

Analysis of Growth and Tourism Clusters in Madura

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Abstract

The tourism sector is one of the essential sectors that drive economic growth. There are many tourist destinations in Madura Island that have uniqueness, where the tourism is based on beaches, culture, history, and even religion. However, the existence of tourist destinations has not been widely felt by the Madurese community economically. Therefore, tourism development in Madura needs attention, considering the tourism sector plays a vital role in encouraging economic growth. This research uses scalogram analysis and K-Means Clustering analysis. The scalogram analysis consists of Location Coefficient (LC) analysis which reflects the level of importance of a facility in an area, and functional index analysis, which is used to measure the hierarchy of facilities in each district or region. Meanwhile, the K-Means Clustering analysis is intended to see the Madura tourism clusters. This study indicates that Sumenep Regency can be the centre of tourism growth in attractions, amenities, and accessibility. The analysis shows that Sumenep Regency is the closest distance to the cluster centre or can be categorized as an advanced cluster. Then, Pamekasan Regency is a less developed cluster because it is far from the cluster centre. This research provides some recommendation in increasing economic growth in Madura.

Keywords: Growth Pole, Madura Tourism, Cluster

JEL Classification: H41, O12, R1, Z32

INTRODUCTION

Indonesia's economic growth is currently supported by sectors that continue developing and improving income or foreign exchange for Indonesia (World Bank, 2021). One of these sectors is the tourism sector, which has developed into one of Indonesia's largest industries for economic growth (Haryana, 2020). The development of tourism in the economic and socio-cultural fields can make a promotional attraction for tourists. The more tourists, the more regional income will be received (Manzoor et al. 2019) and (World Tourism Organization, 2021). Several regions continue to develop their tourism potential to become a source of economic potential in the area, including the Madura region, which consists of

Bangkalan Regency, Sampang Regency, Pamekasan Regency, and Sumenep Regency. The importance of research in tourism development in the Madura region is aimed at reducing the existing local poverty level (Mohammad et al. 2019). Data suggest that all districts in Madura are among the poorest in East Java. Sampang, Bangkalan, and Sumenep have a poverty rate of 22.78%, 20.56%, and 20.18%, respectively, while the Pamekasan poverty level is 14.60%.

The Madura region has the potential of a diverse tourism sector, which can be essential in developing its economics compared to the other areas in East Java. According to Diskominfo (2015), the Madura region has the potential for unique, distinctive, and stunning beauty because it has several potential tourism characteristics. It starts from the charm of the natural beauty of beaches such as Gili Iyang, Slopeng beach, Siring Kemuning beach, Toroan waterfall, and Jumiang beach, whose beauty is not inferior to the beaches on the island of Bali. In addition, Madura also has tourism potential based on culture, history, and religion, such as Karapan Sapi and religious tourism at the Tomb of Syaikhona Kholil Bangkalan. Besides that, the advantage of developing tourism in Madura compared to other East Java areas is that the Madura area will easily attract tourists, supported by the Suramadu Bridge and Trunojoyo Airfield in Sumenep Regency. When viewed from a macroeconomic perspective, the tourism sector can have a positive impact on the economy in Madura, which among others, can increase regional income, expand and equalize employment and employment opportunities, encourage regional development, introduce and utilize tourist objects, and attractions (Budirahmayani & Khoirunurrofik, 2019). Furthermore, when viewed from a microeconomic perspective, the tourism sector can develop the existing MSME sector (Pambudi et al. 2021).

According to the Indonesian Law No. 10/2009 on Tourism, the implementation of tourism aims to increase national income, improve the welfare and prosperity of the people, expand, and equalize business and employment opportunities, encourage regional development, introduce and utilize tourist objects and attractions in Indonesia, foster a sense of love for the homeland and strengthen the friendship between nations. Tourism development also encourages and accelerates Gross Regional Domestic Product (GRDP) revenue. Tourism activities can create demand in both consumption and investment, ultimately leading to the production of goods and services. As long as tourists carry out buying and selling activities at tourist sites, it will directly lead to market demand for goods and services at these tourist attractions.

Table 1. The Number Of Tourist Visitors In Madura

District	Domestic Tourist	Foreigner Tourist
Bangkalan	2,444,134	235
Sampang	354,868	34
Pamekasan	105,773	402
Sumenep	13,190,581	2,610

Source : *Central Bureau of Statistic Tourism Publications, processed*

From the data in Table 1, the number of tourist visitors in the districts in Madura shows the inequality between districts. Therefore, it is essential to develop tourism potential in Madura, including Bangkalan, Sampang, Pamekasan, and Sumenep regencies, to not cause inequality. If this is allowed, it will result in economic growth in the region. The number of tourists will increase the region's income, where the regional income will reflect the conditions of economic growth (Alam & Paramati, 2016). If economic growth in a region is low, it will lead to economic inequality between other regions (Nguyen et al. 2020). Therefore, the government needs to support inequitable tourism development in Madura (Riyanto et al. 2020). Therefore, researchers are interested in conducting a comprehensive study that can see the level of tourism competitiveness readiness of each district in Madura at each tourism growth center seen from the scalogram analysis, location coefficient, and value weighting. In addition, researchers also analyzed the form of mapping existing tourism clusters so that the direction of tourism development policies in the Madura region could be more focused.

This research is based on the growth pole theory, disparity theory, regional cluster theory, and some relevant previous researchers. The growth pole theory combines the principles of concentration and decentralization simultaneously and combines integrated regional and city development policies and programs (Benedek et al. 2019). The disparity theory also explains that disparity is caused by differences in the content of natural resources and differences in the demographic conditions of each region Cingano (2014) and United Nations (2020). The regional cluster theory is a study by Alfred Marshall and Michael E. Porter. According to Porter, a cluster-based economy is a concentrated area with interrelated companies and institutions in specific fields. Porter emphasizes that keyword cluster development is a competition that depends on productivity, where productivity lies in the ability of the industry to create products and services. Several other researchers, such as Li et al. (2016) and Tucki & Pylak (2021) also argue that tourism can reduce inequality, especially income, and make a significant contribution to economic growth both nationally and regionally and can reduce poverty disparities between regions. In addition, researchers are interested in conducting this research because previous researchers, Parmawati et al. (2018), Ritonga Husni et al. (2018) and Dahruji et al. (2022) in their research, use SWOT analysis for the development of tourism potential. Wispandono et al. (2021) and Idris et al. (2021) also research tourism in Madura by including digital communication technology in Madura in their research. Based on these previous studies, the researcher is interested in researching tourism development in Madura by using scalogram analysis and K-means clustering, which can classify objects or cases into relatively homogeneous groups. This analysis can classify districts in Madura based on the similarity of their regional characteristics compared to the SWOT analysis Sano & Nindito (2016) and LT et al. (2021). To deepen the analysis related to tourism development, it first needs to identify the existing tourism centers based on the availability of tourist facilities. Moreover, several clusters can be formed to develop tourism potential in Madura is more measurable and centralized.

METHOD

The locations in this study are four districts in Madura, including Bangkalan, Sampang, Pamekasan, and Sumenep regencies, using a quantitative descriptive

research approach based on the condition of existing tourist facilities. This study uses secondary data sourced from the publications of Statistics Indonesia from each district in Madura. The analysis used in this research is scalogram analysis and K-Means clustering analysis. The scalogram analysis aims to identify which sub-districts on Madura Island can be grouped into tourism centers based on available facilities. The facilities analyzed in this study are the economic facilities in the form of banks and markets, accommodation facilities in the form of tourist destinations, restaurants, diners, hotels, and inns, and health facilities in the form of hospitals and health centers. The steps involved in the scalogram method include:

- a. Each sub-district on Madura Island is arranged based on population ranking
- b. The sub-districts are then sorted based on the number and type of facilities owned
- c. Facilities are arranged in order based on the number of types of facilities owned
- d. The ranking of facility types is arranged based on the number of facility units, and a hierarchy of facilities will be obtained from the highest to the lowest
- e. Find the Location Coefficient (LC) values, weights, and functional indexes.

The location coefficient value (LC) reflects the level of importance of a facility in an area. The higher the location coefficient value in an area, the more urgent or scarce the facility is, and vice versa. If the location coefficient value is low, the facility is considered less important. The location coefficient is related to the distribution of existing facilities. If the number of facilities in an area is large, the value of the location coefficient is low.

On the other hand, if the number of facilities is small, the value of the location coefficient is higher, meaning that the facilities are scarce. The location coefficient value also shows the weight of a facility. The location and weight coefficients can be measured by equation (1) as follows.

$$LC = \frac{1}{\sum i_a} \times 100 \dots\dots\dots (1)$$

Where: LC = Location Coefficient

$\sum i_a$ = Number of facilities i in region a

Furthermore, the facility weight is measured by the following equation 2:

$$Bf = \sum \frac{i_a}{LC} \dots\dots\dots (2)$$

Where: = Facility weight Bf

\sum = Number of facilities i in area a_i

\sum = Total Location Coefficient LC

The functional index is used to measure the hierarchy of facilities in each sub-district. The district that has the highest functional index is a district that deserves to be a tourism center on Madura Island. The functional index shows the district level with the most developed facilities. The following estimates are used to measure the functional index in equation 3:

$$IF = \sum (Lc * x_a) \dots\dots\dots (3)$$

Where: = district functional index aIF
 Lc = Location Coefficient
 x_a = Number of facilities x in district α

So in simple terms the stages in the Skalogram analysis can be described in the following figure:

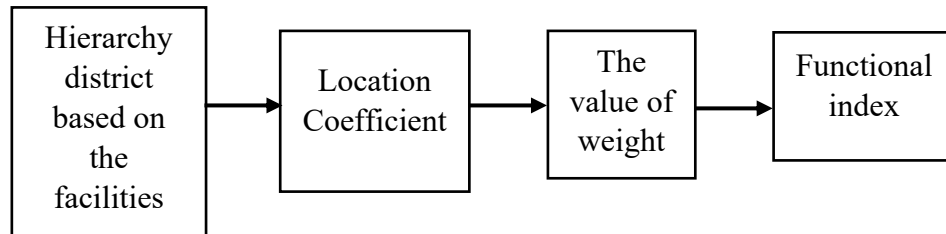


Figure 1. Stage of Skalogram Analysis

For K-Means analysis, a non-hierarchical data grouping method seeks to partition the data into several groups so that data with the same characteristics are included in the same group. The K-Means clustering process is based on the closest distance to the specified center point. One of the distances that are often used is Euclidean, which can be obtained by equation 4:

$$d(X_a, x_b) = \sqrt{(|X_{a1} - X_{b1}|^2 + |X_{a2} - X_{b2}|^2 + \dots + |X_{ap} - X_{bp}|^2)} \dots\dots(4)$$

Where :

X_a, x_b is two data the calculated distance, and p is the dimension of the data used.

Determination of the cluster center point can be seen from the following equation 5 :

$$C_{m(q)} = \frac{1}{n_m} \sum_{i=1}^{n_m} x_{i(q)} \dots\dots\dots(5)$$

- Where : $C_{m(q)}$ = A group of to- m variable p
- m = 1,2,... k
- n_m = The number of objects in the group to - m
- k = The number of clusters
- q = 1,2,... p
- x_i = The value of the observation object to the i variable to the q
- i = 1,2,... nm

RESULTS AND DISCUSSION

Skalogram Analysis

The skalogram analysis is calculated using a functional index that provides information about the facility order of each district. The district with the highest order value is a district that is superior or worthy of being the center of tourism growth in Madura. The attractions facilities include natural, cultural, and artificial tourist destinations. In contrast, amenities facilities include hotels, restaurants,

diners, and markets, and accessibility includes motorized vehicles, non-motorized vehicles, sea transportation, support, and communication facilities. The following are the results of the Scalogram analysis of Tourism facilities which are presented in Table 2.

Table 2. Analysis of the Madura Tourism Skalogram

Regency	Functional Index	Ordo
Sumenep	537.1416	1
Pamekasan	361.7948	2
Bangkalan	177.8245	3
Sampang	123.2391	4

Source: data processed

From Table 2, the functional index results illustrate that the most deserving district to be the center of tourism growth is Sumenep Regency. On the other hand, Sampang Regency, which has the lowest functional index value among the four districts in Madura in tourism facilities, is the least deserving district to be the center of tourism growth. The results of this study are in line with Arief et al. (2019) who revealed that Sumenep Regency is the center of tourism growth because tourism in it has a higher attractiveness for both domestic and foreign tourists compared to tourism in other districts in Madura. In addition, in terms of economic growth Central Bureau of Statistic (2021), noted that growth in Sumenep Regency was higher than in other districts every year. In 2020, the ADHK GRDP of Sumenep Regency was recorded at 23,546.5, while for other districts in Madura, it was below 20,000. It is hoped that later growth in Sumenep Regency can induce growth in the surrounding area. In terms of human resource capabilities, as reflected in the HDI, Sumenep Regency occupies the highest position compared to other districts in Madura where in 2020 it was 67.04. In terms of the availability of a high HDI, it is hoped that the management of tourism development will be more qualified because of the availability of adequate human resources who will be able to serve as examples for tourism development in other districts in Madura.

Location Coefficients and Weighted Values

The location coefficient and value weights describe the urgency of the tourism facilities available on Madura Island. The higher the value of the location coefficient and its weight value, the more urgent or rare these facilities are on Madura Island. Conversely, if the value of the location coefficient and the weight value is low, these facilities are widely available on Madura Island. The following is a table of location coefficients and tourist facilities' weight values, as shown in Table 3. Based on Table 3, three highest location coefficient values are in the attractiveness aspect, including artificial tourist destinations, with the highest location coefficient of 12.5. Two cultural tourism destinations are 4.167, and natural tourism destinations are 3.22. It means that tourist destinations in Madura must continue to be added and preserved, both natural, cultural, and artificial tourism.

Table 3. Location Coefficients and Value Weighted Tourism facilities

No.	Tourism indicators	Location Coefficient	Weighted Value
1	Attraction		
	Natural tourist destinations	3.225	0.133
	Cultural Tourism Destinations	4.167	0.173
	Artificial tourist destinations	12.5	0.519
2	Amenities		
	Hotel	2.439	0.101
	Restaurant	0.119	0.004
	Restaurant	0.061	0.002
	Market	0.289	0.012
3	Accessibility		
	Motor vehicle	0.001	2.458
	Not motorized	0.001	4.380
	Sea Freight	0.012	0.000
	Supporting sea transportation	1.265	0.052
	Means of Communication	0.001	2.235

Source: data processed

The facility aspect with the highest location coefficient value is hotel facilities at 2.439, and the rarest aspect of accessibility is sea transportation support at 1.265. The three aspects of tourism, namely attractiveness, amenity, and accessibility, are interrelated, so their provision must also support each other. The location coefficients and weighted values prove that the inadequate tourism in Madura are nature tourism destinations, as well as the lack of hotel facilities and sea transportation support for tourist arrivals. Because limited funds still constrain the local government in Madura, increasing the development of tourism facilities and infrastructure availability is still not optimal. On the other hand, there is still a lack of public awareness in supporting its participation in tourism development (Kia, 2021; Chan et al. 2021).

Tourism Growth Centers in Madura

The value of the Functional Index shows that Sumenep Regency has the highest value, which means that Sumenep Regency is a worthy district to become a center of tourism growth. In other words, Sumenep Regency is a district that is more advanced in the tourism sector in Madura. Meanwhile, the district with the lowest functional index value is Sampang Regency, which means that Sampang Regency is still lagging other regencies in the tourism sector in Madura. Tourism as an object of research in the case of inequality in the number of tourists between regions will affect the level of economic growth and development. It can be interpreted that if economic growth increases, the inequality in economic development will also increase, and vice versa. The tourism potential in Madura is supported by three aspects, namely Attraction, Amenity and Accessibility. Attractions are tourist attractions owned by each district, both in the form of tourist

destinations and cultural heritage. Facilities are tourism supporting facilities such as hotels, restaurants, diners, and economic and health facilities so that tourists feel comfortable living in the area. And then accessibility means easy access to tourist attractions. Easy access, of course, is also an essential thing in developing tourism in Madura. The following will discuss three aspects of tourism potential in Madura.

1. Attraction

Attractions include several indicators, namely natural, cultural, and artificial tourist destinations. Each district on Madura Island has the advantages of different tourist destinations. Sumenep Regency dominates nature tourism and cultural tourism. Meanwhile, artificial tourism in Bangkalan and Sampang has superior value. According to the functional index value, Sumenep Regency has the potential as a center for tourism growth. In terms of attractions, Sumenep Regency has the highest number of tourist destinations compared to other districts, namely 25 tourist destinations. The analysis results of the location coefficient and the weighted value show that the attraction aspect is the most urgent or rare aspect. Therefore, it is necessary to develop and sustain tourism destinations in Madura, both natural, cultural, and artificial destinations.

2. Amenities

Amenity is tourism supporting facilities and infrastructures such as accommodation, economic facilities, and health so that tourists feel comfortable and satisfied in a destination. The facilities in this study are hotels, restaurants, diners, and markets. The number of facilities in Madura is shown in Table 4.

Table 4. Tourism Amenities In Madura, 2018

Amenities	Bangkalan	Sampang	Pamekasan	Sumenep
Hotel	7	5	13	16
Restaurant	10	5	117	705
Home Eat	129	150	1,325	9
Market	94	54	85	113

Source : *Tourism and Culture Department of Sumenep, Bangkalan, Sampang, Pamekasan Regency*

Table 4 explains that the largest number of hotels are in Sumenep, Pamekasan, Bangkalan, and Sampang. The largest number of restaurants is in Sumenep Regency. Pamekasan Regency excels in the number of restaurants, and the largest number of markets is in Sumenep Regency. The number of facilities provided is very supportive of the sustainability of tourism. In terms of facilities, the minimum number of facilities is 40 hotels. The value of the location coefficient also indicates that the supply of hotels in Madura is still inadequate. Hotels are one of the most important accommodations because they are related to tourist accommodation.

3. Accessibility

Accessibility is how easy it is to access a tourist destination, beautiful tourist destinations, and comfortable accommodation. Without easy access, the result is nil. Accessibility includes motorized vehicles, non-motorized vehicles, sea transportation, supporting means to sea transportation, and communication. Based on the coefficient value of the location, the most urgent facilities are sea transportation and those that support it, given that Madura geographically is an archipelago. The Suramadu bridge is currently the alternative transportation

between Surabaya and Madura, so sea transportation has decreased. On the other hand, there is currently the provision of air transportation with the inauguration of Trunojoyo Airport in the Sumenep Regency. It is hoped to open potential tourism opportunities on Madura Island.

K-Mean Analysis

The results of clustering are presented in Table 5 and Table 6. This table shows the distribution of tourism clusters by sub-district. From the two tables, it is known that the highest tourism cluster in Madura is Sumenep Regency. Sumenep Regency has an overall positive value of the observed variables. A positive Zscore value indicates that the tourism condition of the Sumenep Regency is included in the category of advanced tourism. In other words, the elements of amenities, attractiveness, and accessibility of tourism in Sumenep Regency are sufficient and classified as experiencing good development and need to be improved again.

Meanwhile, Bangkalan and Sampang districts are in the second cluster, namely developing tourism conditions. This result means that tourism amenities, attractiveness, and accessibility in Bangkalan and Sampang regencies are inadequate, or their development needs to be improved more intensively and sustainably. As for the tourism condition of Pamekasan Regency, it is in the third cluster, or tourism conditions have not developed, wherein this cluster, the average value of Zscore is negative. These results illustrate that the elements of amenities, attractiveness, and accessibility of Pamekasan tourism are minimal. Pamekasan's development is still lacking, so it needs continuous improvement and special attention from the Pamekasan Regency government. The results of the K-Mean analysis are in line with research of Sinaga et al. (2015), where tourism in Pamekasan is minimal compared to other districts in Madura due to the lack of innovative strategy to develop tourism potential that has a sustainable impact. Hence, it is necessary to share development strategies which include core zone, support, and conservation of tourism.

Table 5. Cluster Membership

Case Number	District	Cluster	Distance
1	Bangkalan	2	1.820
2	Sampang	2	1.820
3	Pamekasan	3	0.000
4	Sumenep	1	0.000

Source: data processed

From the Anova test, it is known that the results of the ANOVA test indicate that the foreign tourists variable shows 10% significant differences between districts in Madura. Variable of home eat, and motorcycle (number of motorized vehicles) have 5% significant differences between districts in Madura. Variable of restaurant, home eat, sea transportation, and communication facilities show 1% significant differences between districts in Madura.

Table 6. Final Cluster Centers

	Cluster		
	1	2	3
Zscore(domestic tourist)	0.2961	0.3045	-0.9051
Zscore(foreign tourist)	1.4882	-0.5702	-0.3478
Zscore(hotel)	1.1223	-0.8295	0.5368
Zscore(restaurant)	1.4820	-0.6031	-0.2758
Zscore(home eat)	-0.6383	-0.4270	1.4924
Zscore(market)	1.0768	-0.5079	-0.0610
Zscore(tourism object)	0.7266	0.1101	-0.9468
Zscore(promotion event)	1.3056	-0.2611	-0.7834
Zscore(natural tourism)	1.1004	-0.0647	-0.9710
Zscore(cultural tourism)	1.2769	-0.1277	-1.0215
Zscore(made tourism)	0.0000	0.7071	-1.4142
Zscore(motor cycle)	1.0637	-0.8520	0.6403
Zscore(non vehicle)	1.4806	-0.4543	-0.5721
Zscore(sea transportation)	1.4993	-0.5210	-0.4573
Zscore(supporting sea freight)	-0.5000	-0.5000	1.5000
Zscore(communication facilities)	1.3430	-0.7626	0.1823

Source: data processed

There are significant differences between sub-districts in Madura because the availability of public facilities between sub-districts is not evenly distributed. Rahayuningsih (2021) revealed that these public facilities were not evenly distributed because the funds from the local government in each district in Madura were also different, which had an impact on foreign tourist visits.

From the Table 7, it is known that “qcl_1” indicates the number of sub-district clusters in Madura, and “qcl_2” is the distance between the object and the cluster center. The following is a description based on the two tables above:

- a. An advanced tourism cluster or first cluster: contains Sumenep Regency, which has a distance of 0.00 from the center of the first cluster
- b. The developing tourism cluster or the second cluster: contains Sampang and Bangkalan regencies, which are 1.82 away from the center of the second cluster
- c. Undeveloped cluster or third cluster: contains Pamekasan Regency, which has a distance of 0.00 from the center of the third cluster.

Table 7. Distribution Of Cluster and Distance from Center Of Cluster

Regency	QCL_1	QCL_2
Bangkalan	2	1.8156
Sampang	2	1.8156
Pamekasan	3	0.0000
Sumenep	1	0.0000

Source: data processed

Based on the cluster division and the distance from the cluster center, it is known that, in this case, the advanced tourism cluster center is Sumenep Regency. Then the second developing cluster is in Bangkalan and Sampang districts, while the third developing cluster is Pamekasan Regency. According to Cunha & Cunha (2005), Kolveková et al. (2019) the tourism clusters distribution in Madura is influenced by the region typology, the tourist objects' attractiveness, and the availability of facilities and infrastructure in each district.

CONCLUSION

The analysis carried out in this study shows that Sumenep Regency can be used as a center for tourism growth in terms of attractions, amenities, and accessibility. From cluster analysis, Sumenep Regency is the closest to the cluster center or can be categorized into developed clusters. At the same time, Pamekasan Regency is a less developed cluster because it is far from the cluster center. Therefore, the four district governments and provincial governments must continue to strive to increase tourism on the island of Madura in terms of attractions, amenities, and access facilities so that tourism can thrive and impact increasing economic growth in Madura.

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