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Cluster analysis to determine business strategy for MSMEs in Yogyakarta

R S Nugraha^{1,2}, W S Jatiningrum^{1,3} and R D Astuti^{1,4}

¹Department of Industrial Engineering, Ringroad Selatan, Bantul, Special Region of Yogyakarta, Indonesia

E-mail: ²rangasatyanugraha@gmail.com, ³wandhansari.sekar@ie.uad.ac.id,

⁴reni_dwiasuti@ie.uad.ac.id

Abstract. Micro, Small, and Medium Enterprises (MSMEs) in Indonesia need to be encouraged to develop themselves. This is due to their contribution in the national economies. Yogyakarta, known as a creative city, has various kinds of micro enterprises, particularly food business. The appropriate strategies need to be applied to develop their business. Nevertheless, many food businesses in Yogyakarta city has different characteristics. The purpose of this study is to cluster food businesses as micro enterprises in Yogyakarta. K-means method is used to analyse 38 food businesses based on 13 variables related to characteristics of food businesses. 2 clusters obtained were named 'prepared to level up cluster' and 'developing cluster'. 'Prepared to level up cluster' was considered to be more potential than 'developing cluster'. SWOT analysis was then used to formulate the appropriate strategy for each cluster. By calculating total score of internal and external factor evaluation, obtained appropriate strategies for each cluster. Growth strategy through vertical integration was suitable for 'prepared to level up cluster'. Meanwhile, 'developing cluster' need to adopt growth strategy through horizontal integration to develop its business.

1. Introduction

Micro, Small, and Medium Enterprises (MSMEs) has an important role to contribute national economy improvements in Indonesia. This was marked by the success of MSMEs to survive in the period 1997-1998 national crisis. Positive growth of MSMEs in each year also show that MSMEs has contributed significantly [1]. The Ministry of Cooperatives and Small and Medium Enterprises (SMEs) for the Republic of Indonesia stated that total number of MSMEs in Indonesia reached 62.9 million. Therefore MSMEs able to absorb 120 million workers or 3 million more compared to 2016. However, MSMEs deal with several problems, such as limited capital, low quality of human resources, and lack of understanding and using for technology [2][3][4].

Yogyakarta, known as a creative city, also has a variety of MSMEs with positive growth in each year. According to interview with Cooperative, SMEs, Manpower and Transmigration Office of Yogyakarta city, as many as 23.604 MSMEs scattered in Yogyakarta city with various types of business sectors, namely food, handicraft, metal, and service businesses. The most developed is food business, with total 6.373 MSMEs. This is caused by Yogyakarta as a student and tourist destination from various regions [5] [6]. Therefore, various types of food are provided to accommodate various tastes [7] [8]. Cooperative, SMEs, Manpower and Transmigration Office of Yogyakarta city was asked to coordinate MSMEs to be fostered so that they could develop properly. This office appointed a Management and Business Consultant to assist MSMEs in Yogyakarta city. Coaching for MSMEs has been carried out for micro business that are known to be active. These micro businesses have also succeeded through curation process by Cooperative, SMEs, Manpower and Transmigration Office of Yogyakarta city. Coaching programmes conducted consist of training, assistance, consultation, monitoring, collaboration with business partners, and capital assistance.

Each of micro business has their own characteristic. Therefore, each of them needs different business strategy to be applied. The absence of clustering or grouping for micro businesses in Yogyakarta city,



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has made difficulties for related office to determine an appropriate strategy in each micro businesses, particularly in food businesses. Fathania [9] has conducted a cluster analysis for MSMEs in Pasuruan district using k-means. Similar method was also used by Setyaningsih [10] to conduct SMEs cluster analysis in Indonesia. Mustaniroh et. al. [11] was using AHP to determine strategic priorities for each cluster formed. Another method can be used to analyse business strategies is Strength Weakness Opportunity Threat (SWOT) analysis. This method is able to identify various factors systematically to formulate company's strategy [12].

According to Management and Business Consultants for MSMEs, clustering needs to be conducted to cluster micro businesses for food category. This must be carried to facilitate properly coaching process and to determine appropriate business strategies to MSMEs. Thus, food businesses that have similar characteristics will gather in same cluster. Cluster analysis needed to facilitate MSMEs for determining business strategy for each cluster of food business. Therefore, this study aimed to conduct cluster analysis for micro businesses in food category or called food business. Prior similar studies usually determine the business strategies directly for each cluster formed. In this study, business strategies were developed for each cluster using SWOT analysis.

2. Method

The object of this research was 61 food businesses in Yogyakarta city. These micro businesses have been curated by Cooperative, SMEs, Manpower and Transmigration Office of Yogyakarta city. Based on literature review and discussion with Management and Business Consultant for MSMEs in Yogyakarta city, 13 variables related to MSMEs were obtained. They were composed of capital (X1), average gross profit per month (X2), average net profit per month (X3), number of workers (X4), business life (X5), certificate and legality (X6), production capacity per month in Rupiah (X7), increasing for production capacity (X8), management and organization (X9), packaging (X10), branding (X11), modern market (X12), and financial inclusion and literacy (X13). Analysis were conducted through two stages, cluster analysis and SWOT analysis.

2.1. Cluster Analysis

K-means clustering was used to cluster food businesses in several cluster. Micro business with the same characteristics would be included in one cluster. K-means clustering is a non-hierarchical clustering method that needs to partition data into one or more clusters [13]. The initial stage from this method is choosing K (initial from centroid). Random point can be taken to determine the centroid. Each point around centroid will establish a grouping called cluster. Calculation of distance between data and centroid is conducted by the concept of Euclidean Distance. Questionnaires containing questions from 13 variables related to characteristics of MSMEs were arranged. Respondents were owners of food businesses in Yogyakarta city.

2.2. SWOT Analysis

The result of cluster analysis was a number of clusters that showed food businesses with similar characteristics. SWOT analysis was performed in each cluster to determine the appropriate strategy. SWOT analysis is conducted by considering company's internal factors, consist of strengths and weaknesses, and company's external factors, consist of opportunities and threats. Business strategies formulation were conducted by determining weight and ranking from expert.

3. Result and Discussion

According to data from related office, there was 61 food businesses have been curated. However, there were only 45 micro businesses were willing to become respondents. A total of 45 questionnaires were distributed to owner of food businesses in Yogyakarta city. Nevertheless, only 38 completed questionnaires were returned.

3.1. Cluster Analysis

Result of the questionnaires were processed by k-means method using SPSS 23.0. Standardization process was conducted first because the data used has different scale. This process was carried out by changing the original data into z-score data. According to Rosenthal [14], z-score is a raw score calculated by its distance from the mean. It was measured in standard deviation units. Cluster analysis was conducted after z-score was obtained. Based on discussion with consultant of business and management for MSMEs in Yogyakarta city, micro businesses will be divided into 2 clusters, namely prepared to level up and developing cluster. Cluster analysis was conducted by two steps of iteration, as shown in Table 1. According to the result, the minimum distance between cluster centres was 8.939.

Table 1. Iteration stage.

Iteration	Change in cluster centres	
	1	2
1	3.749	3.618
2	0.000	0.000

Table 2 displays final results of cluster centres. Positive z-score indicated data were above its total average, and vice versa. Cluster 1 was contained micro businesses whose characteristics had scores above the total average score of micro businesses studied, except for variable of business life. Micro businesses included cluster 2 have characteristics against with cluster 1. Scores for all variables in cluster were below the total average score of micro businesses studied, except for variable of business life. Therefore, it was concluded that cluster 1 was contained micro businesses who were prepared to level up and cluster 2 was contained developing micro business.

Table 2. Final result of cluster centres.

Variables	Cluster	
	1	2
Z score(X1_Capital)	0.46153	-0.06993
Z score(X2_Average_gross_profit_permonth)	2.31038	-0.35006
Z score(X3_Average_net_profit_permonth)	2.06170	-0.31238
Z score(X4_Number_of_workers)	1.26477	-0.19163
Z score(X5_Business_life)	-0.02548	0.00386
Z score(X6_Certification_and_legality)	0.32171	-0.04874
Z score(X7_Production_capacity_permonth_inrupiah)	0.87535	-0.13263
Z score(X8_Increasing_for_production_capacity)	0.11199	-0.01697
Z score(X9_Management_and_organization)	0.06358	-0.00963
Z score(X10_Packaging)	0.47811	-0.07244
Z score(X11_Branding)	0.01825	-0.00276
Z score(X12_Modern_market)	0.67182	-0.10179
Z score(X13_Financial_inclusion_and_literacy)	0.05271	-0.00799

ANOVA was used to test the effect of variables composed clusters [15]. Table 3 displays ANOVA results with significance level $\alpha = 0.05$. These results indicated that 4 variables have p value < 0.05. They

were X2, X3, X4, and X7. These four variables were proven to have significant differences between clusters. It could be concluded that there were four significant variables as cluster forming. The other variables X1, X5, X6, X8, X9, X10, X11, X12, and X13 were known to have $p \text{ value} > 0.05$. This showed that there was no significance difference between clusters based on these nine variables.

Table 3. ANOVA table.

Variables	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Zscore(X1_Capital)	1.226	1	0.994	36	1.234	0.274
Zscore(X2_Average_gross_profit_permonth)	30.733	1	0.174	36	176.547	0.000
Zscore(X3_Average_net_profit_permonth)	24.473	1	0.348	36	70.331	0.000
Zscore(X4_Number_of_workers)	9.210	1	0.772	36	11.931	0.001
Zscore(X5_Business_life)	0.004	1	1.028	36	0.004	0.952
Zscore(X6_Certification_and_legality)	0.596	1	1.011	36	0.589	0.448
Zscore(X7_Production_capacity_permonth_inrupiah)	4.412	1	0.905	36	4.873	0.034
Zscore(X8_Increasing_for_production_capacity)	0.072	1	1.026	36	0.070	0.792
Zscore(X9_Management_and_organization)	0.023	1	1.027	36	0.023	0.881
Zscore(X10_Packaging)	1.316	1	0.991	36	1.328	0.257
Zscore(X11_Branding)	0.002	1	1.028	36	0.002	0.966
Zscore(X12_Modern_market)	2.599	1	0.956	36	2.719	0.108
Zscore(X13_Financial_inclusion_and_literacy)	0.016	1	1.027	36	0.016	0.901

According to final result, it was found that cluster 1 consisted of five food businesses and cluster 2 consisted of 33 food businesses. There was only 13.16% of food businesses that could be prepared to level up judged by its characteristics. The remaining 86.84% are considered to be MSMEs in developing cluster. This proves that Cooperative, SMEs, Manpower and Transmigration Office of Yogyakarta city still has heavy duty to guide these food businesses in developing cluster to able to level up. Table 4 and Table 5 display list of food business members included in cluster 1 and 2.

Table 4. Members of cluster 1 'prepared to level up cluster'.

No	Food business	Distance
1	Soklat Es Coklat	3.749
2	Selera Roti dan Kue	2.937
3	Premio Jogja Berdikari	2.604
4	Warung Pecel Ndeso	3.237
5	Melinda Brownies Kukus	4.452

Table 6 displays summary of characteristics for each cluster based on significant variables composing clusters, namely average gross profit per month, average net profit per month, number of workers, and production capacity per month in rupiah.

Table 5. Members of cluster 2 ‘developing cluster’.

No	Food business	Distance	No	Food business	Distance
1	Saung Pepes	2.462	18	Juice Nyess	2.403
2	Dapur Azza	2.083	19	Telur Asin Mentes	3.056
3	Ji-Pong	3.565	20	Blessing Snack	3.17
4	Pawon Sentono	5.043	21	Chie Cik Snack	2.885
5	Maxichic	1.68	22	Andien Food	2.351
6	Sumringah	1.981	23	DK Wingko	3.059
7	Rosemary Herbs	2.515	24	Bakpia Disty	2.914
8	Jahe Joss	3.087	25	Irin Catering	3.871
9	Berkah Sabar Sejahtera	3.79	26	Amiratih	3.385
10	Srikandi	2.963	27	Kedai Jiro	3.018
11	Siomay dan Batagor Tugu	3.708	28	Wedang Rejdo	3.474
12	Java Rainbow	3.618	29	Mie Ayam Bakso	3.887
13	Dya Snack & Catering	4.197	30	Glak Gluk Thai Tea	2.941
14	Hanabi Snack	2.242	31	Shinta Pakualaman The Modern Kluwo	2.595
15	Surya Mandiri	4.19	32	Telo Keju Mas Tejo	2.737
16	Bertina Catering & Cakes	2.509	33	Bakpia Erma	3.971
17	Sambel Granat	4.55			

Table 6. Characteristics of each cluster.

Significant variables forming clusters	Cluster	
	Prepared to level up	Developing
X2 Average gross profit per month	Above 15 million	10-15 million
X3 Average net profit per month	5-7 million	1-5 million
X4 Number of workers	4-5 workers	2 workers
X7 Production capacity per month in rupiah	10-15 million	1-10 million

Explanation for each cluster were listed as follows

1. Cluster 1: Prepared to level up

MSMEs prepared to level up were expected to improve their business competence so that they would become highly competitive MSMEs. The government initiated campaign of one million MSMEs to be prepared to level up. This was an acceleration program conducted by government to improve MSMEs competitiveness. This program was formulated into National Medium-Term Development Plan for 2015-2019. This was aimed to make MSMEs ready to deal with ASEAN Economic Community [16]. Generally, prepared to level up cluster have superior characteristics than developing cluster. Average gross income per month reached more than 15 million rupiah or 300 million rupiahs in a year. Average net income per month reached 5-7.5 million rupiah. According to law no 20 of 2008, an enterprise could be categorized as a small enterprise when the annual sales was between 300,000,000 rupiahs and 500,000,000 rupiahs. Food businesses in this cluster, mostly spent 10-15million per rupiah per month for production cost. This corresponded to large income achieved per month. These food businesses could be prepared to level up due to their good financial management. They also had products according to customers want. Therefore, members inside prepared to level up cluster were able to maximize their business financial turnover.

2. Cluster 2: Developing

Developing cluster was considered to have opportunities to develop. Nevertheless, they had not able to follow provisions from government to level up. Food business in this cluster have to improve their internal management. Average gross income per month was still less than ten million while average net income per month less than five million. The products were very simple and there was no

innovation yet. Therefore, product sales were not optimal. These food businesses had not been able to carry out their financial management properly due to their inability to separate between business fund and private fund. As a result, sometimes business fund was used for personal purposes. This caused business circulation could be faltered. Average number of workers in developing cluster was 2-3 persons. This was accordance with provisions stated micro business has less than five workers. Most of food businesses in this developing cluster still employs their family members as workers. As a result, their management and organization structure was very simple. Sometimes there was a lack of professionalism because of working with fellow of family members. This was in accordance with study by Gedajlovic et. al. [17].

3.2. SWOT Analysis

SWOT analysis was conducted to determine strategies for each cluster. SWOT analysis facilitates to build useful framework to identify internal and external factor of organization. Therefore, this tool includes both environmental analysis and the organizational analysis [18]. Identification for each cluster was carried out on internal factor, called strength and weaknesses, and external factor, called opportunities and threats. Those factors were based on the result of characteristics from each cluster and also conducted discussions with the chosen experts. After identified those factors, expert assessment was conducted to obtain appropriate strategies for each cluster. The chosen experts were a business consultant who handled MSMEs issue in Yogyakarta city and her technical staff. The result of assessment was carried out through IFE (Internal Factor Evaluation) and EFE (External Factor Evaluation) matrices. Table 7 and Table 8 show the IFE result from each cluster.

Table 7. IFE matrix for 'prepared to level up cluster'.

No	Strengths	Weight	Rating	Weight x Rating
1	High sales revenue	0.108	3.67	0.39
2	High production capacity	0.097	3.00	0.29
3	Fairly good financial management	0.118	3.00	0.35
4	Effective utilization of manpower	0.108	2.67	0.29
5	Having desirable products for consumers	0.129	3.00	0.39
6	Already promoting and selling products online	0.097	3.33	0.32
No	Weaknesses	Weight	Rating	Weight x Rating
1	Small number of workers (4-5 persons)	0.065	3.33	0.22
2	Having no partnership	0.086	2.67	0.23
3	Products didn't have business license, authorization from National Agency of Drug and Food Control, and halal certification	0.108	3.67	0.39
4	Structure of business management was still low	0.086	3.33	0.29
Total		1.00	32	3.16

Table 8. IFE matrix for ‘developing cluster’.

No	Strengths	Weight	Rating	Weight x Rating
1	Not much spending in labor cost	0.073	2.67	0.19
2	Products were dominated by traditional characteristics	0.064	3.33	0.21
3	Frequently attended to exhibitions	0.091	3.33	0.30
4	Participating in various communities	0.073	2.00	0.15
5	Already promoting and selling products online	0.073	2.33	0.17
No	Weaknesses	Weight	Rating	Weight x Rating
1	Low sales revenue	0.093	3.00	0.28
2	Low production capacity	0.084	3.33	0.28
3	Labor used were from family (1-2 persons)	0.093	3.00	0.28
4	Poor financial management	0.103	2.00	0.21
5	Unable to focus on sold product	0.075	2.67	0.20
6	Products didn't have business license, authorization from National Agency of Drug and Food Control, and halal certification	0.084	3.33	0.28
7	Having no partnership	0.084	2.67	0.22
Total		1.00	34	2.80

High sales revenue was the biggest strength for prepared to level up cluster while frequently participated in exhibition was the biggest strength for developing cluster. The products didn't have business license, authorization from National Agency of Drug and Food Control, and halal certification, was the biggest weakness for prepared to level up cluster. This was a critical factor because consumers have begun to consider these things in making a product purchased. The result for assessment of EFE for each cluster were shown in Table 9 and Table 10.

Table 9. EFE matrix for ‘prepared to level up cluster’.

No	Opportunities	Weight	Rating	Weight x Rating
1	Getting facilities from local government, such as training, assistance, consultation, and monitoring	0.100	3.67	0.37
2	Getting assistance capital	0.091	2.67	0.24
3	Many exhibitions were available to be joined	0.100	3.67	0.37
4	Promoting and selling online were getting easier	0.073	2.67	0.19
5	Many sales partnership schemes were available	0.082	2.33	0.19
6	Society were in good social condition	0.082	3.00	0.25
No	Threats	Weight	Rating	Weight x Rating
1	Many food business competitors	0.073	3.33	0.24
2	The products were easy to imitate	0.091	3.00	0.27
3	Other products have made innovations	0.091	3.00	0.27
4	Price of raw materials was fluctuating, raw materials were difficult to obtain	0.073	2.67	0.19
5	Need of adaptation to face digitalization era	0.073	3.67	0.27
6	Lack of trust to cooperate with business actors	0.073	3.33	0.24
Total		1	37.00	3.10

Table 10. EFE matrix for ‘developing cluster’.

No	Opportunities	Weight	Rating	Weight x Rating
1	Getting facilities from local government, such as training, assistance, consultation, and monitoring	0.096	3.33	0.32
2	Getting assistance capital	0.088	2.67	0.23
3	Many exhibitions were available to be joined	0.096	3.67	0.35
4	Promoting and selling online were getting easier	0.061	2.67	0.16
5	Many sales partnership schemes were available	0.070	2.00	0.14
6	Society were in good social condition	0.070	3.33	0.23

No	Threats	Weight	Rating	Weight x Rating
1	Many food business competitors	0.088	3.33	0.29
2	The products were easy to imitate	0.096	3.67	0.35
3	Other products have made innovations	0.070	3.00	0.21
4	Price of raw materials was fluctuating, raw materials were difficult to obtain	0.096	3.67	0.35
5	Need of adaptation to face digitalization era	0.096	3.33	0.32
6	Lack of trust to cooperate with business actors	0.070	2.67	0.19

Total		1	37.33	3.17
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According to table 9 and 10, the highest score for both clusters was on many opportunities to participate in various exhibition for MSMEs, including food businesses. This could be used for each of food business to introduce their products to consumers. Meanwhile, the biggest threat for both clusters was product ease to be imitated. The score was 0.35 for developing cluster and 0.27 for prepared to level up cluster. Food businesses need to innovate their product to overcome this problem, especially for food businesses in developing cluster due to their higher score.

After evaluating internal and external factors, strategy was formulated for each cluster by plotted their total score as shown in Figure 1.

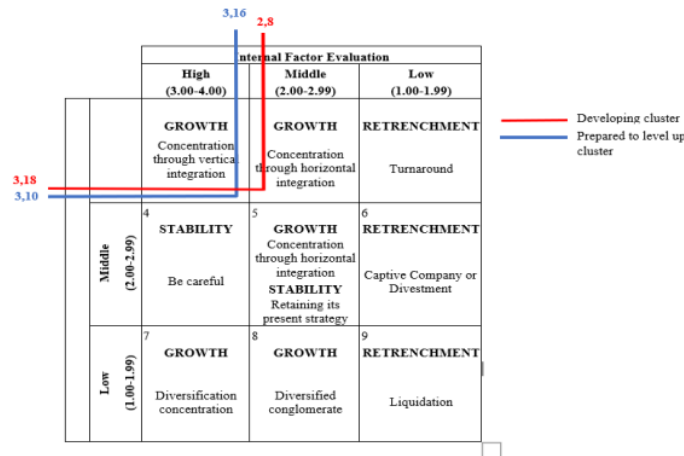


Figure 1. IFAS-EFAS matrix.

Strategy for each cluster were determined by its quadrant position as shown in Figure 1. Strategies for each cluster were explained as follows:

1. Strategy for 'prepared to level up cluster'

The characteristics from prepared to level up cluster were superior to developing cluster. According to figure 1, the appropriate strategy to be applied was growth strategy with concentration through vertical integration. Adeleke [19] stated that this strategy could be conducted by taking over the function of suppliers (backward integration) and distributors (forward integration). Food businesses in this cluster already have high market share and strong competitiveness. This corresponded to the results of SWOT analysis showed that these food businesses already have high sales revenue because their products were preferred by consumers. In addition, their internal management were also quite good. Therefore, this cluster could begin to focus on other strategies, one of which was taking over the role of suppliers. This aimed to minimize total operational costs, such as raw material costs. In addition, constraints related to raw materials such as availability and quality could be minimized. This was due to direct controlling from food businesses to suppliers. Another strategy was to take over function of distributors. It was expected to minimize total distribution cost through this direct controlling.

2. Strategy for 'developing cluster'

Growth strategy with concentration through horizontal integration was appropriate to be applied in developing cluster. According to Athoillah [20], integration horizontal strategy could be conducted by expanding its business or coverage area. It was intended to increase its sales or profit. To realize this strategy, food businesses in this cluster needs to improve their production capacity because they still have a small production capacity. Strengths of this cluster such as participating frequently in exhibitions and being registered in various MSMEs communities, could help this cluster to identify potential location for their business expansion.

4. Conclusion

Two clusters for food businesses in Yogyakarta were constructed by applying cluster analysis. They were 'prepared to level up cluster' and 'developing cluster'. 'Prepared to level up cluster' was considered to be more potential than 'developing cluster'. It was expected could develop their business competence to improve competitiveness. Meanwhile, developing cluster have to improve their internal management before being prepared to become a highly competitive MSMEs. Each of cluster was analysed to determine their appropriate strategy. Their strategy was formulated by conducting SWOT analysis. Internal and external factors were identified for each cluster before formulated the strategy. The appropriate strategy for 'prepared to level up cluster' was growth strategy through vertical integration. This could be conducted by taking over the function of suppliers or distributors. Meanwhile, growth strategy through horizontal integration was appropriate to be applied for 'developing cluster'. This cluster needs to expand its business or coverage area to increase market share. Further research can be conducted in the handicraft industry due to the large number MSMEs engaged.

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