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Forming peer groups for banks in Indonesia: a cluster analysis using financial statements in 2011 and 2019

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Abstract - **This study examines the forming of bank peer groups based on their business activities or strategies as reflected in the financial statements and compares the bank peer groups resulting from the study with the current bank peer groups (BUKU). Using the latest Audited Financial Statements and Quarter 4 Publication Financial Report of all commercial banks in Indonesia, this research provides an overview. This study uses K-means clustering using K-Means analysis to identify peer groups for banks using some different indicators from financial statements. Based on the clustering analysis, we discovered that grouping banks based on core capital is insufficient to adequately explain the bank business activity variation. The result of this study shows that attempts to group the bank's business model should use other indicators, apart from the bank's core capital. Finally, this study provides a recommendation for regulators and the banking industry to set a more proper basis for grouping banks in Indonesia to support the growth and development of the banking industry in Indonesia.**

Keywords - **Bank peer group, bank business activity, bank business model, cluster analysis, financial statements, regulators**

I. INTRODUCTION

The use of appropriate bank peer groups provides more adequate risk and performance analysis. For banks' board members, peer groups are usually used for a comparison in determining compensation plan, incentive plan, and also evaluate stock performance [1]. On the other hand, for the regulators, determining peer groups will help them to monitor and control players in the banking industry, more effectively and efficiently, as what is implemented in Indonesia. The bank peer groups has been sorted by varies classification schemes on previous researches.

In Indonesia, bank peer group regulation was first regulated by Bank Indonesia in Bank Indonesia Regulation No.14/26/PBI/2012, "Business Activities and Office Networks Based on Bank Core Capital" (*Kegiatan Usaha dan Jaringan Kantor Berdasarkan Modal Inti Bank*), effective from 2012 [2]. According to this regulation, Banks in Indonesia are grouped into 4 groups, namely BUKU 1, BUKU 2, BUKU 3, and BUKU 4, based on their core capital. Furthermore, based on this grouping system, each group had different scope or limitation on allowed business activities. However, since 31 December 2013, all financial services sector in Indonesia, including banks, were regulated and supervised by OJK. The latest amendment of the regulation was OJK Regulation No.6/POJK.03/2016, which more specific on regulate the grouping system of Syariah Banking [3].

Reference [4] informed that the asset growth of banks in BUKU 1 and BUKU 2 group is relatively lower and slower compare to banks in BUKU 3 and BUKU 4 group (refer to Table 1). In total, growth of bank size was relatively stable, as seen in 2015 to 2017, the gap of growth was between 10bps to 20bps, while the 2018 was negative due to the financial crisis in Indonesia. Based on this data, it can be concluded that the BUKU grouping might not effective enough in supporting the development of the Indonesian banking industry which directly affecting the development of the national economy. Banking industry has significant role in the development of any country's economy, it acts as a bridge between people with money and who need it [5]. In 1911, Schumpeter argued that economic growth theory believes that financial institutions can help improve the productive capacity of the economy, and can be a source of funding for the country, especially during the growth stage of the economy [6]. The current regulation, which grouping bank based on their core capital might limit the space of growth of banking industry in Indonesia, as the results of regulating bank's scope of business activity based on its amount of core capital. This might result a counterproductive performance and eventually confine the expansion and growth of banking industry, which actually the most significant industry that affect a country economic growth. On the other hand, the minimal core capital restrictions are beneficiary to ensure the stability of banking industry.

The current BUKU grouping is relatively burdensome for smaller banks in BUKU 1 and BUKU 2 groups. As stated in OJK Regulation No.6/POJK.03/2016, banks with larger capital have privilege to do more variative business activities in regarding products, networking (branch and payment station), and also scope of international market [3]. This regulation implies banks with higher capital (BUKU 3 and BUKU 4) are having higher opportunities to grow, meanwhile the smaller banks are having difficulties in expanding and strengthening their position if there are no capital injections. In order to ensure the resilience of banking industry in Indonesia, each bank has to perform well, grow steadily, and also elevate its capability to expand and compete internationally. While the current condition

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shows that the negative growth on BUKU 1 and BUKU 2 banks are dragging down the banking industry as a whole. This situation will continue or even accelerate the consolidation trend. Moreover, in this digital transformation era, this BUKU grouping may prohibit some middle tier new comers to enhance fintech solutions in Indonesia.

TABLE I
GROWTH OF COMMERCIAL BANKS ASSETS BASED ON GROUP OF BUSINESS ACTIVITIES

Group of Bank	2015	2016	2017	2018	2019	2020
BUKU 1	-21.20%	-23.60%	-35.20%	9.80%	-13.30%	-69.20%
BUKU 2	-19.20%	4.20%	-0.40%	-2.10%	9.90%	-0.90%
BUKU 3	27.40%	7.40%	2.20%	11.30%	-4.60%	2.60%
BUKU 4	10.10%	14.40%	19.50%	-16.50%	48.60%	11.90%
Total	**9.30%**	**9.50%**	**9.60%**	**-4.90%**	**21.60%**	**6.90%**

Source: [4]

The large gap of capital range of banks in BUKU 1 (less than IDR 1,000,000,000,000) and BUKU 4 (at least IDR 30,000,000,000,000) makes size of banks in Indonesia are really diverse, but not with bank products. Bank size really matters, on the other hand this does not rule out that relatively smaller banks have more less productivity or less performance compared with bigger banks. Furthermore, there were rapid changing of scope of business activity on each group of BUKU grouping with the continuous amendment of the regulation, this situation has forced the smaller banks to do merge with larger banks or acquired by larger banks.

This research aims to form bank peer groups based on their business activities and strategies as reflected in the financial statements using cluster analysis approach and compare the bank peer groups resulting from the study with the current bank peer groups (BUKU). This research will provide pictures of how the grouping of banks in Indonesia by using cluster analysis, with different variable that describe bank's business activities or strategies as reflected in the financial reports, other than Capital. Furthermore, this research also provides a better view on how the current regulation affect the business activity on each bank group in Indonesia. The unique managerial choices of a bank, regardless of the explanation for these choices, are critical for properly categorizing banks. This study analyzes two specific periods, which are the period before the peer group was being implemented in Indonesia, the latest period after the peer group is implemented in Indonesia. As the result, this study is expected to provide a view on how the peer group should be formed in Indonesia.

II. LITERATURE REVIEW

A. Bank Business Activities

Bank is an institution that accepts demand deposits, deposits, and pays for documents that are attracted to a certain person or institution, discounted securities, provided loans and invested in securities [7]. Commercial bank activities cover the following activities: Raising Funds (Funding), Channeling Funds (Lending), and Providing Other Bank Services (Services). The more varied the bank services a bank can provide, the better. This accuracy is determined by the bank's capital and the ability to provide reliable and qualified human resources. As well, the product should also be technologically sophisticated.

B. Bank in Indonesia

According to Act of The Republic Indonesia number 10 of 1998 concerning Amendments to Act number 7 of 1992 concerning Banking, banking is everything related to banks, including institutions, business activities, as well as ways and processes in carrying out their business activities. Bank are business institution that collect funds from the public in the form of deposits and distribute the funds to the public in the form of credits and/ or other ways for in order to improve the community's quality of life [8]. Reference [8] stated that there are six type of bank in Indonesia: Conventional Banks, Conventional Commercial Banks, Rural Banks, and Islamic Bank. In this research, we used all conventional banks in Indonesia for clustering the banks.

C. Bank Peer Group

A bank peer group is a grouping of commercial banks based on similarity on their amount of assets or other criteria. In each group, banks are having uniform reporting systems and the exact scope of allowed business activities. A bank is usually compared to another bank with a similar condition based on their ability to earn profits which can be seen through their assets, liabilities, and capital. Peer group analysis can provide the financial condition of banking industry competition in the market and give government insight into regulation effectiveness. In Indonesia, the bank peer group was based on OJK Regulation No.6/POJK.03/2016. It regulates Banks can only conduct business activities and have office networks following their Core Capital. Based on their core capital, Banks are grouped into 4 (four) BUKUs.

BUKU 1 banks can only conduct business activities in Rupiah: basic products of fund accumulation, basic products of fund channeling activities, basic products of trade finance activities, limited scope for agency and cooperation, limited scope for payment system and electronic banking, activities of temporary capital participations for the purpose of rescuing credits, activities as foreign currency trader, and other activities categorized as basic products or services in Rupiah that are commonly conducted by Banks and are not in violation with the provisions of legislations [9]. Meanwhile BUKU 2 banks can conduct business activities as may be conducted by BUKU 1 banks

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however they are allow to conduct business activities also in foreign currency transactions. Moreover, BUKU 2 banks allow to conduct wider scope on fund channeling activities, limited treasury activities, wider scope on agency and cooperation, wider scope on payment system and electronic banking, capital participation activities in financial institutions in Indonesia [9]. For BUKU 3 banks, they can conduct business activities as may be conducted by BUKU 1 and BUKU 2 banks [9]. On the other hand they are allowed to conduct capital participations in financial institutions in Indonesia and/or overseas, but limited to the Asian region [9]. Finally, BUKU 4 banks can conduct business activities as may be conducted by BUKU 1, BUKU 2, and BUKU 3 banks. There is an exception for BUKU 4, they are allowed to conduct capital participations in financial institutions in Indonesia and/or all areas overseas in amounts larger than those allowed for BUKU 3 [9].

D. Common Size Financial Statement Variables Analysis

Analysis is a decomposition of a subject on its various parts and study of the parts themselves, as well as the relationships between the parts to obtain a proper understanding and understanding of the overall meaning meaning [10] . The analysis is the activity of thinking to describe a subject into the smallest parts or components so that the characteristics or signs of each part can be identified, then the relationship to each other and the function of each part of the whole.

A financial statement is the final result of a process of recording financial transaction activities in a company that describes the company’s financial condition in one accounting period and is a general description of a company’s performance. The basic financial statements of banks consist of Statement of Financial Position, Statement of Profit or Loss and Other Comprehensive Income, Cash Flow Statement, and Statement of Changes in Stakeholders’ Equity.

Common size financials are useful when analyzing trends in a company or when comparing several companies. Common size statements display all line items as percentages of a common baseline item figure. Common size analysis is sometimes referred to as structural analysis because it examines financial statements’ internal structure. The common-size analysis analyzes financial statements by comparing items in the financial statements as a percentage of key items such as assets and income. In the income statement, the accounts are divided by income, while on the balance sheet, each account is compared to total assets.

D.1 Common Size Financial Statement Variables Analysis - Asset

The first step is to assign value of 100 to total assets. Second step is to find out the percentage of different items of assets on the basis of the total value of assets, respectively. In this study, we used all assets variables in the Statement of Financial Position. Moreover, we also perform detail analysis by grouping the assets into 2 groups: earning and non-earning assets. The earning assets are all assets that contributes in generating revenue for the company, in the form of interest or others. Meanwhile, the non-earning assets are all assets that not earning revenues. According to 14/22/PBI/2012, concerning Credit Provision or Financing by Commercial Banks and Technical Assistance in the Context of the Development of Micro, Small and Medium Enterprises, it regulates the obligation of commercial banks to channel their funds in the form of credit/financing to MSMEs with a minimum share of 20% in stages, followed by the application of incentives/disincentives [11]. Therefore, we also perform a cluster analysis based on size of customers, Small Medium Enterprises (SME) and Non-Small Medium Enterprises (Non-SME).

D.2 Common Size Financial Statement Variables Analysis - Liabilities

The first step is to assign value of 100 to total liabilities. Second step is to find out the percentage of different items of liabilities on the basis of the total value liabilities, respectively. In this study we used all liabilities variables in the Statement of Financial Position. By doing cluster analysis based on common size financial statement liabilities, we hope that we will be able to reviewing the focus of each banks whether in *Dana Murah*, known as Current Account and Saving Account which have lower interest rate, or accounts with higher rate (Time Deposit).

E. Profitability Ratios

Profitability ratios reveal a company's ability to generate a reasonable profit and return on investment. The ratios are a reliable indicator of a company's financial health and how well it manages its assets [12]. Profitability cannot be underestimated because it serves as an indicator of a business's success and ensures its survival and growth; it also serves as a valuable indicator that may assist users in making decisions and performing managerial tasks [13]. In this study, we use Net Interest Margin Ratio (NIM), Return on Assets Ratio (ROA), and (Charge-offs)/Loans.

F. Risk Ratios

In most industries, the common risk management ideology is to reduce the potential for risks and reduce the impact of potential losses [14]. Risk management, in this view, can have an effect on a company's competitiveness. Risk typically manifests itself in an unstable environment and unpredictable circumstances, for example, credit risk, interest rate risk, liquidity risk, market risk, and currency risk [15]. Intense competition is a key determinant of risk management practice implementation, and inadequate risk

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management practices can indicate a lack of control mechanisms [16]. In the financial sector, risk is related with the unpredictability of earning and losing money, making it a critical component of investment [17]. This study uses credit risk ratios (Non-Performing Loan Ratios), proportion of Cash and Marketable Securities to Total Assets, and ratios of Changes in Assets to Total Assets which represent risk management in bank.

G. Previous Study

Cluster analysis has been utilized infrequently in previous bank studies. Studies by [18] and [19] grouped banks based on their stock returns, while [20], [21], and [22] were using selected balance sheet in regards of bank activities. There were also studies using bank-specific financial ratios or risk measures performed by [23], [24], [25], [26], and [27]. There was also a study which aims to find relationships between the investing, lending, and financing decisions of banks by using canonical correlation analysis [29]. Reference [30] studied bank loan growth in relation to bank capital and discovered that loan type matching produces unequal effects. Meanwhile, [31] used all balance sheet variables to measure the risk and profitability of banks.

Neither study examines other possible matched groups using the characteristics of banks as a whole. Therefore, one of our contributions to the literature is the development of grouping banks based on their business activities as reflected in financial statements and also segment bank risk and return characteristics.

III. METHODOLOGY

This research uses K-means clustering using K-Means analysis. K-Means clustering is a method with the initial stage of determining one or more cluster centers and then grouping all objects with a threshold value determined from the center (centroid). Based on Euclidean distances, this hierarchical clustering algorithm assigns each bank to a single cluster, the closest centroid cluster. This method is being used as this research wants to group banks based on the characteristic similarity. Data uses in this research is obtained from secondary data, which are Published Annual Report and Audited Financial Report for the year ended 2011 and 2019.

The results of the clustering are then being used to identify the peer groups based on the economic activity. By identifying the data in 2 periods, which are before the regulations of existing peer group implemented (2011) and the latest year end (2019), this will provide an overview of developments and relevance of existing regulations.

In this study, cluster analyses are being performed using several approaches with different variables. Cluster analyses perform are using all variables used in this research, common size financial statements (asset and liabilities), equity ratios, profitability ratios, and risk ratios. Moreover, to provide a detail analysis on cluster analysis based on assets, this study also performs cluster analysis for the detailed earning assets, non-earning assets, and loans for SME or Non-SME customers.

IV. RESULTS

A. Descriptive Statistics

In 2019, total conventional banks in Indonesia were 96 banks. However, after we performed descriptive statistics analysis and data cleansing, the total final sample used in this research is 84 banks. The descriptive statistics analysis results for each variable with 84 samples used showed the gap of mean and standard deviation are relatively small while some variables' gap is still large which was due to the nature of the variables.

Using the same sample as 2019, total conventional banks in Indonesia used for 2011 data analysis is 84 banks. The descriptive statistics analysis results for each variable with 84 samples used showed the gap of mean and standard deviation are relatively small while some variables' gap is still large which was due to the nature of the variables.

B. All Variable

Comparing data 2019 and 2011, it was shown that there were two clusters that relatively not evenly distributed compared to other clusters. It can be concluded that the main clusters were only two on each period, Cluster 1 and 2 in 2019 and Cluster 1 and 4 in 2011.

Cluster	BUKU Grouping	2019	2011
Cluster 1	BUKU 1	4	3
	BUKU 2	22	17
	BUKU 3	12	7
	BUKU 4	0	5
Cluster 2	BUKU 1	3	1
	BUKU 2	16	7
	BUKU 3	9	2
	BUKU 4	7	0
Cluster 3	BUKU 1	1	1
	BUKU 2	8	1
	BUKU 3	0	0
	BUKU 4	0	0
Cluster 4	BUKU 1	2	5
	BUKU 2	0	21
	BUKU 3	0	12
	BUKU 4	0	2

Fig. 1. K-means Cluster Analysis Result by All Variable (left data 2019, right data 2011)

C. Common Size Financial Statements – Asset

The results showed that banks with the relatively same size, which grouped into the same BUKU grouping, were not always have the same asset composition. In the

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Figure 4.2, it was shown BUKU 3 and BUKU 4 banks were spreading into all clusters, except for BUKU 4 banks in 2011. It can be concluded that bank size cannot really describes each bank's strategy. Comparing the 2019 result with 2011 result, there were shifting of some BUKU 2 banks' asset composition as shown in Figure 4.2. In 2011, BUKU 2 banks were more concentrated in Cluster 1, however in 2019, some of them were shifted to Cluster 2, 3, and 4. Number of members in Cluster 1, 2, 3, and 4 in 2019 were more relatively more evenly distributed, compared to 2011.

Cluster	BUKU Grouping	2019	2011
Cluster 1	BUKU 1	6	4
	BUKU 2	9	29
	BUKU 3	1	12
	BUKU 4	1	7
Cluster 2	BUKU 1	0	5
	BUKU 2	9	11
	BUKU 3	12	1
	BUKU 4	3	0
Cluster 3	BUKU 1	0	1
	BUKU 2	14	0
	BUKU 3	5	0
	BUKU 4	3	0
Cluster 4	BUKU 1	4	0
	BUKU 2	14	6
	BUKU 3	3	8
	BUKU 4	0	0

Fig. 2. K-means Cluster Analysis Result by Common Size Financial Statements – Asset
(left data 2019, right data 2011)

D. Common Size Financial Statements – Non-Earning Asset

As shown in Fig.3, the non-earning assets composition on each bank were relatively similar which represented by concentrated cluster, Cluster 1 in 2019 and Cluster 3 in 2011. It was also shown that the composition of non-earning assets on each bank became more similar in 2019, as the number of members in Cluster 1 was higher than number of Cluster 3 in 2019.

Cluster	BUKU Grouping	2019	2011
Cluster 1	BUKU 1	8	3
	BUKU 2	39	20
	BUKU 3	17	3
	BUKU 4	4	1
Cluster 2	BUKU 1	2	1
	BUKU 2	6	0
	BUKU 3	1	1
	BUKU 4	1	0
Cluster 3	BUKU 1	0	6
	BUKU 2	0	26
	BUKU 3	0	16
	BUKU 4	1	5
Cluster 4	BUKU 1	0	0
	BUKU 2	1	0
	BUKU 3	3	1
	BUKU 4	1	1

Fig. 3. K-means Cluster Analysis Result by Common Size Financial Statements – Non-Earning Asset
(left data 2019, right data 2011)

E. Common Size Financial Statements – Earning Asset

Comparing the results of 2019 and 2011, it was shown that in 2019 the strategy of each banks on generating revenue were becoming more differentiated, which represented by more evenly distributed member on each cluster. In general, Cluster 1 represented group of banks with focus on SME customers, Cluster 2 represented group of banks with focus on commercial banking, Cluster 3 represented group of banks with focus on foreign currency transactions, and Cluster 4 represented group of regional banks. On Figure 4.4, each cluster in 2019 had a mix between BUKU 1, BUKU 2, BUKU 3, and BUKU 4 banks which showed that each bank had already their business focus without influence of its capital amount. It can be concluded that the BUKU grouping was no longer relevant in terms of strategy determination on each bank.

Cluster	BUKU Grouping	2019	2011
Cluster 1	BUKU 1	3	4
	BUKU 2	8	28
	BUKU 3	1	13
	BUKU 4	1	6
Cluster 2	BUKU 1	2	5
	BUKU 2	20	11
	BUKU 3	11	1
	BUKU 4	5	0
Cluster 3	BUKU 1	0	1
	BUKU 2	4	0
	BUKU 3	6	0
	BUKU 4	1	1
Cluster 4	BUKU 1	5	0
	BUKU 2	14	7
	BUKU 3	3	7
	BUKU 4	0	0

Fig. 4. K-means Cluster Analysis Result by Common Size Financial Statements – Earning Asset
(left data 2019, right data 2011)

F. Common Size Financial Statements – Loans for SME or Non-SME Customers

Fig.5 showed that the results for 2019 data and 2011 data was relatively similar. This result may be concluded that the government efforts in order to encourage lending to SMEs had been less effective. There was also a shifting member of BUKU 4 banks, such as PT Pan Indonesia Bank and PT Bank Danamon Indonesia which were in the same group with PT Bank Rakyat Indonesia, PT Bank Negara Indonesia in 2011, was shifting to the same cluster with PT Bank Central Asia in 2019.

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Cluster	BUKU Grouping	2019	2011
Cluster 1	BUKU 1	3	4
	BUKU 2	17	6
	BUKU 3	6	0
	BUKU 4	3	0
Cluster 2	BUKU 1	1	1
	BUKU 2	2	0
	BUKU 3	0	0
	BUKU 4	0	0
Cluster 3	BUKU 1	3	1
	BUKU 2	10	18
	BUKU 3	2	5
	BUKU 4	2	4
Cluster 4	BUKU 1	3	4
	BUKU 2	17	22
	BUKU 3	13	16
	BUKU 4	2	3

Fig. 5. K-means Cluster Analysis Result by Common Size Financial Statements – Loans for SME or Non-SME Customers
(left data 2019, right data 2011)

G. Common Size Financial Statements – Liabilities

In Fig. 6, it was shown that the 2019 and 2011 results were relatively similar. There were two main clusters, Cluster 2 and 3 in 2019 and Cluster 1 and 3 in 2011, that filled with more clusters than the other two clusters. However, in 2019, the liabilities composition of each banks became more concentrated, which represented by the number of members in Cluster 1 and 4 were less than Cluster 2 and 4 in 2011. Compared with the result of cluster analysis based on assets, the result was contradictory, while the cluster analysis based on assets in 2019 was suggesting there were more evenly distributed to each cluster.

Cluster	BUKU Grouping	2019	2011
Cluster 1	BUKU 1	3	0
	BUKU 2	6	10
	BUKU 3	0	8
	BUKU 4	2	7
Cluster 2	BUKU 1	6	3
	BUKU 2	24	11
	BUKU 3	4	2
	BUKU 4	0	0
Cluster 3	BUKU 1	4	7
	BUKU 2	19	23
	BUKU 3	9	8
	BUKU 4	5	0
Cluster 4	BUKU 1	0	0
	BUKU 2	0	10
	BUKU 3	2	8
	BUKU 4	0	7

Fig. 6. K-means Cluster Analysis Result by Common Size Financial Statements – Liabilities
(left data 2019, right data 2011)

H. Equity Ratios

As shown in Fig.7, the cluster analysis results before BUKU grouping (2011) and after BUKU grouping (2019) were relatively similar.

Cluster	BUKU Grouping	2019	2011
Cluster 1	BUKU 1	5	2
	BUKU 2	10	10
	BUKU 3	9	0
	BUKU 4	0	0
Cluster 2	BUKU 1	0	0
	BUKU 2	8	2
	BUKU 3	0	0
	BUKU 4	0	0
Cluster 3	BUKU 1	4	1
	BUKU 2	27	4
	BUKU 3	12	2
	BUKU 4	7	0
Cluster 4	BUKU 1	1	7
	BUKU 2	1	30
	BUKU 3	0	9
	BUKU 4	0	7

Fig. 7. K-means Cluster Analysis Result by Equity Ratios
(left data 2019, right data 2011)

I. Profitability Ratios

The cluster analysis result in both period that the cluster with higher average of total assets had the higher profitability ratio, it showed that there is economic of scale in banking industry. Comparing with the cluster analysis result based on Assets (size), there was similarity in the results, banks in 2019 were more concentrated into two main clusters.

Cluster	BUKU Grouping	2019	2011
Cluster 1	BUKU 1	3	2
	BUKU 2	15	10
	BUKU 3	8	4
	BUKU 4	6	3
Cluster 2	BUKU 1	1	3
	BUKU 2	1	15
	BUKU 3	0	7
	BUKU 4	0	4
Cluster 3	BUKU 1	2	1
	BUKU 2	0	0
	BUKU 3	0	0
	BUKU 4	0	0
Cluster 4	BUKU 1	4	4
	BUKU 2	30	21
	BUKU 3	13	10
	BUKU 4	1	0

Fig. 8. K-means Cluster Analysis Result by Profitability Ratios
(left data 2019, right data 2011)

J. Risk Ratios

The results from both periods showed that the cluster with higher average of total assets was having lower risk. In 2011, the cluster analysis result showed that banks concentrated in one cluster, Cluster 2. Meanwhile, the clusters in 2019 were more evenly distributed. This indicated that the banks in Cluster 2 were shifting to other clusters, specifically BUKU 2 and BUKU 3 banks. Compared with the result of cluster analysis based on assets, this can be concluded that there were banks with high profitability that had low risk.

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Cluster	BUKU Grouping	2019	2011
Cluster 1	BUKU 1	4	1
	BUKU 2	23	4
	BUKU 3	16	0
	BUKU 4	7	0
Cluster 2	BUKU 1	2	7
	BUKU 2	5	40
	BUKU 3	2	21
	BUKU 4	0	7
Cluster 3	BUKU 1	1	0
	BUKU 2	1	1
	BUKU 3	0	0
	BUKU 4	0	0
Cluster 4	BUKU 1	3	2
	BUKU 2	17	1
	BUKU 3	3	0
	BUKU 4	0	0

Fig. 9. K-means Cluster Analysis Result by Risk Ratios (left data 2019, right data 2011)

K. Discussion

A study done by [31] which performed cluster analysis in United States banks, it found that the clustering banks in United States was mainly determined by lenders. Meanwhile, [20] who studied European banks for period 1993-1999 by using selected balance sheet and income statement variables found that the first group was specialized in the traditional banking activity (loans and deposits), while group two included more diversified banks and with a high importance of the inter-bank activities.

This result is in alignment with previous studies mentioned above that claimed the clustering was mainly determined by loans. In this part, this study also found that the cluster analysis was mainly influenced by the banks size. However, this study has found additional result which also contributing the results of cluster analysis other than size, which was the composition of each assets variable that represented each bank's strategy in terms of their focus of revenue generator. This study found that grouping banks by using size as the sole determinant, were not fully describing each bank's characteristic. This was supported by cluster analysis result that showed there were always a mixing of BUKU 1, BUKU 2, BUKU 3, and BUKU 4 banks in each cluster. Furthermore, this results also suggested that as the larger banks are spreading into all clusters, the growth of each clusters relatively more even, except for cluster with no BUKU 3 or BUKU 4 on it.

Clustering with different determinant always showed cluster with high average of total assets have better performance compared to other 3 clusters. It was also shown that there were always only two main clusters, except for cluster analysis using all assets variables, size of customers (Loan for SME and non-SME), and earning assets. There were also come consistency in terms of members on each cluster formed. First, almost all regional banks (*Bank Pembangunan Daerah*) were always grouped into the same cluster no matter what the determinant is. Second, PT Bank Mandiri Tbk., PT Bank Central Asia Tbk., and PT Bank CIMB Niaga Tbk., which are BUKU 4 banks were almost always in the same cluster, except for cluster analysis based on all asset and customer size. Third, PT Maybank Indonesia Tbk. and PT OCBC NISP Tbk., which are BUKU 3 banks, were always in the same cluster except for cluster analysis using equity ratios.

Comparing the results of cluster analyses in 2011 (before BUKU grouping being implemented) and 2019, it was shown that the clusters formed are relatively similar in terms of number of members. The significant differences were in the member of each cluster that being more evenly distributed or even more concentrated in certain cluster. If the cluster analysis of 2011 data resulted there were only 2 or 3 main clusters, usually in 2019 the results were in similar proportion. However, there was an exceptional for cluster analysis based on assets. Referring to Fig. 2, it was shown that in 2011, the clusters formed were more concentrated in 3 clusters, yet the number of members were significantly high in one cluster only. On the other hand, in 2019, the clusters formed were more evenly distributed into 4 groups. This results actually suggested that there may be a partial success of BUKU grouping, any how it also showed that there was a mixing of BUKU 1, BUKU 2, BUKU 3, and BUKU 4 banks in each cluster. The results of cluster analyses also showed that the groups formed were relatively difference with different determinants.

V. CONCLUSION

Using the 2019 data, the cluster analysis results 4 clusters. There are 38 banks in Cluster 1 and 35 banks in Cluster 2, however Cluster 3 and 4 have fewer banks, only 9 and 2 banks, respectively. Banks in Cluster 3 and 4 relatively have low performance based on their profitability ratios and worse risk management based on their risk ratios. Meanwhile, using the 2011 data, the cluster analysis results 4 clusters. There are 32 banks in Cluster 1 and 40 banks in Cluster 4, however Cluster 2 and 3 have fewer banks, only 10 and 2 banks, respectively. Banks in Cluster 2 and 3 relatively have low performance based on their profitability ratios and worse risk management based on their risk ratios. These results can be concluded as there are only two main clusters on each clustering analysis performed in each period. Furthermore, performing cluster analysis using proportion of earning assets variables has found that banks with similar characteristics fall into the same group. This can be concluded bank in Indonesia can be grouped by its revenue generators.

In Cluster 1 and 4 for 2019 data and Cluster 1 and 4 for 2011 data, all BUKU 4 banks are centralized in these clusters. However, there are also BUKU 1, BUKU 2, and BUKU 3 banks in these clusters. This implies that the current BUKU grouping are not being able to fully described the characteristics of each bank. Using the 2019 and 2011 data, the cluster analysis on each different group of variables shows that size quite matters in banks

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performance by profitability ratios and also risk management by risk ratios. It is found that cluster with highest amount of average of total assets has the highest proportion of profitability ratios and lowest proportion of risk ratios. It also shows that most of the BUKU 4 banks have more focus on CASA. Meanwhile, clusters with smaller banks shows higher CAR and proportion of Equity to Total Assets.

Future research can be done by using other cluster analysis tools, using data from longer period and varies economic situation (such as crisis, governmental changing, etc.), and also including all banks in Indonesia, including non-conventional banks.

VI. IMPLICATION

A. Regulator

This study enriches the literature for bank industry, specifically for bank peering. This research found the current BUKU grouping is not effective and efficient enough to group banks in Indonesia, while also limiting their scope of business activity based on it. Result shows that with varies variable used in this research to perform cluster analysis, the BUKU grouping is not exactly able to group banks in Indonesia into the appropriate group. According to the results, each cluster formed in this research was not reflecting precisely the BUKU grouping. Furthermore, based on the cluster analyses with different determinants, it was shown that the cluster formed were relatively different, it can be suggested that banks cannot be grouped by using one or several characteristics only. This might suggest that different grouping can be effectively used for different needs. In regards with the cluster analyses resulting from this study, there are some grouping formed: size-based group, strategy-based group, profitability-based group, and risk-based group.

This finding may raise awareness of regulators whether the current grouping is effective and relevant to the banking industry in Indonesia. Whether the scope of business activity should be limited by capital basis only or there should be another addition of basis to group the banks. The regulator may need to revisit and reconsider to establish a more integrated and relevant grouping for banks in Indonesia.

B. Management

Based on the results and analysis above, our research would provide implications for managerial levels in banking industry in Indonesia. In banking industry, the competitive is pretty tough as all banks are trying to compete in order to grab the same market. Furthermore, we also can see that there are many new comers who try to enter the industry. We can also see the trend on the banking industry is more on the following the big banks moves', such as example PT Bank Central Asia. For example, nowadays the bigger banks are trying to digitalized their banks, or even form a digital basis bank, and we can see that other banks are starting to follow this trend. This condition leads that banks in Indonesia have less varied products. In this kind of situation, banks are really sensitive to each other. Therefore, knowing their true position in industry will benefit the banks. Banks with more knowledge of their peers, as well as their competitors, have more advantage in the industry. Managers should be able to use this information to make financial and strategic decisions. By doing so, it can eventually increase their performance in future periods, as well. It is also importance for top level management to have wide networking and high social experiences to be able to make meaningful decisions.

Furthermore, referring to Fig. 4, regardless of the size, banks have already specific focus on their business strategy on how they generate revenue. This may imply that banks should be more innovative in a way not only following market leader. This way will result more varies banking products and also increase market interest on each bank. Customers will be evenly distributed based on their needs and segments.

Indonesia is one of emerging countries which are predicted to have bright economic development, it is predicted that Indonesian economic development will dominate the world economic development in 2025 [32]. It is also projected that Indonesia will be a great industrial country in 2045, as mentioned in a book called Megachange 50 published by The Economist; Indonesia will be a developed country with a total income of roughly US $ 24.000 in 2050 [32]. Currently, the government encourages to carry out movements to support the development of the golden generation who will take control of Indonesia in 2045. Banking industry can also take part in this movement, by offering varies type of product that can be sell to golden generation, which population is almost 50% of Indonesia's population according to [33], and also interact them to increase the early awareness on investment and savings.

Finally, when grouping banks using basis other than their size, risk on smaller banks, if they allow to perform same business activities with larger banks, might be concerning. As mentioned on the results and discussion above, it was shown that smaller banks have lower risk management compared to larger banks. Financial institutions, including banks, are really vulnerable to risk.

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