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## **UMKM Clusterization with Unsupervised Neural Networks Method for Accounting by Business Capital**

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## UMKM Clusterization with Unsupervised Neural Networks Method for Accounting by Business Capital

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### Abstract

Based on the Law No. 20 Article 6/ 2008 the enterprises are categorized into three, namely Micro, Small, Medium Enterprises (MSME). However, the Central Bureau of Statistics reports that the MSME consists of seven variables: administration, workers, Gross Domestic Product (on business), Gross Domestic Product (on constant price 2000), total of non oil and gas export, Investment (prevailing price), and Investment (Contant price 2000). Due to these number of variables, clustering the enterprises based on the assets and turnover is quite weak. The present research aims to apply a clustering method named Unsupervised Neural Networks with the Kohonen SOM on the MSME. The data used were MSME data taken from 2010-2018. The testing proves that based on the training parameter Alpha 0.1, decalfa 0.2 with the iteration value 500, the MSME was clustered into two. The first cluster was the Micro Enterprise Cluster. The second consists of the Small and Medium Enterprises. The two types of MSME clusterization found lead to recommendation on providing the credit categories based on the clusters.

**Keywords:** Clusterization, MSME, Unsupervised Neural Netwrks, Kohonen SOM.

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### Introduction

The central bank of Indonesia, Bank Indonesia, regulates that the commercial banks in Indonesia must serve Micro, Small, Medium Enterprises (MSME) loans of minimum 20% . The policy is for facilitating the access of the MSME in getting loans. This is for facilitating the MSME owners in accessing loans for expanding their business. One of program called Kredit Usaha Rakyat (KUR).

According to the Presidential Decree of Republic Indonesia No 19/2015 on the changes to the presidential decree No. 14/2015 about policy on MSME. The Article 15 mentions that the Margin rate for Micro enterprise is 7% a year or equals to the flat margin. The policy is one of the government commitment in supporting the MSME growth. In fact, MSME has limit access on getting bank loan which is only aroun a sixth of the loan nationally Darwin (2018). Even in 2013, it only gained three percent of the national credit. Whereas, the higher credit given is linear to the higher UKM growth (Indriyati, 2018).

### Method

The present research imported data from <http://www.depkop.go.id/data-umkm> between 2010 – 2018 with the variables of: administration, workers, Gross Domestic Product (on business), Gross Domestic Product (on constant price 2000), total of non oil and gas export, Investment (prevailing price), and Investment (Contant price 2000). The data are displayed on the table below:

Table 1. MSME Data between 2010 – 2018

Year	MSME	Administration	Workers	Gross Domestic Product (on business)	Gross Domestic Product (on constant price 2000)	Total of non oil and gas export	Investment (prevailing price)	Investment (Contant price 2000)
2010	Micro	52176771	89960695	1747339.0	682259.8	14375.3	123896.2	37144.9
	Small	546643	3520497	517919.7	224311.0	36839.7	288328.5	85714.9
	Medium	41336	2712431	704087.5	306028.5	111039.6	369132.3	101149.0
2011	Micro	53504416	91729384	2011544.2	719070.2	16687.5	150784.4	42240.1
	Small	586397	3768885	596884.4	239111.4	38001.0	343048.9	93856.6
	Medium	42008	2740644	803146.0	324390.2	121206.4	433284.2	111042.8
2012	Micro	52206444	94957797	2579388.4	761228.8	17249.3	155182.6	42351.3
	Small	602195	3919992	740271.3	261315.8	39311.7	355305.9	94779.4
	Medium	44280	2844669	1002170.3	346781.4	130880.8	481716.7	123804.1
2013	Micro	55856176	99859517	2951120.6	790825.6	15235.2	175529.1	44711.3
	Small	629418	435970	798122.2	294260.7	32508.8	452790.0	104726.4
	Medium	48997	3262023	1120325.3	366373.9	118882.4	622482.0	150738.0
2014	Micro	57189393	104624466	3326564.8	807804.5	15989.5	185717.2	42053.3
	Small	654222	5570231	876385.3	342.579.2	32051.8	620216.0	111652.8
	Medium	52106	3949385	1237057.8	386535.1	134071.4	849300.3	187635.5
2015	Micro	58521987	110807864	3841836.0	848985.0	15562.0	190257.0	45387.0
	Small	681522	7307503	984489.0	395426.0	759622.0	31289.0	116970.0
	Medium	59263	5114020	1401960.0	411019.0	868870.0	139124.0	198674.0
2016	Micro	60863578	103839015	4292287.8	2736613.7	22719.3	262271.0	194124.6
	Small	731047	5402073	1128056.8	1123613.8	45536.4	749745.5	471627.5
	Medium	56551	3587622	1588938.3	1311318.0	186870.4	1045955.5	785644.8
2017	Micro	62106900	107232992	4727989.4	2856607.8	26466.4	282701.5	203583.0
	Small	757090	5704321	1234210.7	1191871.1	52985.4	813853.9	496161.1
	Medium	58627	3736103	1742435.7	1376935.8	219656.9	1140184.4	846636.3
2018	Micro	63350222	107376540	5303075.7	2927890.5	25006.4	290840.2	206233.6
	Small	783132	5831256	1347104.3	1355705.7	47099.7	996666.1	522653.9
	Medium	60702	3770835	1923715.4	1437551.9	221734.8	1277043.2	946252.1

### Clusterization

The clusterization is done by applying Unsupervised Neural Networks called Kohonen Self-Organizing Map (SOM) with seven variable input above shown on the table. The best training parameter are on alpha 0.1 and decalfa 0.2 with the iteration of 50, 100 and 500; alpha 0.1 and decalfa 0.3 with the iteration of 100; alpha 0.1 and decalfa 0.4 with the iteration of 100; and alpha 0.1 and decalfa 0.5 with the iteration of 100.

### Results and Discussion

The following figures show the clustering results of MSME with 27 data taken between 2010 and 2018. The Unsupervised Neural Networks of a Kohonen SOM was applied for the clusterization. Figure 1 to 3 are the clusterization results of Alpha 0.1 and Decalfa 0.2 with different Iteration values of 50, 100, and 500.

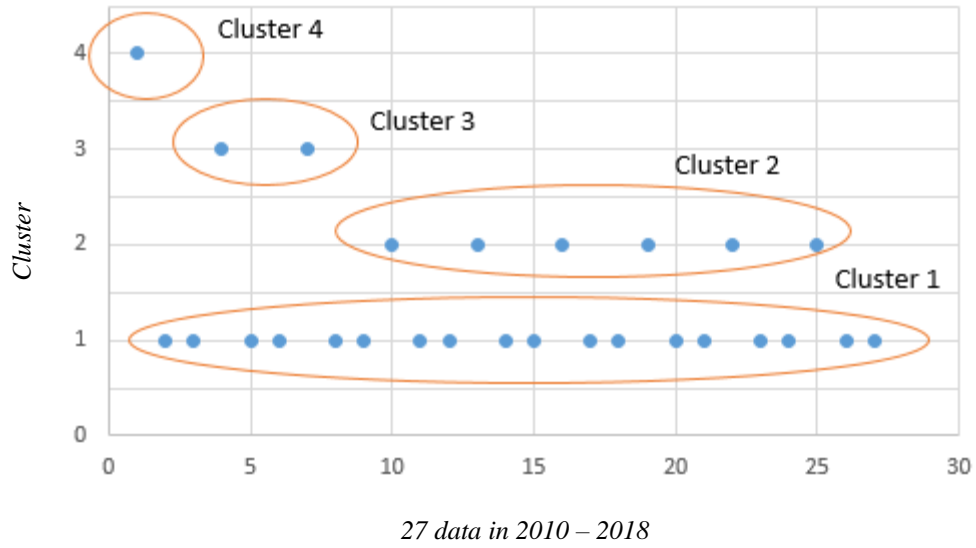


Figure 1. The MSME Clusterization Result of Alpha 0.1 and Decalfa 0.2 with Iteration of 50

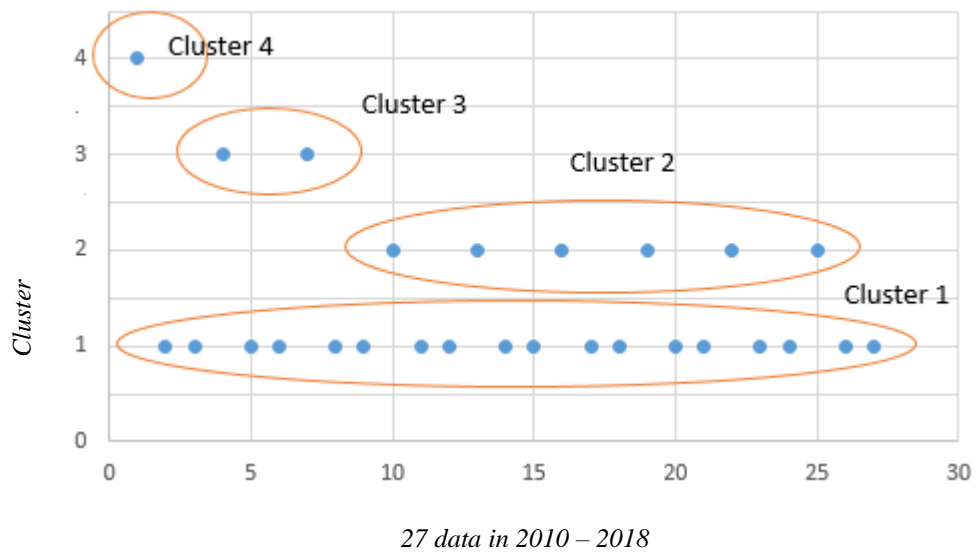


Figure 2. The MSME Clusterization Result of Alpha 0.1 and Decalfa 0.2 with Iteration of 100

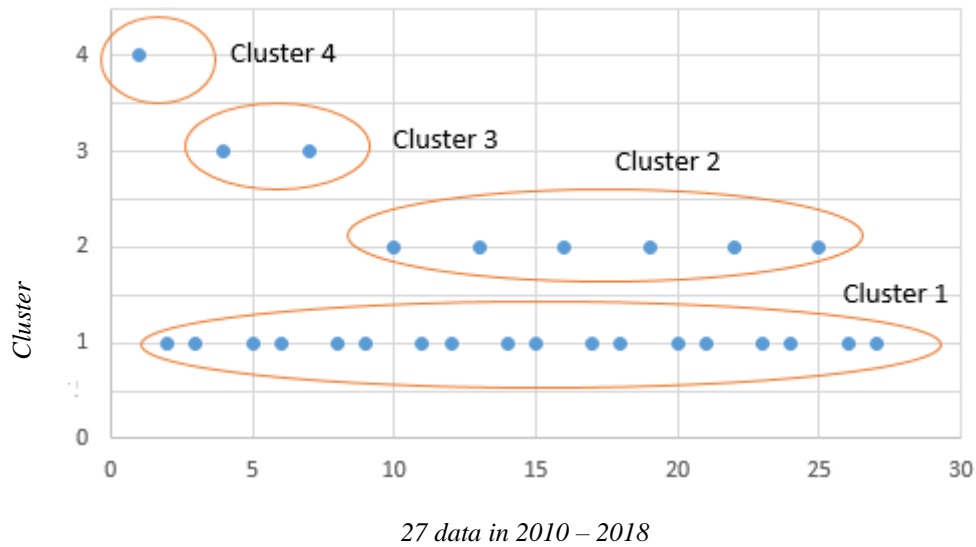


Figure 3. The MSME Clusterization Result of Alpha 0.1 and Decalfa 0.2 with Iteration of 500

The figure 1-3 show that the different iteration parameters resulted on the stable clusterization. The figures also show that the best performance is on the iteration parameter value of 50. The clusterization of Micro Enterprise (MiE) in 2010 was clustered in one data. In between 2011 and 2012, it was clustered into three clusters with two data. From 2013 until 2018, this was clustered into two with six data. Apparently, the Small Enterprise (SE) and Medium Enterprise (ME) in 2010 to 2018 were clustered into one based on the Unsupervised Neural Networks SOM-Kohonen method.

The next figures 4-6 show the MSME clusterization result of alpha 0.1 and decalfa 0.3, 0.4, and 0.5 with the iteration parameter of 100.

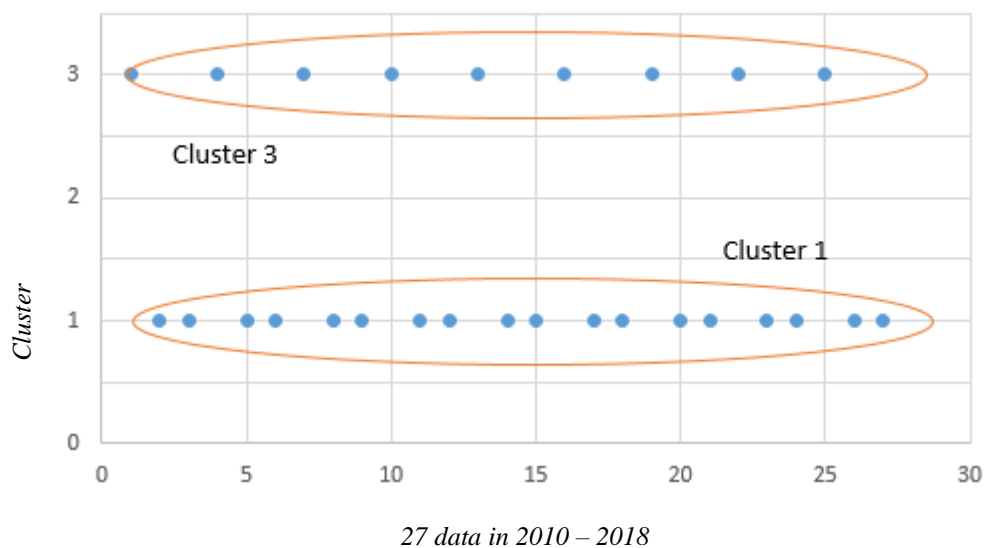


Figure 4. The MSME Clusterization Result of Alpha 0.1 and Decalfa 0.3 with Iteration of 100

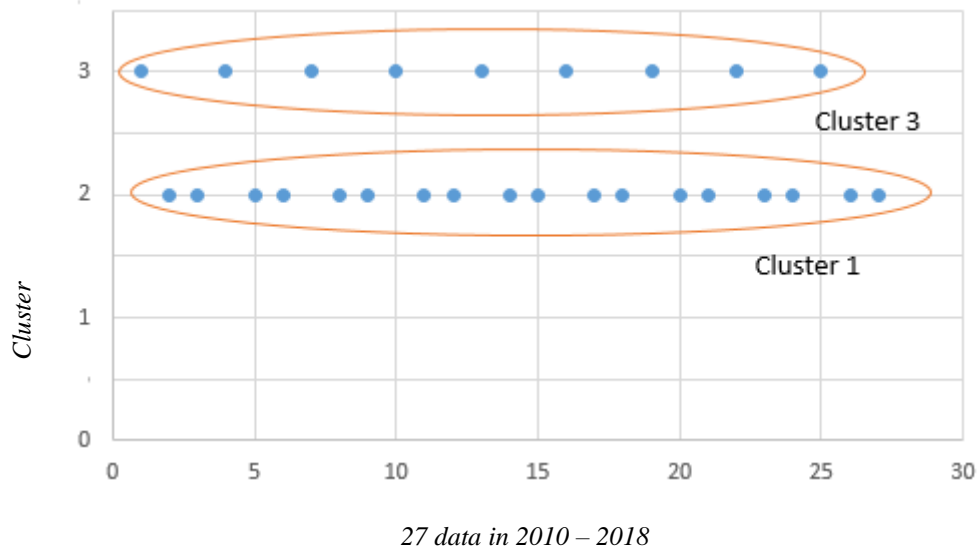


Figure 3. The MSME Clusterization Result of Alpha 0.1 and Decalfa 0.4 with Iteration of 100

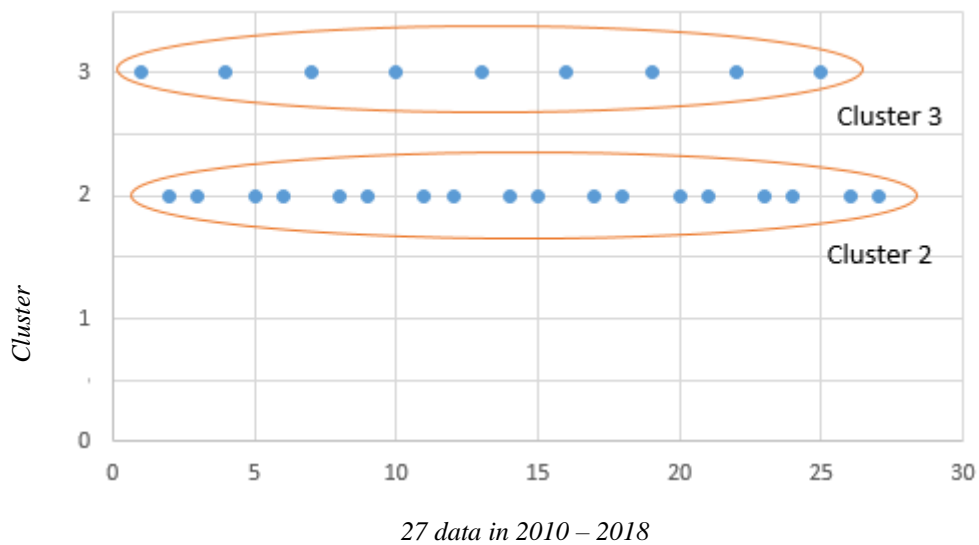


Figure 3. The MSME Clusterization Result of Alpha 0.1 and Decalfa 0.5 with Iteration of 100

From Figure 4-6 it can be seen that the MiE from 2010 to 2018 was clustered to Cluster 3 as one cluster. Meanwhile, SE and ME are joined one cluster, Cluster 1 (Figure 4 & 5) and Cluster 2 (Figure 6).

Comparing the six figures above, the clusterization of MSME shown on Figure 1-3 is unconvergence to the MSME grouping. This is different from SE and ME which are clustered into one. On Figure 4-6, the different parameter is applied for the clusterization in which the clustered data show the same data.

### Conclusion

The MSME clusterization using the method of Unsupervised Neural Networks SOM-Kohonen on the 27 data between 2010-2018 found two types of clusters. The first is the Cluster Micro Enterprise and the second is the Cluster Small Enterprise and Medium Enterprise.

## **Recommendations**

The finding of the present research implies on the suggestion that based on the clusterization, the MSME credits should be given differently. The Small and the Medium Enterprises should get higher percentage than the Micro Enterprise

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