

K-Means Clustering Analysis on 9 Provinces with the Highest Investment Realization in Indonesia Based on Sector for East Java Province

East Java Investment and One-Stop Integrated Services Agency
(DPMPTSP)

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I. Introduction

Background

The East Java Province Investment and One-Stop Integrated Service Office (DPMPTSP) has a vital role in providing accurate and reliable investment information. Through cooperation with various entities, such as the Provincial Government and Regional Government Organizations, DPMPTSP creates synergy in an effort to strengthen national data infrastructure, ensuring that the data used in development planning is the latest, most complete, and most accurate. The development of digital platforms such as the East Java Province DPMPTSP website is an effective means of communicating with the public, especially investors, and supporting the creation of a conducive and transparent investment climate. In this context, the analysis and research conducted within the framework of the Practical Work (KP) activities at DPMPTSP provide an important contribution in understanding the potential of leading sectors and encouraging potential sectors in both domestic and foreign investment, in accordance with the needs and dynamics of development at the local and national levels.

Purpose

The aim of this Internship is:

- a. Creating infographics and videographics related to investment realization in East Java Province based on various categories within a certain time period at the East Java Province Investment and One-Stop Integrated Service Office.
- b. Conducting clustering analysis to determine which clusters in East Java Province have superior sector characteristics with which provinces are related to domestic capital receipts (PMDN) and foreign capital receipts (PMA).

Significance

The benefits obtained from internships are:

- a. Obtained infographics related to the realization of investment in East Java Province based on various categories in a certain time period at the East Java Province Investment and One-Stop Integrated Service Office Berkah in order to see data patterns and trends more clearly while creating publication materials in the form of videographics.
- b. The results of statistical clustering analysis were obtained to identify the characteristics of the leading sectors in East Java Province that have similarities with other provinces and in other sectors.

II. Overview of the Institutions for Internship

The East Java Investment and One-Stop Integrated Service Agency (DPMPTSP) is one of the Regional Apparatus Organizations (OPD) under the East Java Provincial Government and is located at Jl. Johar No.17, Alun-alun Contong, Bubutan District, Surabaya City. This agency is responsible for facilitating and providing integrated services in the licensing and investment process in an area.



Figure 2.1 East Java DPMPTSP Building

DPMPTSP East Java is the spearhead in promoting investment and accelerating the licensing process in the region. With a focus on investment, DPMPTSP East Java actively invites investors, both domestic and foreign, to invest in this province. Implementing the One-Stop Integrated Service (PTSP) concept, this agency ensures that business actors can take care of all their permits efficiently and in an integrated manner.

DPMPTSP East Java is responsible for providing business permits that involve processes such as Principle Permits, Location Permits, and Environmental Permits. By providing information on investment potential in various sectors, this agency plays a role in guiding investors to understand the opportunities available. In addition, DPMPTSP also contributes to formulating regional economic policies with a focus on sectors that have significant growth potential.

Close cooperation with various related agencies, both at the provincial and national levels, is the strategy of the East Java DPMPTSP to create a conducive investment environment. Thus, the provincial DPMPTSP plays an important role in increasing economic competitiveness, attracting sustainable investment, and contributing to economic and social development in East Java. Through careful supervision and evaluation, the East Java DPMPTSP is committed to maintaining sustainability and efficiency in business licensing services, supporting the growth of the business sector, and creating an investment climate that is beneficial to all parties.

III. Internship Results

1. Infographics and Videographics

Infographics and videographics produced during 1 month of internship at DPMPTSP East Java contain information about the top 5 regencies/cities with the largest PMDN (Domestic Investment), PMA (Foreign Investment), and PMA+PMDN values in East Java Province, the top 5 countries of origin of PMA, and the top 5 highest investment sectors based on PMA, PMDN, and PMA+PMDN values in the period January-July 2023 (Semester I 2023) and April-July 2023 (Trimester II 2023). The results of the infographics and videographics can be accessed on the ITS Statistics Corner website (<https://pojokstatistik.bps.go.id>) or the ITS Statistics Corner YouTube Channel (<https://www.youtube.com/@POJOKSTATISTIKITS>). The following is an excerpt from the infographics and videographics in Figure 3.1.



Figure 3.1 Infographic and Videographic Results Snippet

2. Clustering Analysis

a. Based on Domestic Capital Intake (PMDN)

The statistical analysis conducted is clustering analysis on foreign investment (PMA) data in 9 provinces with the highest average PMDN value in Indonesia, namely Banten, DIY, DKI, West Java, Central Java, East Java, East Kalimantan, Riau, and Central Sulawesi with 23 investment sectors (Mining, Basic Metal Industry, Metal Goods, Non-Machinery and Equipment, Chemical and Pharmaceutical Industry, Other Industries, Food Industry, Transportation, Warehouse and Telecommunication, Electricity, Gas and Water, Rubber and Plastic Industry, Trade and Repair, Hotel and Restaurant, Non-Metallic Mineral Industry, Machinery Industry, Electronics, Medical Instruments, Electrical Equipment, Precision, Optics and Watches, Other Services, Wood Industry, Paper and Printing Industry, Leather Goods and Footwear Industry, Motor Vehicle Industry and Other Transportation Equipment, Housing, Industrial and Office Areas, Textile Industry, Food Crops, Plantations, and Animal Husbandry, Fisheries, Construction, and Forestry). Based on K-Means Clustering, 6 clusters were produced as in Figure 3.2.

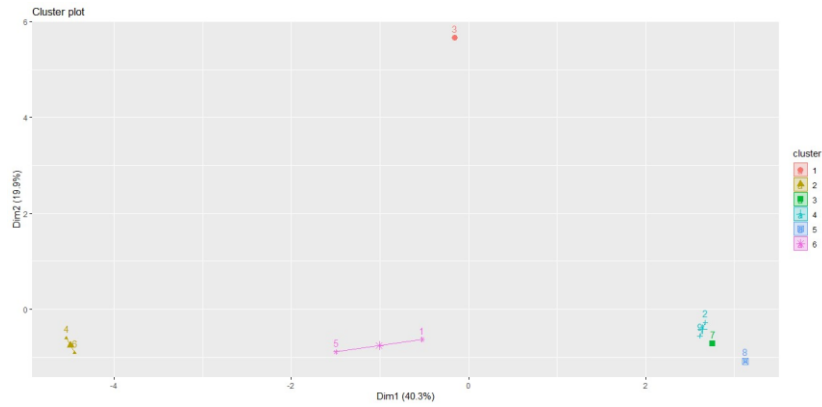


Figure 3.2 PMDN Cluster Results in 9 Provinces in Indonesia

with details of each cluster as follows:

Tabel 3.1 PMDN Clustering Results

Cluster	Total	Province
1	1	DKI Jakarta
2	2	West Java, East Java
3	1	East Kalimantan
4	2	DIY Yogyakarta, Central Sulawesi
5	1	Riau
6	2	Banten, Central Java

From the results of the k-means cluster analysis, the model criteria value was obtained to see how far the model created can explain all available data, which is 97.2% which is a fairly good value, meaning that the existing model can explain as far as 97.2%, while the rest is influenced by other factors. The clustering profile containing the leading sectors in each cluster is as follows:

Tabel 3.4 PMDN Clustering Profile

Cluster	Total	Province	Leading Sectors
1	1	DKI Jakarta	<ul style="list-style-type: none"> Hotels and restaurants Other services Construction Trade and repair Housing, industrial areas and offices Transportation, warehousing and telecommunications
2	2	West Java, East Java	<ul style="list-style-type: none"> Rubber and plastic industry Wood industry Motor vehicle and other transportation industry Paper and printing industry Other industries Basic metal industry, metal goods, not machinery and equipment Food industry Non-metallic mineral industry Textile industry Fisheries
3	1	East Kalimantan	<ul style="list-style-type: none"> Chemical and pharmaceutical industry Mining
4	2	DIY Yogyakarta, Central Sulawesi	-
5	1	Riau	<ul style="list-style-type: none"> Forestry Electricity, gas and water Food crops, plantations and livestock
6	2	Banten, Central Java	<ul style="list-style-type: none"> Machinery, electronics, medical instruments, electrical equipment, precision, optics and watches industry Leather goods and footwear industry

It can be seen that East Java Province is in the same cluster as West Java Province for the realization of PMDN investment where in this cluster there are leading sectors: rubber and plastic industry, wood industry, vehicle and motor industry, paper

and printing industry, other industries, basic metal industry, metal goods, non-machinery and equipment, food industry, non-metallic mineral industry, textile industry, and fisheries.

b. Based on Foreign Capital Inflow (PMA)

The statistical analysis conducted was clustering analysis on foreign investment (PMA) data in 8 provinces with the largest average PMA value in Indonesia, namely Banten, DIY, DKI, West Java, Central Java, East Java, East Kalimantan, and Riau with 23 investment sectors. In this analysis, Central Sulawesi Province was not included because there was an imbalance in investment value in the province compared to other provinces. Based on the clustering analysis, 2 clusters were produced as follows:

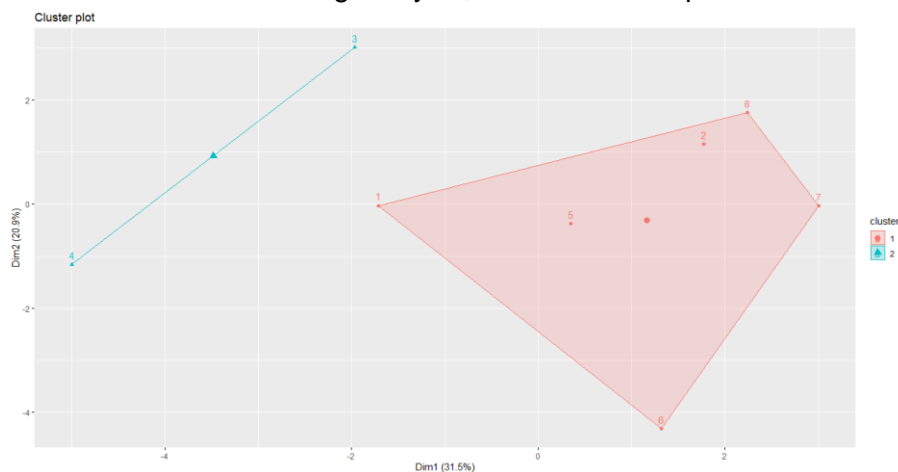


Figure 3.3 Results of Provincial PMA Clusters

with details of each cluster as follows:

Tabel 3.3 PMA Clustering Results

Cluster	Total	Province
1	2	DKI Jakarta, West Java
2	6	Banten, DIY, Central Java, East Java, East Kalimantan, Riau

the results of the k-means cluster analysis, the model criteria value was obtained to see how far the model created can explain all available data, which is 56.85% which is a fairly good value, meaning that the existing model can explain as far as 56.85%, while the rest is influenced by other factors. The clustering profile containing the leading sectors in each cluster is as follows:

Tabel 3.4 PMA Clustering Profile

Cluster	Total	Province	Leading Sectors
1	2	DKI Jakarta, West Java	Wood Industry; Paper and Printing Industry; Basic Metal Industry, Metal Goods, Non-Machinery and Equipment; Non-Metal Mineral Industry; Forestry; Electricity, Gas and Water; Fisheries; Mining; Food Crops, Plantations and Livestock.
2	6	Banten, DIY,	Hotels and Restaurants; Machinery,

		Central Java, East Java, East Kalimantan, Riau	Electronics, Medical Instruments, Equipment, Electrical, Precision, Optical and Watch Industries; Leather Goods and Footwear Industries; Rubber and Plastic Industries; Motor Vehicles and Other Transportation Equipment Industries; Chemical and Pharmaceutical Industries; Other Industries; Food Industries; Textile Industries; Other Services; Construction; Trade and Repair; Housing, Industrial Estates and Offices; Transportation, Warehouses and Telecommunications.
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It can be seen that DKI Jakarta Province is in the same cluster as West Java Province in the realization of PMA investment where in this cluster there are 10 leading sectors, namely the Wood Industry; Paper and Printing Industry; Basic Metal Industry, Metal Goods, Not Machinery and Equipment; Non-Metallic Mineral Industry; Forestry; Electricity, Gas and Water; Fisheries; Mining; Food Crops, Plantations and Livestock.

East Java Province is in the same cluster as Banten, DIY, Central Java, East Kalimantan, and Riau provinces in the realization of PMA investment where in this cluster there are 10 leading sectors, namely Hotels and Restaurants; Machinery, Electronics, Medical Instruments, Equipment, Electricity, Precision, Optics and Watches Industry; Leather Goods and Footwear Industry; Rubber and Plastic Industry; Motor Vehicle and Other Transportation Industry; Chemical and Pharmaceutical Industry; Other Industries; Food Industry; Textile Industry; Other Services; Construction; Trade and Repair; Housing, Industrial and Office Areas; Transportation, and Warehouses and Telecommunications.

c. Based on Total Domestic Capital Receipts and Foreign Capital Receipts (PMDN+PMA)

The statistical analysis conducted is clustering analysis on foreign investment (PMA) data in 8 provinces with the largest average PMA value in Indonesia, namely Banten, DIY, DKI, West Java, Central Java, East Java, East Kalimantan, Central Sulawesi and Riau with 23 investment sectors. Based on the clustering analysis, 2 clusters were produced as follows:

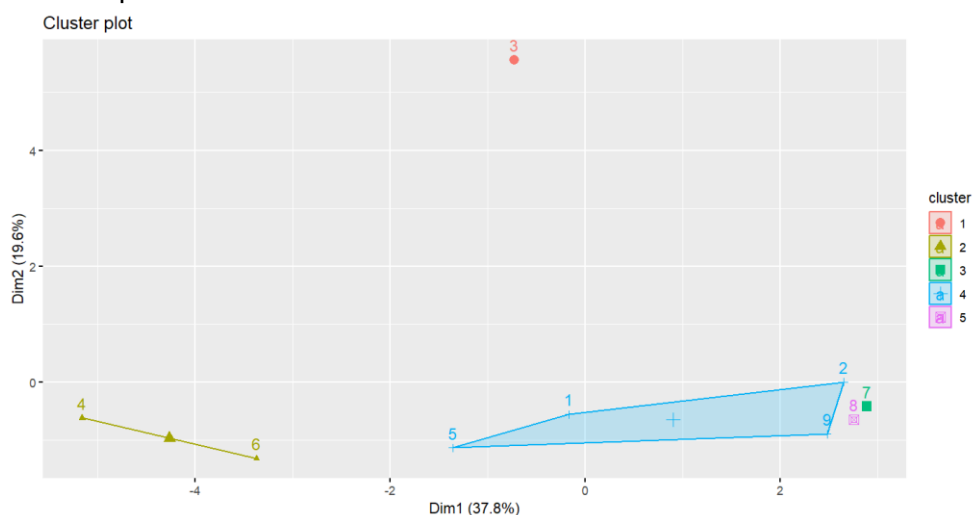


Figure 3.4 Results of PMDN+PMA Clusters in Provinces with details of each cluster as follows:

Tabel 3.5 PMDN+PMA Clustering Results

Cluster	Total	Province
1	1	DKI Jakarta
2	2	West Java, East Java
3	1	East Kalimantan
4	4	Banten, DIY Yogyakarta, Central Java, Central Sulawesi
5	1	Riau

From the results of the k-means cluster analysis, the model criteria value was obtained to see how far the model created can explain all available data, which is 95.7% which is a fairly good value, meaning that the existing model can explain as far as 95.7%, while the rest is influenced by other factors. The clustering profile containing the leading sectors in each cluster is as follows:

Tabel 3.6 PMDN+PMA Clustering Profile

Cluster	Total	Province	Leading Sectors
1	1	DKI Jakarta	<ul style="list-style-type: none"> • Chemical and pharmaceutical industry • Mining
2	2	West Java, East Java	<ul style="list-style-type: none"> • Hotels and restaurants • Other services • Construction • Trade and repair • Housing, industrial areas and offices • Transportation, warehousing and telecommunications
3	1	East Kalimantan	<ul style="list-style-type: none"> • Kehutanan • Listrik, gas, dan air • Tanaman pangan, perkebunan, dan peternakan • Forestry • Electricity, gas and water • Food crops, plantations and livestock
4	4	Banten, DIY Yogyakarta, Central Java, Central Sulawesi	-
5	1	Riau	<ul style="list-style-type: none"> • Machinery, electronics, medical instruments, electrical equipment, precision, optical and watch industries • Leather goods and

			footwear industries <ul style="list-style-type: none"> ● Rubber and plastic industries ● Wood industries ● Motor vehicles and other transportation industries ● Paper and printing industries ● Other industries ● Basic metals, metal goods, not machinery and equipment industries ● Food industries ● Non-metallic minerals ● Textiles ● Fisheries
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It can be seen that East Java Province is in the same cluster as West Java Province for the realization of PMDN+PMA investment, where this cluster has the following leading sectors: hotels and restaurants, other services, construction, trade and repair, housing, industrial areas and offices, as well as transportation, warehouses and telecommunications.

IV. Conclusion

After carrying out a series of internship activities and analysis, the following conclusions can be obtained:

1. Gresik Regency, Surabaya City and Pasuruan Regency, as well as the food and transportation, warehouse & telecommunications industry sectors are the provinces with the 3 largest PMA, PMDN, and PMA+PMDN investment values in East Java Province in Semester I 2023. Likewise in the period in Quarter II 2023, the three regencies/cities still dominate the 3 largest PMA, PMDN, and PMA+PMDN investment values in East Java in the Mining, Food industry and basic metal industry, metal goods, not machinery and equipment sectors.
2. Clustering results:
 - a. Based on the k-means clustering analysis of PMDN from 9 Provinces with the highest average investment value, it produces 6 clusters where the first cluster is occupied by DKI Jakarta, the second cluster is occupied by West Java, East Java, the third cluster is occupied by East Kalimantan, the fourth cluster is occupied by DIY Yogyakarta, Central Sulawesi, the fifth cluster is occupied by Riau, and the sixth cluster is occupied by Banten, Central Java. East Java Province is in the same cluster as West Java Province and has the characteristics of leading sectors, namely the rubber and plastic industry, wood industry, vehicle and motor industry, paper and printing industry, other industries, basic metal industry, metal goods, non-machinery and equipment, food industry, non-metallic mineral industry, textile industry, and fisheries.
 - b. K-Means clustering analysis of PMA in 8 provinces with the highest average investment value resulted in 2 clusters with the first cluster containing DKI Jakarta and West Java Provinces, and the second cluster containing Banten, DIY, Central Java, East Java, East Kalimantan, Riau Provinces. East Java Province is in the same cluster as 5 other provinces with leading sector characteristics, namely Hotels and Restaurants;

Machinery, Electronics, Medical Instruments, Equipment, Electricity, Precision, Optics and Watches Industry; Leather Goods and Footwear Industry; Rubber and Plastic Industry; Motor Vehicle and Other Transportation Industry; Chemical and Pharmaceutical Industry; Other Industries; Food Industry; Textile Industry; Other Services; Construction; Trade and Repair; Housing, Industrial Estates and Offices; Transportation, and Warehouses and Telecommunications.

- c. Meanwhile, the K-Means clustering analysis of Total PMDN + PMA produces 5 clusters, namely the first cluster is occupied by DKI Jakarta, the second cluster is occupied by West Java and East Java, the third cluster is occupied by East Kalimantan and the fourth cluster is occupied by Banten, DIY Yogyakarta, Central Java, Central Sulawesi, and the fifth cluster is occupied by Riau. Where East Java Province is in the same cluster as West Java Province has the characteristics of leading sectors, namely hotels and restaurants, other services, construction, trade and repair, housing, industrial areas, and offices, as well as transportation, warehouses, and telecommunications.