financial literacy is one of the skills useful for managing finances effectively, which is useful for personal well-being (Hung et al., 2011). According to OJK, financial literacy has 3 important aspects, including knowledge, skills, and beliefs, and these 3 aspects influence a person in making a decision related to finance.

Financial literacy is a reflection of a person's financial behavior. If a person has a high level of financial literacy, then show positive financial behavior. Someone with a high financial literacy tends to save, invest, and avoid debt-related activities (Arofah, 2019). There is a need for skills to make behavior changes so that people can be more confident in using their knowledge related to financial literacy to identify financial products and services to achieve prosperity (Dwiastanti, 2015). In addition, research from Lusardi and Messy (2023) said that low levels of financial literacy negatively impact individuals' ability to make the right financial decisions, and increased financial literacy is expected to improve financial well-being globally.

Hypothesis 1: Financial literacy affects the formation of a person's consumptive behavior

Hypothesis 2: A high level of financial literacy will indicate positive financial behavior

C. Financial Behavior

Financial behavior is a person's actions in managing the finances they have. Financial behavior is divided into 2, namely long-term financial behavior, which involves more future planning, such as preparing emergency funds and savings accounts. In contrast, short-term financial behavior includes short-term planning, such as covering expenses by paying all monthly bills (Wagner & Walstad, 2019).

D. User Segmentation

Segmentation is one way for companies to build the right communication with customers by knowing customer activities, improving communication, and understanding customer desires, which can positively impact the company by providing services according to customer characteristics (Sari et al., 2016).

To create effective segmentation, there needs to be a division of segments where each segment is evaluated based on certain criteria, and it is necessary to see whether consumers in the segment and marketing are appropriate and can be followed up. This must be done so companies can provide their consumers with the best service with limited resources (Cooil et al., 2008).

E. The Influence Of Financial Behavior In The Formation Of Customer Segmentation

Each individual has a different consumptive pattern. This can come from various things, such as a person's understanding level or demographic aspect. The many types of consumer behavior can impact the formation of customer segmentation based on

their behavior patterns. This is to the research of Chellaboina et al. (2022), where dividing segmentation based on behavior patterns has a positive impact, including more effective marketing strategies, predicting consumer behavior, increasing customer loyalty and retention, customer experience personnel, optimizing customer journeys, supporting product development, and others.

Hypothesis 3: Customer segmentation can be observed through consumer consumptive behaviour

III. RESEARCH METHODOLOGY

This study will use a cross-sectional survey design method that will facilitate data collection, will be carried out at a certain time, and can provide information related to the relationship of variables with one another (Creswell & Creswell, 2018), which is the same as the purpose of this study to show the relationship between financial literacy and financial behavior towards digital payment segmentation in Indonesia.

A. Population And Sample

The population of this study is Indonesian people who have used digital payments, with Generation Z who have used digital payments. This is evidenced by a survey conducted by KIC using respondents aged 17-55 years, where digital payment users come from Gen Y, followed by Gen Z and Gen X.

The respondents had criteria: people who had used digital payment services for the last 6 months. Respondents who have not used digital payment services for the past 6 months were not used as a sample.

This study used a purposive sampling method. This is because, with purposive sampling, there are special criteria to become respondents in this study. In addition, this method aims to make the respondents obtain the criteria and objectives of this study (Etikan, 2016).

B. Data Collection

Data collection in this study used the online questionnaire method. This is because of widespread internet access, making it easier for researchers to collect the data needed. This questionnaire is almost identical to offline questionnaires but can provide advantages such as lower usage costs and relatively faster distribution (Regmi et al., 2017). The preparation of this questionnaire is based on variables that have been determined by combining several questions aligned with each variable's indicators.

C. Data Analysis Techniques

Data analysis techniques used using the K-Means Clustering Method. The K-Means Clustering Method enables dividing the data into groups with a high interest in each other and significant differences in each data group.

D. Measurement

The questionnaire will be divided into sections according to 2 variables determined. There are variables that are the main focus of this study, namely financial literacy, financial behavior, and user segmentation.

I). *Financial literacy: This section will ask respondents questions about understanding related to financial understanding*

II). *Financial behavior: This section will provide questions to respondents regarding digital payment usage activities*

III). *User segmentation: This section will contain questions to respondents regarding the level of customer satisfaction and customer demographics*

E. *Operational Definition: Financial Literacy (X1)*

Financial literacy is a person's understanding of managing their finances to be more effective and efficient for personal welfare (Hung et al., 2011). In this variable, there are several dimensions, including:

I). Basic understanding finance*:*

This section explains where financial literacy relates to diversifying individual portfolios. This means that financial literacy involves basic knowledge related to basic financial concepts such as interest rates, diversification, and inflation (Mouna & Jarboui, 2015). Questions on this dimension may be related to respondents' basic understanding of basic financial concepts.

II). Transaction type:

Understanding financial literacy are expected to enable you to manage your finances as well as possible. This is useful for creating financial benefits. In this section, one needs to pay attention to the long-term financial well-being of each individual by making financial decisions appropriately, such as finance in the context of complex instruments, such as mortgages, reverse mortgages, and crypto assets (Lusardi & Messy, 2023). In addition, people who understand finance well are generally more inclined to save, invest, and avoid involvement in debt-related matters (Arofah, 2019). Questions on this dimension may be related to how the respondents' long-term finances are managed.

F. Operational Definition: Behavioral Finance (X2)

Financial behavior is a person's activity in managing their finances as much as possible. In this section, there are several dimensions, including:

I). Transaction type:

There are 4 digital payments with the highest usage in Indonesia, including GoPay, OVO, Dana, and Shopeepay (Dewi, 2022). Several digital payment types include credit, credit cards, debit cards, e-wallets, e-money, and internet bankingInternetndicator will contain questions related to which digital payments and what services are often used. In addition, this dimension may contain questions related to what consumers most often purchase products or services

II). Shopping pattern:

The emergence of digital payments has an impact on changing consumer shopping patterns because of the convenience obtained, such as making transactions anywhere and anytime (Kurniawan et al., 2019). This indicator will contain questions related to consumptive, balanced, or frugal spending patterns

III). Transaction frequency:

Transaction frequency is the level of customer use of a product. There are 4 digital payments whose use is increasing, which is the highest arrangement of transaction frequencies ranging from shopeepay, OVO, GoPay, and Dana where this data was obtained from a survey with 1000 respondents (Burhan, 2021). This indicator will contain questions about which platforms have a high frequency of transactions and what factors affect them

G. Operational Definition: Customer Segmentation (Y)

Segmentation here is the division of consumers based on the pattern of transactions they make on digital payments. In this section, there are several dimensions, including:

I). Customer satisfaction level:

Customer satisfaction indicates that a company has successfully provided services and products that its consumers desire (Cleveland et al., 2011). Questions on this indicator may include features provided, service experience, and product availability.

II). User demographics*:*

There are 4 demographic variables in determining customer segmentation are often used in a study, including age, income, gender, and education (Cleveland et al., 2011). Questions on this indicator may include the age, income, gender, and education of respondents.

IV. RESULT

This study aims to identify the segmentation of digital payment service users in Indonesia based on the amount of revenue per month with user transaction patterns. The data obtained based on this online questionnaire amounted to 400 respondents, where the data will be processed using the K-Means Clustering method with the Python programming language.

A. Financial Literacy Level Analysis

Four hundred respondents, 142 men, and 258 women, filled out this questionnaire. This data produces an average value wherein women get an average of 68/98 and men get an average value of 65/98. From this, women's financial literacy level is higher than men's. This can also be seen in Figure 2 and Figure 3, where women get 98 more scores than men.

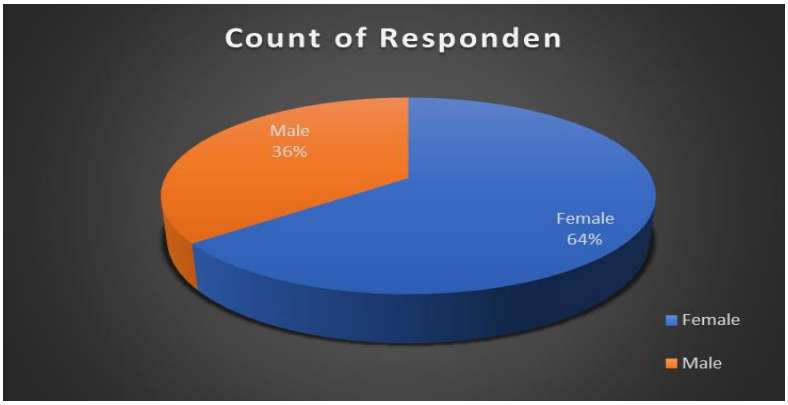

Figure 1. Count of Respondent

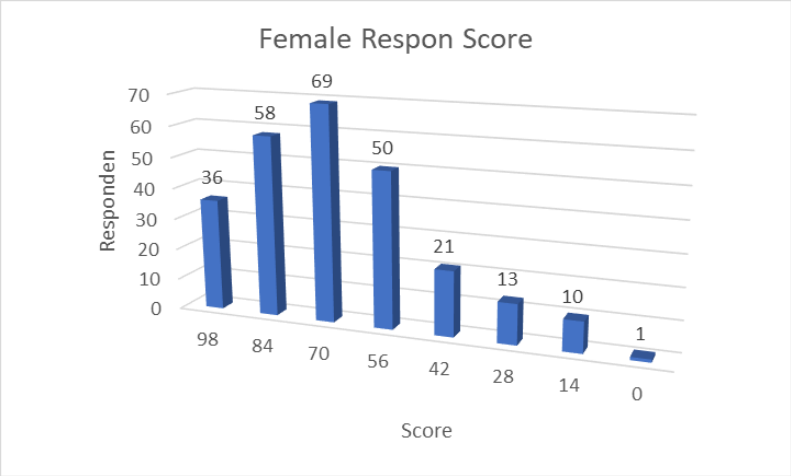

Figure 2. Female Respon Score

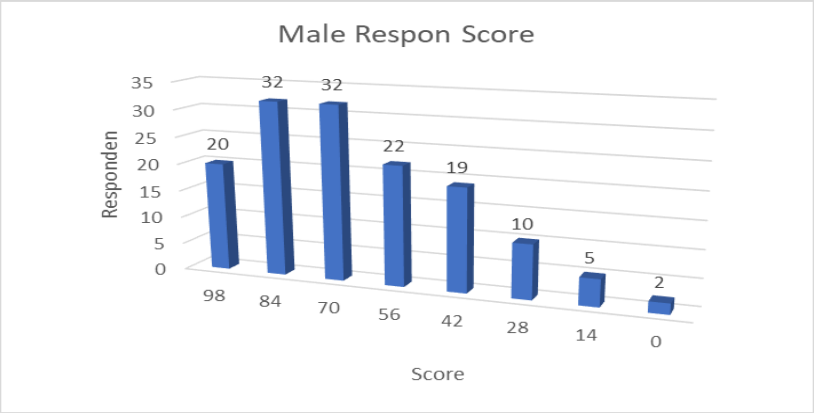

Figure 3. Male Respon Score

B. Data Analytics

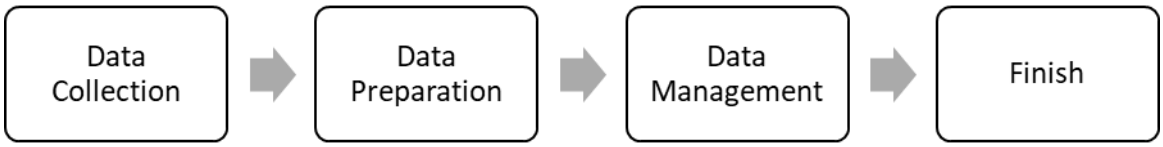

Figure 4. Data analysis flow

Managing data to reach a conclusion or result by research needs to be done coherently and precisely. Starting from data collection, where in this section, data is collected according to research needs. The research method in this study was data collected using the online questionnaire method and with the criteria of active digital payment users in Indonesia for the last 4 months. In this data collection section, 400 respondents were collected.

After the data is collected, the next step is to prepare the data, which includes selecting variables to be used, cleaning data, and standardizing data. This is all done using the Python programming language and several existing libraries. The dataset results are stored in Microsoft Excel or csv files in the variable selection section. The attributes used in the questionnaire result data table are Income/Pocket Money, Digital Services, Behavior Pattern Variables, Frequency of Use, Level of Promotion Use, Level of Trust, Impact Related to Payment Efficiency, Duration of Service, Level of Convenience, Level of Transaction Security, and Level of Financial Literacy. This data will be formed into a 3-dimensional K-Means graph using core variables, namely Income/Pocket Money, Digital Services, and Behavior Pattern Variables. The three data will be processed to determine the relationship between the amount of income and digital services used to determine consumer behavior patterns. The next step is data cleanup, useful for deleting empty rows or no values. This data cleaning serves for optimization when managing data later. And the last step is to do standard scaling on data using standardScaler from scikit-learn. A standard scaling procedure changes the data distribution to have an average of 0 and a standard deviation of 1.

C. Data Management

The K-Means Clustering method is useful for dividing the cluster of respondents based on the variables used. This study uses 3 main variables set in the data selection process. The first step in data management is determining the most optimal number of clusters. This research uses the Elbow Method method, using the Python programming language.

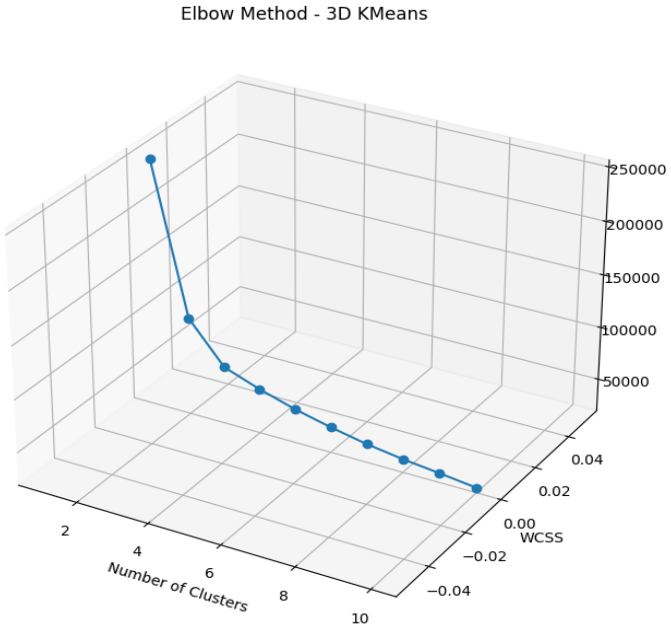

Figure 5. Graph of The Elbow Method

In applying the Elbow Method graph, the optimal cluster can be determined by looking at a point where adding clusters no longer provides a significant decrease in inertia (WCSS). However, determining the most optimal cluster for 3-dimensional graphics takes much work. Therefore, a certain prompt is needed to calculate or determine the most optimal cluster in the 3-dimensional graph. This can be done using the Silhouette Coefficient method in determining the most optimal cluster. This Silhouette Coefficient is useful for showing the most optimal number of clusters with values between -1 and 1. A positive value indicates how well the object matches its cluster, while a negative value indicates that the object is better suited to another cluster. With the application of the Silhouette Coefficient, it can be known in value where the optimal cluster is in the second cluster, as can be seen in Figure 6.

	Number of Clusters (k)	Silhouette Coefficient
0	2	0.478976
1	3	0.418542
2	4	0.369084
3	5	0.379327

Figure 6. Optimal Cluster Calculation

The figure above shows that the number of second clusters is the most optimal cluster, shown from the Silhouette Coefficiency calculation, which shows the closest value of 0.478976, where the value is closest to the value of 1.
After determining the optimal cluster, the next step is to visualize the K-Means Clustering analysis.

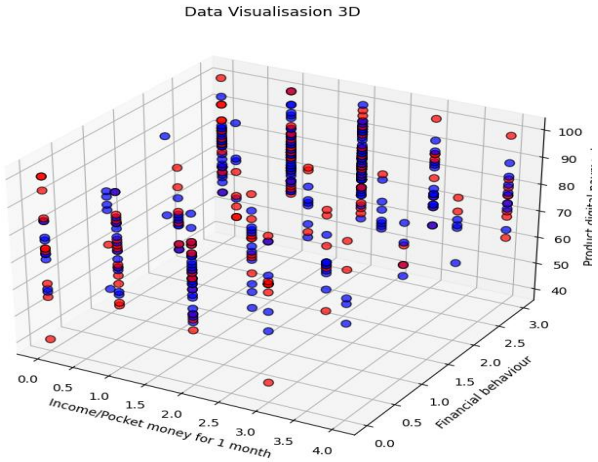

Figure 7. K-Means Data Visualization

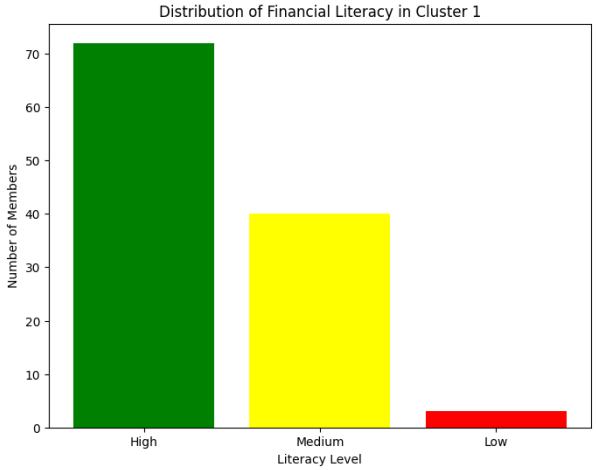

Figure 8. Distribution of Financial Literacy Cluster 1

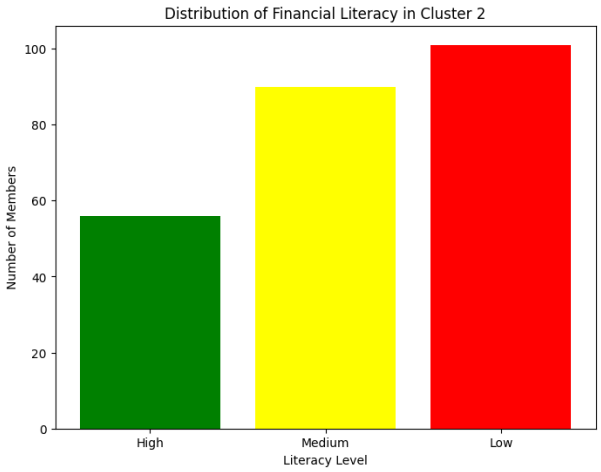

Figure 9. Distribution of Financial Literacy Cluster 2

The visualization depicts 2 predefined clusters. The three clusters are distinguished according to their color, namely blue and red. The first cluster is symbolized by red, where this cluster consists of 153 respondents with an average monthly income/allowance of Rp1,000,000 – Rp3,000,000 with a lower level of financial behavior than the second cluster. In addition, the first cluster shows a fairly high financial literacy value compared to the second cluster. The second cluster is symbolized by blue, with 247 respondents and an average monthly income/allowance of Rp1,000,000 – Rp3,000,000. In this second cluster, the level of financial behavior is relatively higher than in the first cluster, with a lower literacy level as well. The literacy level of each cluster can be seen in Figure 8 and Figure 9.

After visualizing the data, the next step is to calculate vector points to determine the relationship between one variable and another.

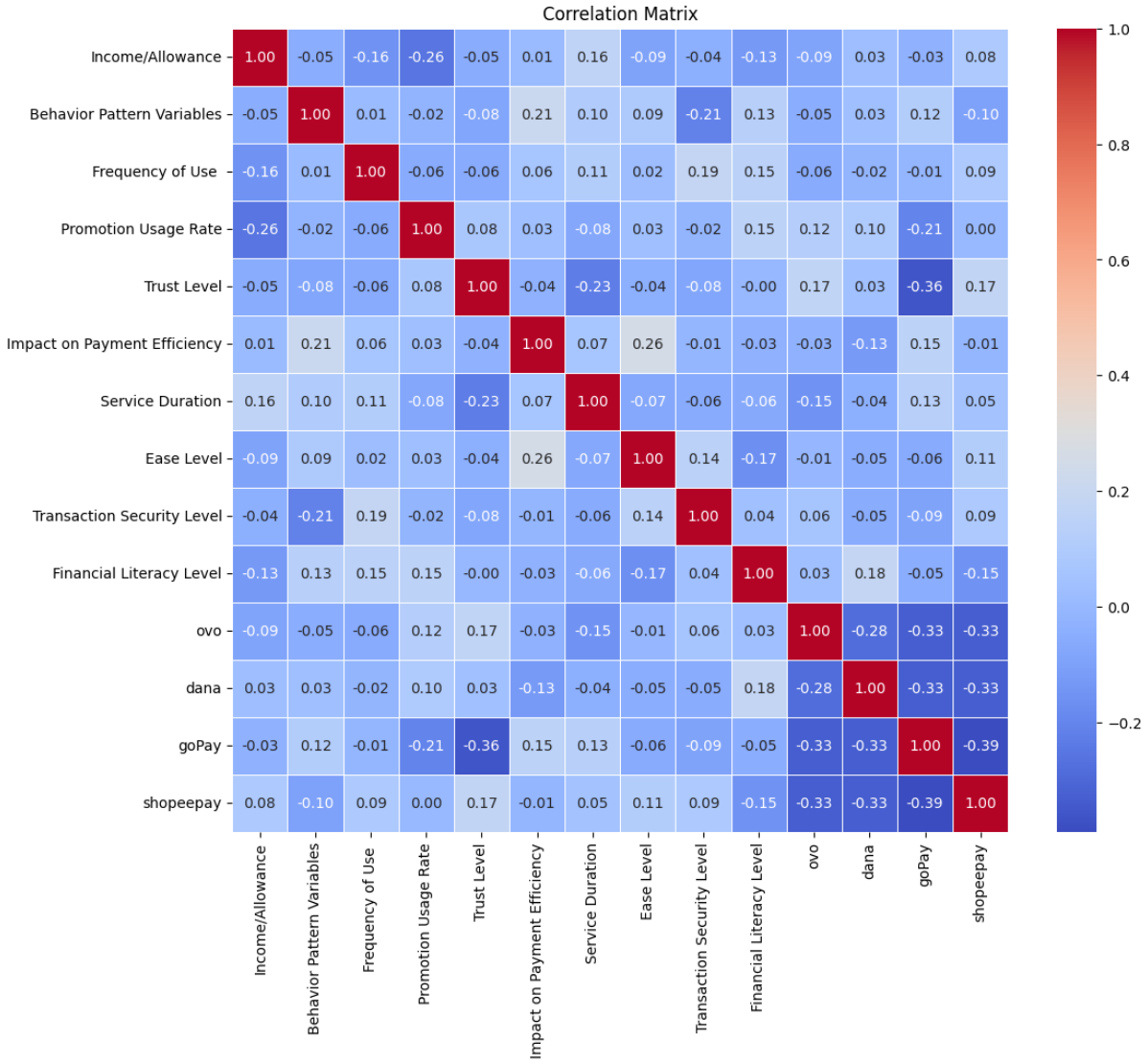

Figure 10. Matrix Correlation

From the picture, it can be explained as related to the differences in colors that exist, where each color shows the relationship between two variables.

I). Red Color (Positive): This color shows a positive relationship between two variables, where if the value of one variable increases, then the value of the other variable also tends to increase.

II). Blue (Negative): This color shows a negative relationship between two variables. If one variable value increases, the value of other variables tends to decrease, and vice versa.

III). Lighter Color: This color shows a stronger relationship, where the whiter the color, the higher the correlation level.

In addition to color, there is also a number in each box. Where this number represents the value of the relationship between two variables. The value is 1 to -1, with a value of 1 indicating a positive value, a value of -1 indicating a negative value, and a value of 0 indicating no correlation.

V. DISCUSSION

This study discusses the relationship between financial literacy and consumer behavior towards forming digital payment segmentation in Indonesia. This study tests the hypothesis that financial literacy will shape consumer behavior patterns, high literacy will tend to create positive consumptive patterns, and customer segmentation can be observed based on consumer behavior patterns.

A. Market Segmentation Based on Transaction Behavior

Market segmentation is very important in a business strategy. This behavioral segmentation can provide more detailed information related to the use of digital payment services by different consumers. Segmentation based on transaction behavior supports this theory by offering a deeper understanding of how consumers differ when using digital payment services. This is supported by Kotler and Keller's marketing principles, whereby identifying a different group in the market will be useful for adjusting marketing strategies more effectively (Kotler & Keller, 2016).

Improvement of marketing strategies can also be made through digital marketing with a customer segmentation approach. The customer segmentation approach will help optimize identifying different target consumers (Sheth, 2023). The right segmentation can also increase the effectiveness of the 'Attention' and 'Interest' stages in the AIDA model as marketing communications become more focused and relevant for each segment.

From the findings of the 4 digital payments listed, there are differences in segmentation based on behavior patterns in each digital payment. Starting from Shopeepay, which users tend to use for daily needs, followed by top-ups (e-wallet balances, credit, internet packages, etc.). Funds are more likely to be used for top-up needs (e-wallet balance, credit, internet, etc.) and by purchasing daily necessities. GoPay is often used to make beverage and food transactions, followed by top-up activities (e-wallet balance, credit, internet packages, etc.). And for OVO, its use is more likely in purchasing daily necessities.

In addition, the findings of this study say that gender also affects the level of consumptive behavior, but the influence given is not too high. The type of goods that women more often buy than men is beauty products. As for men, they tend to use digital payments for top-up activities (e-wallet balances, credit, internet packages, etc.). Regarding everyday products, both women and men have similarities.

In addition, the last education also affects the understanding of consumer finance. However, the influence could be better; many other factors affect a person's financial understanding. This is shown by the findings of this study, where respondents with higher education have a relatively high financial literacy value. This is based on research from Baihaqqy et al. (2020), which states that the higher the level of education, the higher the understanding related to financial literacy. Which is where it will affect good financial decision-making.

B. Financial Literacy and Its Effects on Consumer Behavior and Forming Positive Behavior Patterns

In addition, financial literacy is also quite influential on consumer behavior in the process of making purchase decisions or using digital services. This is reinforced by research from Niti Widari et al. (2023), who said that financial literacy will hurt consumer behavior, with increasing financial literacy causing a decrease in consumptive behavior. This is also related to the findings of this study, where clusters with high financial literacy will have relatively lower financial behavior than the second cluster. In addition, the findings in this study in the matrix section show that the variable level of literacy has a low level of correlation with the variable frequency of use and has a fairly high correlation with behavioral pattern variables. From the questionnaire data provided and the matrix, it can be explained that someone with a high level of literacy will have a relatively high frequency of consumption by having a level of financial behavior management that refers to the long term.

Given the findings of this study, where financial literacy in the use of digital payment services is important. Therefore, every service provider should consider programs related to developing the financial literacy of their consumers. This can be done with online seminars, tutorials, or educational content in the application. Regarding segmentation with a low literacy level, service providers can provide easy-to-use and understand products. This can be done by providing clear instructions and customer support that is easy to access

C. Application of K-Means Clustering Methodology Using Pyhton

Using the K-Means Clustering method can further assist researchers in conducting big data analysis to identify consumer behavior patterns. Applying this method can produce segmentation on a topic discussed in the research, which can be useful for determining business strategies later. With the formation of segmentation of each consumer, interested parties such as digital service providers can analyze every characteristic of their consumers who have similarities in terms of needs. This is because K-Means Clustering using Python is more optimal than traditional K-means. This is related to research from Zare and Emadi (2020), which says that the development use of K-Means Clustering is more optimal than traditional K-Means Clustering.

D. Implications for Financial Management

Understanding the different financial literacy among consumer segments provides insight into how financial products and services should be communicated and presented. This is supported by research conducted by Danila et al. (2019), where knowledge related to financial products is followed by behavior in financial decision-making. This can be seen in the matrix table

of Dana users, where they have a high relationship value with financial literacy, which is inverse to the frequency of use. In addition, the Shopeepay product, which has a fairly high attachment to easy use, causes a high frequency of use.

E. Academic Implications and Future Research Directions

This research must address the financial literature linking consumer behavior, financial literacy, and digital payment services. This paves the way for advanced research related to multidisciplinary studies by combining the study of marketing management, finance, consumer psychology, and information technology. With the following approach, we can gain greater insight into how consumer behavior patterns and financial literacy influence the adoption of digital payment services. In addition, it also opens up opportunities to develop more effective strategies in facing challenges and opportunities in the digital era.

VI. CONCLUSION

The practical application of these research results in the digital payment services industry is not only about technical improvements or more focused marketing but also about understanding and meeting the needs of diverse consumers. This includes a customer-centric approach, leveraging technology, and constantly innovating to keep up with changing consumer behavior and market trends.

This study also answers the hypothetical hypothesis that financial literacy will affect consumer behavior patterns. The pattern of consumer behavior will form a segmentation according to the type of behavior pattern with a high level of similarity.

Based on this research analysis on the segmentation of digital payment service users in Indonesia, here are some suggestions for future research:

A. In-depth Research on Consumer Behavior

Future research may develop their research methods. Not only using quantitative approaches but also combining qualitative and quantitative methods. This is useful for gaining more understanding or information related to consumer motivations, attitudes, and perceptions related to digital payment services.

In addition, future research can examine how psychological and social factors, such as trust, social norms, and peer influence influence influence decisions using digital payments.

B. Advanced Studies on Financial Literacy

Future research can examine the effectiveness of financial education initiatives provided by digital payment service providers to their consumers to improve their financial literacy. In addition, it can also explore how financial literacy can affect financial behavior, including financial risk management and investment decisions.

C. Trend Analysis and Technology Innovation

Future research could analyze how new technologies such as blockchain, AI, and machine learning can impact the changing digital payments landscape and consumer behavior, whichWhich contains the factors that encourage the adoption or resistance to innovation in digital payment services.

D. Cross-Cultural Comparative Studies

Researchers can then compare the behavior of digital payment service users in Indonesia with other countries, which is useful for understanding the differences and similarities in a broader global context. In addition, further research can examine how cultural values and social norms in Indonesia affect the adoption and use of digital payment services.

E. Socioeconomic Impact

Further research can analyze the broader economic impact of digital payment services, including how they can contribute to increased financial inclusion. In addition, it can also research socioeconomic impacts that can affect access and use of digital payment services.

F. Integration with the Wider Financial System

Future research can examine the potential and challenges of partnerships between digital payment service providers and traditional financial institutions. This can discuss how regulatory changes affect the digital payment industry and consumer behavior.

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