

Segmenting QRIS Users Using Cluster Analysis in Indonesia

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Abstract

The payment sector is the most prominent financial technology in Indonesia. The widespread use of digital payments give rise to more than 48 licensed e-wallet systems in Indonesia and lead Bank Indonesia to developed QRIS. QRIS displays a QR code that can be used by various Payment System Service Providers. However, it was found that the use of QRIS has not been fully accepted. There are still users who have not used QRIS. These include not knowing the process, lack of confidence in the security of transactions, feeling more comfortable and easier to use cash, and because the infrastructure and environment do not support it. The research was conducted through a questionnaire with a purposive sampling method, to see whether there is a demographic correlation with the level of QRIS adoption and create user segmentation based on technology acceptance factors (performance expectancy, effort expectancy, social influence, facilitating conditions, perceived trust, and attitude). The procedure was carried out using CFA analysis, cluster analysis, and chi-square test. By carrying out segmentation, it is hoped that it will provide an overview of QRIS users based on age, gender, income, occupation, and level of education for QRIS applications in Indonesia.

Keywords

QRIS, Digital Payments, Segmentation, K-Means Clustering, Technology Acceptance

1. Introduction

Technology has entered life over the last few decades and has had a significant impact on life, one of them is the financial sector. Digital payments were introduced as a new way to carry out convenient and effective financial transactions. Using digital payments can avoid direct contact between individuals, make transactions quicker, more secure, lower transaction costs, and eliminate counterfeit currency. In Indonesia, the adoption rate of digital payments is quite high. The most reasons why digital payments are increasing rapidly is because they are convenient, fast, real-time, and users do not need to use cash. Digital payments only require a smartphone and internet access. In 2021, Indonesia is in third place as the country with the highest adoption rate in Southeast Asia, namely 95%, below Singapore and Malaysia (Statista 2024). The most popular digital payment in Indonesia is E-wallet and currently, there are more than 48 licensed e-wallet systems in Indonesia. Because e-wallet service providers have different QR codes from each other and this causes merchants to provide many QR codes, Bank Indonesia developed QRIS.

Unfortunately, it was found that the use of QRIS has not been fully accepted. A survey conducted by The Economics among 300 public respondents stated that 93% knew about QR and 81 percent were willing to use it, but only 19 percent had ever used it (Antara 2021). Research in the Jabodetabek area, Indonesia in 2023 stated that 62.9% of MSME business owners had not used QRIS, where the age range of respondents was 40-50 years and more than 50 years. In fact, according to BPS 2024, the population aged 15–64 years, which is the productive age population, is 186.77 million people, representing 69.28 percent of Indonesia's population. The productive age population has a positive and significant influence on Indonesia's economic growth. There are still some people who have not used QRIS because they do not know the process, lack confidence in transaction security, feel it is more comfortable and

easier to use cash, and because the infrastructure and environment do not support it (Karniawati et al. 2021, Setiawan and Mahyuni 2020, Rahmayati et al. 2023).

1.1 Objectives

The use of QRIS in Indonesia until 2023 will continue to increase. However, it was found that the use of QRIS has not been fully accepted. There are still some groups who have not used QRIS. Based on previous research, things that can influence the level of technology adoption include age (Avrile 2023), income (Ashfiah et al. 2023, Dash et al. 2023), level of education (Anggadipati et al. 2022, Bhat et al. 2024), gender (Song et al. 2023, Khamesian et al. 2021), occupation (Agrawal et al. 2023, Dash et al. 2023) and geographic location (Brand et al. 2020, Jaiswal et al. 2023). Apart from that, many studies have analyzed the adoption factors of QRIS or the adoption of digital payments, but only a few studies have discussed user segmentation. Some segmentation research related to mobile payments is Chawla and Joshi's (2021) research which segmented consumers based on TAM (Technology Acceptance Model), then Shukla's (2022) research used a cluster approach to classify mobile payment users in India, Dash et al. (2023) which divides market segments based on consumer attitudes, influence adoption using the DOI (Diffusion of Innovation) model, and Jaiswal et al. (2023) which creates user profiles based on their perceptions. There is no research yet understands the specific pattern of QRIS usage, while QRIS usage is more massive because it combines various types of QR. Therefore, this research is needed to see whether there is a demographic correlation with the level of adoption, what factors influence QRIS adoption, and create user segmentation as a consideration for deploying appropriate network infrastructure and adopting QRIS according to the target market.

2. Literature Review

2.1 QRIS Payment System

Quick Response Code Indonesian Standard (QRIS) is a combination of various types of QR from various Payment System Service Providers (PJSP) using a QR Code. QRIS is a QR Code standard for payments via server-based electronic money applications, electronic wallets, or mobile banking. QRIS has the advantages of being easy, fast, safe, and cheap, and can increase efficiency and transparency in the payment system (Lau and Kulsum 2023). QRIS was developed by the payment system industry together with Bank Indonesia so that the transaction process using QR Codes can be easier, faster, and more secure. All Payment System Service Providers who will use QR Code Payments are required to implement QRIS which has been regulated in BI provisions in the Regulation of Members of the Board of Governors Number 23/8/2021 (Bank Indonesia).

There are 3 types of payment methods, namely Static QRIS Merchant Presented Mode (QRIS MPM), Dynamic QRIS MPM, and QRIS Customer Presented Mode (CPM). With Static QRIS MPM, the QR is displayed via a sticker or other print. The same QR Code is used for each payment transaction, it does not contain the nominal payment that must be paid, so it requires input of the nominal amount by the customer. Whereas in Dynamic MPM QRIS, the QR Code is displayed via a receipt printed via an EDC (Electronic Data Capture) machine/displayed on a monitor and non-digital (EDC receipt and others). A different QR Code is printed for each payment transaction, the QR Code has contains the nominal payment to be paid. The illustration can be seen in Figure 1: Static and Dynamic Merchant Presented Mode. Lastly, QRIS CPM displays the user's QRIS in the payment application on the user's cellphone/device. CPM is suitable for merchants who require high transaction speeds, such as transportation, parking, and modern retail providers. Illustration for CPM can be seen in Figure 2: Consumer Presented Mode. The choice of payment type using the QR Code above depends on the needs and preferences of the merchant and customer. Even though the types are different, each QRIS has the same benefits (Bank Indonesia).

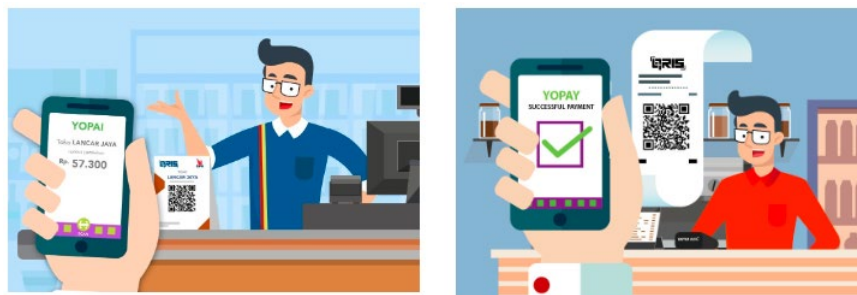


Figure 1. Static and Dynamic Merchant Presented Mode



Figure 2. Consumer Presented Mode

2.2 UTAUT

UTAUT or 'Unified Theory of Acceptance & Use of Technology' propounded by Venkatesh et al. 2003. It is a model that aims to explain technology acceptance based on previous technology acceptance theories, namely Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Motivational Model, Theory of Planned Behavior (TPB), Combined TAM and TPB (C-TAM-TPB), Model of PC Utilization (MPCU), Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT) (Venkatesh et al. 2003). UTAUT has four key determinants of behavioral intention and use, they are performance expectancy, efforts expectancy, social in-fluence, and facilitating condition.

Performance expectancy (PE) can be described as how one believes using a system will help one obtain better job performance and the usefulness of the system. Mubarok et al. (2023) and Musyaffi et al. (2021) found that performance expectancy significantly influences the adoption of QRIS. In this research PE is used to measure the level of user confidence that QRIS is a technology that can improve daily life performance. Effort expectancy (EE) measures the ease of system use, when using only minimal effort in operating the technology. If the use of technology is easy, it allows someone to continue using the technology. Effort expectancy also has a strong influence on behavior intention (Musyaffi et al. 2021, Sivathanu 2019). Social influence (SI) refers to how other people's opinions influence a person's use of technology. When many people talk about QRIS, they are quite satisfied and the widespread use of QRIS ultimately influences potential users to use QRIS as payment technology in e-wallets. It was found that social influence has an impact indirectly on interest in using QRIS in generation Z (Mareta et al. 2023). Facilitating conditions are measured as the extent to which the organizational and technical infrastructure exists to support the use of the system.

In the present study we also have two additional constructs of perceive trust and attitude in the context of segmentation QRIS users. Perceive Trust refers to the extent of belief that a service is reliable and safe to adopt (Al-Saedi et al. 2020). Previous research states that the higher the level of trust, the greater the chances of m-payments adoption (Jaiswal et al. 2023, Al-Saedi et al. 2020). Attitude is a form of a person's feelings about carrying out a behavior (Davis 1989). When people see something, an attitude of thoughts and beliefs is born, which ultimately leads to acceptance or rejection. Indicator in the measurement of this variable for example, is that the use of a system is a good idea, use using the system is something fun, and using the system is a wise decision. The research results of Tenggingo and Mauritsius (2022) show that attitude towards QRIS payments influences the intention to use QRIS payments.

3. Methods

3.1 Sample and Data

QRIS user data was collected by conducting an online questionnaire to answer 18 statements using a 5-point likert scale. Responses were collected using nonprobabilistic purposive sampling for the Jakarta and surrounding areas (Jakarta, Bogor, Depok, Tangerang, Bekasi). The minimum sample size was determined using the Isaac and Michael method with an error rate of 5%, namely 385 respondents.

3.2 Research Data

The scale items for different variables were adapted from previous studies such as performance expectancy drawn from the studies by Jaiswal et al. (2023), Patil et al. (2020), Al-Saedi et al. (2020), and Ong et al. (2023). The measure for social influence was taken from Akinwale and Kyari (2022), Bhat et al. (2024), and Sivathanu (2019). The

facilitating conditions scale was adapted from the works of Patil et al. (2020) and Ong et al. (2023) while attitude was developed from Syah et al. (2022) and Bhat et al. (2024). Perceived trust was drawn from Al-Saedi et al. (2020).

The questionnaire consists of two parts. The first one was related to respondents' demographic features seeking information about the frequency of using QRIS. The second one was about statements performance expectancy, effort expectancy, social influence, facilitating conditions, perceive trust, and attitude.

4. Data Collection

The analysis procedure uses confirmatory factor analysis (CFA), cluster analysis, and the bivariate statistical method of Chi-square to examine the segmentation.

4.1 Reliability and Validity Test

Reliability test was calculated using CFA and AVE, and validity test using Cronbach's Alpha and Composite reliability, both measure the first 105 respondents. Table 1 presents the results of reliability and validity. Cronbach's Alpha and Compo-site Reliability (CR) of the factors ranged from 0.827 to 0.923 and 0.826 to 0.966, respectively, which were greater than the verge of 0.70, indicating good results for meeting internal and convergence consistency of constructs' reliability. Factor loading of each item was greater than the threshold of 0.50, have the suitability of constructs' structure and items' dimensionality. Average variance Extracted (AVEs) results sur-passes the threshold of 0.50, indicating the acceptable condition for convergent validity.

Table 1. Reliability and validity analysis

Construct	Item	Loading	Cronbach's Alpha	AVE	Composite Reliability
Performance Expectancy	PE1	0,0872	0,909	0,813	0,960
	PE2	0,761			
	PE3	1,000			
Effort Expectancy	EE1	0,870	0,894	0,773	0,938
	EE2	0957			
	EE3	0,770			
Social Influence	SI1	0,915	0,886	0,720	0,901
	SI2	0,827			
	SI3	0,807			
Facilitating Condition	FC1	0,931	0,827	0,637	0,826
	FC2	0,785			
	FC3	0,655			
Perceive Trust	PT1	0,742	0,857	0,706	0,895
	PT2	0,880			
	PT3	0,834			
Attitude	AT1	0,828	0,923	0,827	0,966
	AT2	0,933			
	AT3	0,924			

4.2 Cluster Analysis

After being declared reliable and valid, the questionnaire was distributed again to more people and finally a total of 391 respondents were obtained. Cluster analysis was performed using hierarchical and non-hierarchical techniques, to evaluate cluster solutions' optimum number and memberships. First, hierarchical cluster using Ward's linkage method with agglomeration coefficient to determine an apt number of cluster solutions applying the stopping rule. Figure 3 shows the results of the agglomeration schedule coefficient test. At this stage, the number of clusters that will

be formed can be determined. In Figure 3, it is shown that there are 4 clusters formed, this can be seen because the sharp decline occurred in the first to fourth bars. With the formation of 4 clusters, we will continue using k-means using standardization conversion (i.e., Z scores) of the underlying six clustering variables to divide the distribution of respondents into 4 clusters. Grouping 4 clusters using k-means shows the frequency of respondents per cluster as in Table 2.

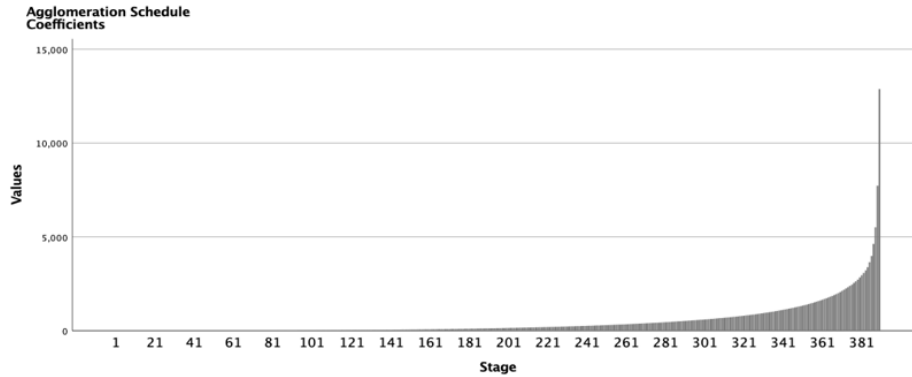


Figure 3. Agglomeration Schedule Coefficient Test

Table 2. Frequency of Respondents by Cluster

Number of Cases in each Cluster		
Cluster	1	151.000
	2	9.000
	3	50.000
	4	181.000
Valid		391.000
Missing		.000

From the table it is shown that in cluster 1 there were 151 respondents (38.62%), then in cluster 2 there were 9 respondents (2.30%), cluster 3 had 50 respondents (12.79%), and cluster 4 had 181 respondents. (46.29%). Thus, almost half of the respondents were in cluster 4, followed by cluster 1, cluster 3, and cluster 2. Table 3 summarizes the results of the clusters analysis. Table 3 shows the size of the initial cluster center in each cluster based on the forming variables. It can be stated that the lower cluster is cluster 2, then the lower middle cluster is cluster 3, the upper middle cluster is cluster 1, and the upper cluster is cluster 4. Table 4 shows the ANOVA results in this study. In the anova table, the p-value for a ll forming variables is 0.00 (below the alpha significance level of 5%), which means that all forming variables can differentiate the characteristics of the clusters formed.

Table 3. Initial Cluster Centers

	Initial Cluster Centers			
	Cluster			
	1	2	3	4
Zscore(PI)	-1.40317	-4.47801	-3.16022	.79315
Zscore(EE)	.70253	-4.77303	-1.12265	.24624
Zscore(SI)	1.24157	-3.54515	-2.34847	-2.74736
Zscore(FC)	-1.84617	-4.01912	-1.41158	1.19595
Zscore(PT)	-.22759	-4.05959	-.65337	.19819
Zscore(AT)	.61452	-3.89577	-2.66570	.20449

Table 4. ANOVA

ANOVA						
	Cluster Mean Square	df	Error Mean Square	df	F	Sig.
Zscore(PI)	87.512	3	.329	387	265.698	.000
Zscore(EI)	91.711	3	.297	387	308.980	.000
Zscore(SI)	71.579	3	.453	387	158.056	.000
Zscore(FC)	81.861	3	.373	387	219.368	.000
Zscore(PT)	96.363	3	.261	387	369.560	.000
Zscore(AT)	93.972	3	.279	387	336.477	.000

4.3 Chi-square analysis

Pearson's chi-square was applied to analyze the difference between demographic variables like gender, age, occupation (Table 5), region, level of education, income, and frequency with the four distinct clusters resulting from the initial phase. All variables were utilized to test the significant differences between the clusters using Chi-square test, result shows in Table 6. It was found that the variables job, education level, income and frequency had a p-value below 0.05, which means that in the four clusters formed there were demographic differences in these variables. Meanwhile, gender, age and area of residence have a p-value above 0.05, which means that the four clusters have the same demographics on these variables.

Table 5. Cluster Distribution according to Respondent Demographics

		Cluster Number of Case							
		1		2		3		4	
		Count	Column N %	Count	Column N %	Count	Column N %	Count	Column N %
Gender	Man	76	50.3%	5	55.6%	25	50.0%	85	47.0%
	Woman	75	49.7%	4	44.4%	25	50.0%	96	53.0%
Age	20 - 29 years old	72	47.7%	4	44.4%	16	32.0%	76	42.0%
	30 - 39 years old	23	15.2%	1	11.1%	10	20.0%	30	16.6%
	40 - 49 years old	15	9.9%	0	0.0%	6	12.0%	15	8.3%
	50 - 59 years old	18	11.9%	2	22.2%	6	12.0%	20	11.0%
	> 60 years old	4	2.6%	1	11.1%	5	10.0%	6	3.3%
	< 20 years old	19	12.6%	1	11.1%	7	14.0%	34	18.8%
Occupation	Housewife	7	4.6%	2	22.2%	5	10.0%	10	5.5%
	Private sector employee	85	56.3%	2	22.2%	24	48.0%	92	50.8%
	Civil Servants (PNS)	15	9.9%	1	11.1%	7	14.0%	23	12.7%
	Student/Students	22	14.6%	1	11.1%	7	14.0%	40	22.1%
	Education Personnel (Teachers/Lecturers)	15	9.9%	0	0.0%	1	2.0%	7	3.9%
	Entrepreneur	7	4.6%	3	33.3%	6	12.0%	9	5.0%
Region	Bekasi	24	15.9%	0	0.0%	11	22.0%	36	19.9%
	Bogor	40	26.5%	5	55.6%	14	28.0%	70	38.7%
	Depok	6	4.0%	0	0.0%	6	12.0%	7	3.9%
	Jakarta	71	47.0%	3	33.3%	17	34.0%	58	32.0%
	Tangerang	10	6.6%	1	11.1%	2	4.0%	10	5.5%
Level of education	Diploma or bachelor's degree	108	71.5%	5	55.6%	32	64.0%	114	63.0%
	Other	15	9.9%	0	0.0%	3	6.0%	19	10.5%
	High school or equivalent	25	16.6%	2	22.2%	13	26.0%	48	26.5%

	Middle school or earlier level	3	2.0%	2	22.2%	2	4.0%	0	0.0%
Income (per Month)	< 3.000.000	30	19.9%	6	66.7%	9	18.0%	38	21.0%
	> 20.000.000	9	6.0%	0	0.0%	5	10.0%	18	9.9%
	10.000.000 - 20.000.000	49	32.5%	0	0.0%	10	20.0%	40	22.1%
	3.000.000 - 5.000.000	16	10.6%	0	0.0%	10	20.0%	23	12.7%
	5.000.000 - 10.000.000	47	31.1%	3	33.3%	16	32.0%	62	34.3%
Frequency of using QRIS	Twice a week	15	9.9%	0	0.0%	6	12.0%	28	15.5%
	More than three times a week	96	63.6%	3	33.3%	11	22.0%	81	44.8%
	Once a week	25	16.6%	5	55.6%	29	58.0%	53	29.3%
	Three times a week	15	9.9%	1	11.1%	4	8.0%	19	10.5%

Table 6. Chi-square test

Pearson Chi-Square Tests		Cluster	Number of
		Case	
Gender	Chi-square	.579	
	df	3	
	Sig.	.901 ^a	
Age	Chi-square	13.970	
	df	15	
	Sig.	.528 ^{a,b}	
Occupation	Chi-square	33.354	
	df	15	
	Sig.	.004 ^{a,b,*}	
Wilayah tinggal	Chi-square	20.601	
	df	12	
	Sig.	.057 ^{a,b}	
Level of Education	Chi-square	32.409	
	df	9	
	Sig.	.000 ^{a,b,*}	
Income (per Month)	Chi-square	22.348	
	df	12	
	Sig.	.034 ^{a,b,*}	
Frequency of using QRIS	Chi-square	43.651	
	df	9	
	Sig.	.000 ^{a,b,*}	

5. Results and Discussion

Based on the level of cluster homogeneity and heterogeneity between clusters, 4 clusters were obtained. From the 4 clusters, the demographic variables that differ significantly are occupation, education level, income, and frequency of QRIS use. The explanations are sorted from clusters with high to low adoption rates as follows.

1. Cluster 4: Users with the Highest Acceptance Rate

This cluster is the biggest distinct group. Based on the test attributes, this group shows a positive perception of the use of QRIS. These results are presented in Table 3. The output explains that this cluster has a positive opinion on almost all test attributes such as PI, EE, FC, PT, and AT. Therefore, they are willingfull and easy to use QRIS in their payment system. Based on the demographic results, this cluster uses QRIS more than 3 times a week, amounting to 44.8% of the number of respondents and is dominated by those aged 20-29 years (42%). Most of this cluster work as private

employees (50.8%) who have a diploma/bachelor's degree (63%) and the majority of respondents have an income in the range of 5-10 million as much as 34.3% and 10-20 million as much as 22.1%.

2. Cluster 1: Users with Upper Middle Acceptance Level

Based on the test attributes, this group shows a slightly skeptical perception of the use of QRIS in their payment system. By referring to Table 3, the output explains that QRIS users in this cluster have positive opinions on the EE, SI and AT attributes. And for the PI, FC and PT attributes, this cluster has a slightly negative opinion. Looking at the demographic results in Table 5, in this cluster, 66.3% use QRIS more than 3 times a week and are dominated by private employees (56.3%) who have an age range of 20-29 years (47.7%). Most of this cluster are diploma/bachelor graduates who have a range of income of the 10-20 million range is 32.5% and the 5-10 million is 31.1%.

3. Cluster 3: Users with Lower Middle Acceptance Level

The third cluster, based on test attributes, shows little doubt in using QRIS in its payment system. The output from this test shows that this cluster has a slightly negative opinion in all test attributes such as PI, EE, SI, FC, PT and AT. To a certain extent, they showed their willingness to continue using QRIS even though there were doubts about its use. From Table 5, the demographic results show that most of this cluster only uses QRIS once a week (58%) and has an age range of 20-29 years (32%). The group in this cluster is dominated by private employees (48%) with an education level equivalent to a diploma/bachelor's degree as much as 64%, but the majority of respondents have an income in the range of 5-10 million (32%).

4. Cluster 2: Users with the Lowest Acceptance Rate

The results of the research, as shown in Table 3, show that this cluster has a negative perception of using QRIS in its payment system. It was found that all research attributes in this cluster such as PI, EE, SI, FC, PT, and AT had negative values. Referring to the demographic results in Table 5, most of this cluster only uses QRIS as a payment system only once a week. This group is dominated by young adults aged 20-29 years (44.4%) who work as entrepreneurs (33.3%) who earn under 3 million (66.7%).

6. Conclusion

This section summarizes research findings regarding market segmentation of QRIS users in Jabodetabek, Indonesia and tries to outline the basis and characteristics of each cluster. This research shows that a perspective regarding QRIS user segmentation and adoption behavior as well as demographics play an important role in classifying and creating profiles to meet segmentation goals and managerial decisions in society, a market environment that is continuously evolving. This study uses a UTAUT-based model with a mix of multivariate techniques to identify distinct sets of clusters and their validation, followed by a bivariate approach (Chi-square test) to profile segment results. In line with this, this research combines six test variables related to adoption behavior as well as demographic variables.

Thus, this segmentation work explores performance expectancy, effort expectancy, facilitating conditions, social influence, perceived trust, and attitude act as control variables, and affected by demographic characteristics' (gender, age, occupation, education, frequency of QRIS use, and geographic region) in the current segmentation framework. Based on existing test measures and socio-demographic characteristics using analytical grouping procedures, four clusters were obtained.

The fourth cluster is the largest group that has a positive interest in QRIS as a payment system in terms of user trust and behavior. The demographic characteristics explain that this cluster is dominated by young adults (42%) with an educational profile equivalent to a diploma/bachelor's degree (63%). In addition, the highest users (34%) have a monthly income of 5-10 million and the frequency of using QRIS as payment more than 3 times a week is 44.8%.

The first cluster is the second largest group that is skeptical about the use of QRIS as a payment system. Even though opinions are slightly negative on several attributes such as Performance Expectations, Facilities and Trust, the frequency of using QRIS more than three times a week is the highest compared to the other three clusters (63.6%). The demographic characteristics of this character are dominated by young adults aged 20-29 years (47.7%). Most jobs in this cluster are private employees (56.3%) with a monthly income range of 10-20 million per month (32.5%).

Therefore, these findings imply that although opinions regarding the use of QRIS are positive, the amount of monthly income also influences the frequency of use of QRIS as a payment system.

The third cluster is a group that has a negative perception in the behavior of adopting QRIS as a payment system. Apart from that, from the demographic characteristics, even though most of the group has a monthly income range of 5-10 million (32%) and has a diploma/graduate education (64%), the frequency of using QRIS is the lowest compared to the other 3 clusters. The majority of QRIS use frequency in this cluster is once a week (58%). It can be interpreted that negative perceptions can influence people in using technology.

Meanwhile, the second segment is the smallest cluster whose observations and perceptions are poor in all attributes such as performance expectations, facilitating conditions, perceived effort, social influence, and perceived trust. This cluster has the demographic characteristics of working as entrepreneurs (33%) who earn less than 3 million (66.7%). This group only uses the QRIS payment system once a week (55%). In this cluster, it can be interpreted that the perception of the use of certain technology can be influenced by the level of monthly income of everyone.

7. Limitations and future study

However, few inherent limitations exist in this paper, which may be considered in the future direction of upcoming research. First, this study adopts an online survey restricted to Jakarta and surrounding areas, and which majorly educated class. This may restrict the generalizability of the current research outcome. Potential studies may approach the rural area survey method which may endow an extensive validation. Next, future research may include other inducing adoption behavior variables, which may strengthen the current segmentation model.

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